Péter Őri

An alternative laryngeal analysis of languages with two obstruent series[*]

0. Introduction

Over half of the UPSID languages[1] have two series of obstruents differing solely in their laryngeal properties (Maddieson 1984: 26). In recent phonological works (see Beckman, Jessen & Ringen 2013 or Backley 2011, among many others), two melodic elements (or distinctive features) are generally applied in order to represent this contrast: |L| (or [voice]) in voicing languages like Hungarian and |H| (or [spread glottis]) in aspirating languages such as English. In this paper, I aim to prove that the element |H| is sufficient to encode the two-way opposition in both language types. I argue that phonologically speaking, these languages differ only in the processes operating on |H|. The result is a simpler laryngeal analysis. As for the variance across languages in the physical characteristics of the two sets of obstruents, it should be regarded only as the result of the different phonetic realizations of |H| and the lack thereof. The typology of laryngeal systems with two obstruent series that can be established in the present Same-Element-Different-Processes approach will also be discussed.

In section 1, I provide a brief overview of the phonetics of laryngeal phenomena, and in section 2, I summarize how they have been analyzed in the phonological literature. Then, I attempt to illustrate in section 3 that both the phonetic realization and the phonological behavior of the laryngeal elements show greater complexity and therefore less uniformity than is usually reported in phonological works, which may be taken to point toward the necessity for the alternative analysis presented in section 4. Finally, section 5 concludes the paper.

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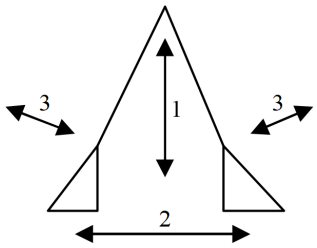
[1] The languages of the UCLA (University of California, Los Angeles) Phonological Segment Inventory Database (UPSID), which are representative of the world's languages (Maddieson 1984).

1. Some phonetic background

In most of the world's languages, vocal cord activities can serve as a means of distinguishing obstruents which are otherwise articulated identically. The schematized figure in (1), from van der Hulst (2015: 329), illustrates the three ways in which the vocal cords in the larynx can alter their states, which or the combinations of which can produce contrastive differences in sound segments.

(1) Possible changes in the state of the vocal cords



The little triangles represent the arytenoid cartilages, the lines connected to them the vocal cords, and the enclosed space the glottis. Movements: 1—reduced stretching of the vocal cords; 2—adduction/abduction of the arytenoid cartilages; 3—in/outward rotation of the arytenoid cartilages (medial compression).

In case their neutral stretching is decreased, the vocal cords are set into vibration by the airstream passing through the glottis. If the arytenoid cartilages are pulled apart, the glottis is spread, which insures the free passage of the air. Finally, the constriction of the glottis due to the adduction and the inward rotation of the arytenoid cartilages results in the complete blockage of the airflow. Approximately every other language uses only one of the above articulatory maneuvers to create a simple two-way contrast in obstruents (Maddieson 1984: 26); and of these laryngeal systems, about 90% are estimated to employ either of the first two gestures (Szigetvári 1996: 98). As to their acoustic correlates, the slackening and thus the vibration of the vocal cords can be mapped to periodicity in the acoustic signal (Lieberman 1970: n. 2), which is involved in the production of voiced segments like [b]. The spreading of the glottis leads to stable voicelessness extending beyond the duration of plosives, causing a delay in the initiation of voicing in the next sound. This is perceived as a little puff of air following the plosive (e.g. [p^h]), a phenomenon referred to as aspiration. If a plosive is articulated with the neutral glottal state, the result is a plain voiceless consonant (e.g. [p]).

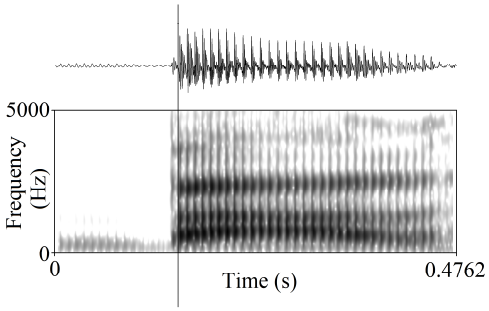
Romance languages (e.g. Italian, Spanish and French), Slavic languages (e.g. Ukrainian and Czech) and Hungarian are examples of linguistic systems contrasting voiced obstruents and plain voiceless obstruents (e.g. [b] vs. [p]).

In Mandarin or Germanic languages with the exception of Afrikaans, Dutch, Yiddish and Scots (e.g. German, Icelandic and English), the distinctive property for plosives in word-initial position is the presence or absence of aspiration (e.g. [pʰ] vs. [p]). The former group is generally referred to as true voicing languages, and the latter as aspirating languages (see Iverson & Salmons 1995: 369, van Rooy & Wissing 2001: 296 and Abercrombie 1967: 136).

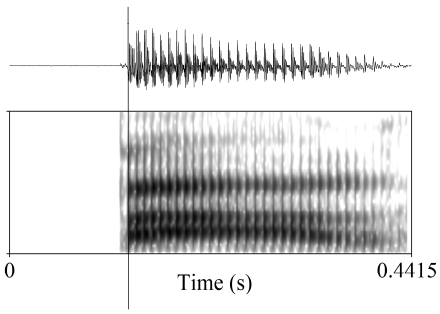
For a comparison of the two language types contrasting two series of obstruents, let us take a look at the figures in (2), which show the waveforms and spectrograms of the Hungarian words *bál* and *Pál* along with their English equivalents, *ball* and *Paul*, as pronounced by American speakers.

(2) Oscillograms and spectrograms of

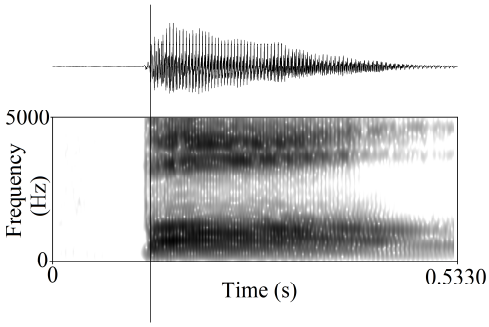
a. Hun. *bál*



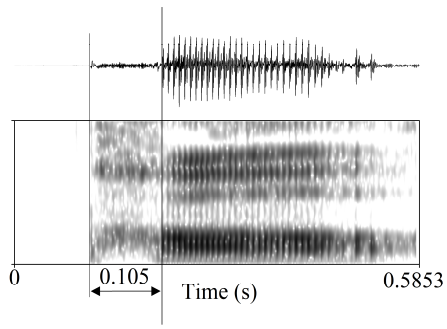
b. Hun. *Pál*



c. Eng. *ball*



d. Eng. *Paul*



The striated darker area in the low frequency range (i.e. the voice bar) in the spectrogram and the periodic waveform throughout the duration of the /b/ of Hun. *bál* indicate vocal cord vibration, a necessary characteristic of voiced obstruents in Hungarian (see (2a)). The beginning of periodicity in the sound

wave and the appearance of the voice bar shortly after the release of the plosive in *Pál* in (2b) means that it is a plain voiceless consonant. Although the /b/ of Eng. *ball* can be pronounced partially voiced, vocal cord vibration is not a requirement for "voiced" plosives word-initially in English to be perceived as such. As a result, the first segment of Hun. *Pál* and that of Eng. *ball* ([p~b̥]) can be articulated identically (compare (2b) and (2c)). What actually distinguishes the /p/ of Eng. *Paul* from these is aspiration: the vocal cords start to vibrate considerably later than the release of the plosive (this delay is 105 ms in (2d), which is the duration of the aperiodic waveform before the appearance of periodicity in the following vowel).

This tripartite categorization of plosives can be expressed with reference to voice onset time (VOT), the measure of time specifying the beginning of vocal cord vibration relative to the release of the plosive, as proposed by Lisker & Abramson (1964). The VOT value has a negative coefficient in the case of [b] (negative/lead VOT), whereas it is close to 0 for [p] (zero/short lag VOT) and positive (normally more than 40 ms) in the case of [p^h] (long lag VOT). So, voicing languages distinguish obstruents with negative VOT from obstruents with zero VOT, while in aspirating languages, the contrast between word-initial plosives lies in one category having zero VOT and the other positive VOT. As we have seen, the terms "voiced" and "voiceless" do not always describe precisely the significant phonetic properties of English /b/ and /p/, respectively, which supports the common practice in the phonological literature of calling the former a lenis and the latter a fortis obstruent in aspirating languages.[2]

2. Trends in laryngeal analysis

The fact that laryngeal opposition between the two obstruent series in an aspirating language does not necessarily involve actual voicing, in contrast to what the spelling and even phonemic transcriptions may suggest, is not a novel observation. Regarding English, we can find precise and accurate descriptions of the physical realization of the contrast in, for instance, Jones

[2] Of course, we can find phonetically voiced segments in aspirating languages too; however, this sort of voicing is different from a phonological point of view. Whereas the voicing of obstruents in Hungarian involves an *active* articulatory gesture, i.e. the speaker has to make an effort to set the vocal cords into vibration, the same physical characteristic of a lenis plosive in English is simply due to the effect of the environment: for example, the /b/ of Eng. *abbey* becomes *passively* voiced because it occurs in intersonorant position, which is a voicing environment. As for sonorant consonants and vowels, the default case in any language is that they are articulated with vocal cord vibration, meaning that they are *spontaneously* voiced.

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(1922),[3] from a century ago. In this work, the properties that set apart the obstruents of a laryngeal system like English from those of a true voicing language are explicitly pointed out.

We can cite proposals from around the middle of the previous century of distinctive laryngeal features that aim to faithfully mirror phonetic reality (for summaries, see e.g. Mielke (2011) and Lieberman (1970)). Jakobson, Fant & Halle (1952), who use acoustically defined features, take [voiced] to represent the laryngeal contrast in languages like Hungarian, while in the case of English-type languages, they ascribe this role to the feature [tense], which is "manifested [in consonants] primarily by the length of their sounding period, and in stops, in addition, by the greater strength of the explosion" (26, 36). The phonetically based distinctive features identified by Chomsky & Halle (1968), on the other hand, can be expressed in articulatory terms; the ones related to laryngeal contrasts involving voicing and aspiration are [voiced], [heightened subglottal pressure] and [tense] (324–329).

Nevertheless, the view that is considered the traditional approach in the phonological literature applies only [voice][4] for the representation of the two-way laryngeal contrast in both voicing and aspirating languages (see Beckman, Jessen & Ringen 2013: 259). Examples of phonological works on laryngeal phenomena applying this approach include Lieberman (1970), Keating (1984), Lombardi (1995, 1999) and Wetzels & Mascaró (2001). In

[3] Let us continue to take the English bilabial plosives as an example; Jones points out the following phonetic details regarding their laryngeal properties:

> [W]hen **p** is followed by a stressed vowel …, it is pronounced with considerable force, and a noticeable puff of breath or 'aspiration', i. e. a slight **h**, is heard after the explosion of the **p** and before the beginning of the vowel. (1922: 24)

> [W]hen **b** … occur[s] initially …, [it is] partially devocalized in the pronunciation of most people, that is to say, voice is not heard during the whole of the stop but only during part of it, generally the latter part. With some speakers the voice disappears altogether, so that the [sound] become[s] **b̥** …. (1922: 35)

[4] If [voice] is taken to be monovalent/unary/privative, a two-way laryngeal contrast can be understood as [voice] vs. [Ø], i.e. as the presence vs. absence of the feature in obstruents (see e.g. the analyses in Lombardi (1995, 1999)). In frameworks which use a bivalent/binary [±voice] feature, the opposition between underlyingly voiced and voiceless obstruents is regarded as equipollent and therefore symmetrical: both categories are specified for the feature but with opposite signs, i.e. they are either [+voice] or [−voice] (see e.g. Keating 1984). Reasons for the necessity for binary models in laryngeal analysis can be found in e.g. Wetzels & Mascaró (2001). For a comparison of monovalency with bivalency in distinctive features as well as for arguments for assuming the former in phonological analysis, see e.g. Harris & Lindsey (1995: 36–44). In the present study, too, the monovalent view is adopted.

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such analyses, the obstruent of both Hun. *bál* and Eng. *ball* is specified for [voice], which makes them the marked category, while both Hun. *Pál* and Eng. *Paul* begin with a laryngeally unspecified, i.e. unmarked, obstruent.

Now, what seems to require an explanation is the possible mismatch in an aspirating language between the presence or absence of the feature [voice] in the phonological representation of an obstruent and the actual realization of the segment as voiced, plain voiceless or voiceless aspirated. In SPE-based models, it can be accounted for by the application of redundancy rules and other rules in the phonology of the language. The former type may assign aspiration (in certain environments provided that aspiration is context-dependent in the given language) to obstruents unspecified for [voice], whereas other rules can insure the voiceless realization of underlyingly voiced obstruents occurring in nonvoicing environments by changing their laryngeal specification (see Chomsky & Halle 1968: 164–171). According to Lieberman (as cited in Keating 1984: 290), the cross-linguistic variation in the realization of the laryngeal contrast in the phonology is due to the fact that "the physical scale appropriate to a voicing feature is the VOT scale, and … plus/minus values of the feature[5] will have different quantitative VOT values in different languages." Keating (1984) complements and formalizes this proposal, introducing an intermediate phonetic level with the categories {voiced}, {voiceless unaspirated} and {voiceless aspirated} between the phonological level of representation and the level of concrete physical realization. The two values of the phonological feature [±voice] can be mapped to two of these three discrete, and thus technically abstract, phonetic categories, which finally gain actual physical realization already continuous in time. In this analysis, the phonological feature [±voice] is responsible for encoding the two-way laryngeal opposition between the obstruent categories. Also, by assigning the same feature specification to voiced obstruents in voicing languages and to lenis obstruents in aspirating languages, we can account for cross-linguistic phenomena in which rules target precisely these sets of obstruent or their complementary sets (more on which in subsection 4.2). As for the three phonetic categories, their role is to represent the maximum number of attested contrasts possible along the VOT continuum. This is also the level at which markedness relations between the obstruent series can be captured.

Hall calls the [voice]-only view summarized above the "broad interpretation of the feature [voice]" (2001: 32). There is another approach to laryngeal analysis, which has become more popular in recent decades; it can be referred to as the "narrow interpretation of the feature [voice]." Some of the

[5] Lieberman (1970) and Keating (1984) both consider the laryngeal feature to be binary; however, I believe, their analyses can be adjusted and carried out in a privative model too.

proponents of this nontraditional view are Halle & Stevens (1971), Clements (1985), Iverson & Salmons (1995), Honeybone (2005) and Beckman, Jessen & Ringen (2013). In such analyses, an obstruent can be specified for [voice] only if its articulation involves vocal cord vibration in any environment. Therefore, this distinctive feature can be applied only in the case of true voicing languages, in which voiced obstruents such as /b, d, g/ ([b, d, g]) form the laryngeally marked series, whereas their voiceless counterparts, e.g. /p, t, k/ ([p, t, k]), are taken as the unmarked set. In an aspirating language, on the other hand, /b, d, g/ (often realized word-initially as [p, t, k]) are analyzed as the laryngeally unmarked category and /p, t, k/ (pronounced [p^h, t^h, k^h] in word-initial position) as the marked series, specified for the feature [spread glottis], or, simply, [aspirated].

It seems reasonable to establish two typological categories by representing the binary laryngeal contrast in voicing and aspirating languages differently right at the phonological level. The first advantage of such an analysis is that it reflects phonetic reality (see e.g. Beckman, Jessen & Ringen 2013): In a voicing language, a marked segment, i.e. one that is specified for [voice], is produced with vocal cord vibration as an active articulatory gesture throughout its whole duration; in an aspirating language, voicing is only a passive process, the effect of a voicing environment on a laryngeally unmarked obstruent, and is usually partial. The obstruents the articulation of which requires more physical effort in this type of language are the fortes, which are therefore marked for [aspiration].

Another argument supporting the idea of applying different laryngeal features for the two language types concerns the phonological behavior of the marked and unmarked obstruent series in each laryngeal system. According to Kaye's Phonological Epistemological Principle, "the only source of phonological knowledge is phonological behaviour" (Kaye 2005: 283). For instance, in the English word *notebook*, /t/ and /b/ occur next to each other, but if this loanword is pronounced in Hungarian, the first consonant of the cluster is /d/. Based on this observation, it seems justifiable to assume that in Hungarian, [voice] is the active laryngeal feature, and /b/ is a marked obstruent specified for it, so [voice] can spread from /b/ to the unmarked /t/ preceding it, making the voiceless segment voiced (see e.g. van Rooy & Wissing 2001). In English, such voice assimilation does not take place, which can be easily accounted for if we analyze /b/ as a laryngeally unspecified obstruent. If, on the other hand, /t/ is the marked segment possessing the feature [aspiration] in English, sonorant devoicing after fortis obstruents (e.g. in [t̥]*ain* and [pl̥]*ain*), a phenomenon characteristic of aspirating languages,

can be thought of as the spreading of the laryngeal feature to the sonorant (see e.g. Iverson & Salmons 1995).

Authors like Harris (1994) and Backley (2011) also advocate for the "narrow interpretation of [voice]," although in a different framework. They work in Element Theory (ET), where the melodic element |L| is used in order to represent the laryngeal contrast in voicing languages, while fortis obstruents in aspirating languages are taken to contain |H|.[6] This theory has been chosen as the framework of the present study too; however, this decision has no actual consequence for the conclusion of the analysis.

3. Nothing is impossible…

Observing laryngeal properties and phenomena in voicing and aspirating languages, we might have the impression that the melodic elements |L| and |H| have some sort of unique characteristics which result in the uniform behavior of the respective obstruent series of languages of the same type and lead to systematic differences between the two kinds of laryngeal system. As for |L|, the two main indicators of its presence in a language seem to be the complete voicedness of one of the obstruent series and regressive voice assimilation, which is regarded by Westbury (as cited in van Rooy & Wissing 2001: 310) as "not just a 'rule' that should be stipulated [but] an inherent consequence, even property, of the distinctive feature [voice]," or the melodic element |L|. That is, not only the obligatoriness of the process but also its direction appears to be carved in stone. Similarly, there are particular patterns that are related to |H| as well: although regressive laryngeal assimilation cannot be found in languages like standard dialects of English (Lombardi (1999: 299), for example, considers the assimilation of aspiration rare or nonexistent), progressive sonorant devoicing is often cited as an evidence of |H| being the active laryngeal element in these languages (see e.g. Backley 2011: 137). All in all, based on the regularities described above, it could be concluded, on the one hand, that both |L| and |H| must be associated with some quasi-specific phonetic properties, and, on the other hand, that the spreading of each element has characteristics that are necessarily and unambiguously related to it. In this section, we are going to see that this is, in fact, not the case. The mentioned "inherent properties" are tendencies only, while other patterns also exist, making the picture much more complex than it might seem at first glance.

[6] For a comparison of analyses assuming distinctive features and those applying melodic elements, see e.g. Harris & Lindsey (1995).

3.1. Phonetic qualities

Although full voicedness in obstruents and aspiration are generally connected to |L| and |H|, respectively, and the laryngeally unmarked obstruent series, which lack either element, tends to be pronounced as simple voiceless segments (Backley 2011: 124–162), there are serious variations in the realization of the different categories.

In some dialects of Icelandic, the aspiration of marked plosives, which are taken to contain |H|, is not restricted to prosodically strong positions (see Árnason 1980: 9 and Þráinsson 1994: 147–148, 150–151). In English, an example of the same laryngeal system, aspiration as a physical correlate of |H| is context dependent, reported to occur only in foot-initial plosives. Also, its amount is a function of the degree of stress of the vowel following it (Iverson & Salmons 1995: 372–376). This complex but systematic pattern becomes less straightforwardly definable though if we take into account findings like that of G. Kiss (2017), whose experiment has revealed that considerable aspiration may be possible in post-tonic position as well (e.g. in *wrí*[tʰ]*er*). Additionally, in a broader sense, the regular realization of fortisness is the increased length of the obstruent; however, the exact manifestation of this robustness in noninitial position may display further differences. In Swedish, for instance, preaspiration can be applied in words like *dä*[ʰk] ‘deck’ (Ringen & Helgason 2004: 56), whereas in English, the fortisness of a final obstruent in words like *deck* is implemented as the extra length of the consonant (often reinforced by preglottalization in the case of noncontinuant obstruents) and the considerably shortened duration of the preceding vowel (Kaye 2014: 258–259, 265–266).[7]

[7] We can find works in the literature in which particular allophonic alternations related to fortisness are incorporated into the phonological representation; see e.g. Backley (2011: 140–142) or Huber & Balogné Bérces (2010: 454–455), who analyze postfortis sonorant devoicing as the spreading of the element encoding the fortisness of the obstruent to the following sonorant, or Pöchtrager (2006), who accounts for prefortis clipping in English by assuming that the phonological representation of a segment has a structure, a theory in which |H| is no longer a melodic element but an empty slot in the structure of obstruents licensed within the obstruent itself in case of fortes and by the preceding vowel in the case of lenes, which explains the different vowel–obstruent length ratios across the two final vowel+obstruent sequence types. I will, however, not consider the details of the phonetic realization of phonological contrasts to be relevant in the phonology (similarly to Balogné Bérces & Huszthy’s (2018: n. 6) stance on sonorant devoicing after fortis obstruents). I agree with Cyran’s (2019: 154–155) view suggesting that, together with the passive voicing of obstruents, aspiration as an implementation of fortisness belongs to the phonetic component—along with all of the allophonic phenomena accompanying it such as sonorant devoicing, I suppose.

Furthermore, sonorant devoicing can actually occur in voicing languages too, and we have no reason to attribute it to |H|-spreading. One relevant example is French, in which a

As for the laryngeally unspecified obstruents, their realization is to a great extent determined by which type of language they occur in. While in aspirating languages, such unmarked obstruents frequently undergo passive voicing in a voicing environment, this process is inhibited in voicing languages, otherwise these obstruents would become phonetically indistinguishable from their underlyingly voiced counterparts (Cyran 2011: 56). At the same time, it should be noted that, for example, Icelandic is an exception to this systematic difference: unmarked obstruents in this H-language tend not to become voiced in any environment, in which respect they behave exactly as if Icelandic were an L-language. Moreover, we can find significant phonetic variations in the realization of unmarked obstruents across other aspirating languages as well. On the one hand, these differences may lie in what counts as a sufficiently strong environment capable of triggering passive voicing in the given systems. Icelandic seems to represent one extremity on this scale as it tends to completely block the process, not allowing passive voicing to occur at all (Árnason 1980: 9); in German, intervocalic position appears to be enough in many cases to cause unmarked obstruents to undergo voicing (see Beckman, Jessen & Ringen 2013); and, finally, in English, even word-initial lenis obstruents may become partially voiced, showing that presonorant position can already function as a voice-inducing environment (see the results of the studies cited in Hunnicutt & Morris 2016: 217). On the other hand, the degree of voicedness in lenis obstruents also varies cross-linguistically. In the research of Jacewicz, Fox & Lyle (as cited in Hunnicutt & Morris 2016: 217), in Wisconsin English, which can be taken to represent General American English, word-initial, utterance-medial lenes following a liquid were found to be voiced throughout only about 67% of their closure on average; in the case of Alabama and Mississippi (henceforward Southern American) English speakers, this number was around 90.5% for morpheme-initial, utterance-medial lenes following another lenis obstruent (Hunnicutt & Morris 2016: 220–221), which is reminiscent of

sonorant in a word-initial or -final cluster consisting of a voiceless obstruent and the sonorant normally becomes voiceless (e.g. in *créer* [kɸ̥ee] ‘to create,’ *quatre* [katʁ̥] ‘four’ and *carte* [kaɸ̥t] ‘map’) (see Fagyal, Jenkins & Kibbee 2006: 48). This phenomenon has been found in Hungarian word-initial voiceless plosive+sonorant sequences as well (Lehnert-LeHouillier 2009: 65) and has been categorized as phonetic in nature since its amount does not vary in proportion to speaking rate, neither is it sensitive to morpheme boundaries (for details on these criteria, see Lehnert-LeHouillier (2009: 51–55) and footnote 8).

obstruent voicedness in ordinary voicing languages such as Russian (see Beckman, Jessen & Ringen 2013).[8]

Furthermore, as far as the realization of unmarked obstruents in voicing languages is concerned, again, these segments are supposed to be pronounced voiceless unaspirated, a tendency slightly contradicted by the Hungarian data in Gósy (2000: 20, 24): in her research, the average VOT value of the voiceless velar stop is 50.2 ms when pronounced in isolated words and as high as 35.3 ms even in spontaneous speech, which exceeds 35 ms, the threshold of perceiving a plosive as aspirated (G. Kiss 2017). Similarly, Lehnert-LeHouillier (2009: 65) also points out the tendency of Hungarian voiceless plosives across places of articulation to be considerably more aspirated than expected in the case of a typical L-language.

Finally, laryngeal systems like Kashmiri (spoken in India), which contrast aspirated and unaspirated plosives and display word-final neutralization, mean an even greater puzzle since the difference between them and a typical H-system is more essential than a slight cross-linguistic variance in the interpretation of |H| and its absence. The surprising feature of laryngeal neutralization in these languages is that it is the aspirated series that the two

[8] If we take the presence of |L| as a laryngeal element in a language to imply voice assimilation, following van Rooy & Wissing (2001), it would be ungrounded to assume both |H| and |L| in Southern American English or Swedish, in which fortis obstruents can be aspirated, and lenis obstruents are phonetically voiced but do not trigger voicing. The analysis of such languages as regular H-systems will be discussed and argued for in subsection 4.2. It should be noted though that there are authors such as Hunnicutt & Morris (2016) and Beckman & Ringen (2004) who suggest that both [voice] and [spread glottis] be used in the phonological representation in these languages. This idea can be supported by two arguments. First, according to some phonologists (e.g. Beckman, Helgason, McMurray & Ringen 2011 and Lehnert-LeHouillier 2009), if the amount of aspiration or voicing varies in proportion to speaking rate, i.e. the phonological contrast becomes more salient in slower speech due to the enhancement of the phonetic cues, which indicates that these properties originate at the level of speech planning, we should consider these segmental characteristics phonological in nature—actually, this applies to Swedish. In this paper, however, I take the different physical properties of the realization of a given laryngeal contrast as a purely phonetic issue, whether they are the results of active planning or defined by universal phonetics. As for the second argument, if one works in the framework of Optimality Theory (OT), two theory-specific principles (namely Richness of the Base and Lexicon Optimization) appear to be right at hand to justify the need for the two phonological features (for details, see Beckman & Ringen (2004)). Nevertheless, the necessity for two laryngeal elements on such a basis seems to be questionable at best for reasons I provide in Őri (2020) along with a possible [aspiration]-only OT analysis for Swedish (195–199). In sum, I argue that full voicedness in one of the obstruent categories in languages like Swedish is, in fact, just a phonetic laryngeal property of the phonologically unmarked set—in this respect, the analysis proposed in the present study is similar to that of Keating (1984).

sets of plosives are neutralized to (Vaux & Samuels 2005: 418–419)—the obstruents that are taken by most phonologists as the marked category.[9] This laryngeal pattern leaves us with two options: we either accept a marked segment as the result of neutralization or expand more drastically the limits on what physical realizations phonological specifications may be mapped to (for hypothetical representations that could be assumed in such languages, see Balogné Bérces & Huszthy (2018: 166)).

In conclusion, among the above examples, we can find languages in which the phonetic realization of |L|, |H| or |Ø| falls outside the normal range associated with the given phonological category, making it phonetically identical, or at least very similar, to another phonological category. For instance, the lenis obstruents of Southern American English are voiced so much that if we only take the phonetic criterion into account, they could be analyzed as possessing |L|, whereas the laryngeally unspecified obstruents in languages like Hungarian tend to be aspirated more significantly than would be necessary or expected, supporting a suspicion that |H| might play a role in the phonological representation of such a language. We are also going to see that the physical characteristics of obstruents often suggest quite a different laryngeal representation in the phonology than their behavior in the system.

3.2. Spreading

Current phonological analyses usually consider both laryngeal elements to be tied to very specific processes with regard to the obligatoriness of their spreading as well as its direction. Frequent as they might be, these are only properties of great probability at most.

As for the assimilation of aspiration targeting obstruents, it is less than typical (see Lombardi 1999: 299). Examples of laryngeal systems in which fortisness does not spread include standard dialects of English, where lenis+fortis sequences may freely occur, e.g. in *sai*/d s/*omething*.[10] There exist, however, laryngeal systems like Yorkshire English, in which fortisness does cause regressive assimilation, e.g. the phrase *said something* becomes

[9] German may also appear to display final neutralization to the fortis (i.e. the marked) category, which is what the voicelessness and optional aspiration of plosives in word-final position suggests (see Vaux & Samuels 2005: 418); however, these final obstruents can also be analyzed as delaryngealized (i.e. unspecified) segments, which are pronounced voiceless by default (Beckman 2011: 192–193).

[10] Even though in lenis+fortis sequences, a lenis obstruent normally "devoices," or, simply, does not undergo passive voicing (e.g. *sai*[d̥ s]*omething*), the contrast between a voiceless lenis and its fortis counterpart is still maintained (see e.g. Balogné Bérces 2017: 152–153), primarily by the length of the preceding vowel.

homophonous with *set something* (see e.g. Wells 1982: 366–367). We also find languages which exhibit bidirectional spreading of fortisness. The most commonly cited example in the literature is Swedish (see Ringen & Helgason 2004: 60), in which the left- and rightward directionality of laryngeal assimilation can be illustrated with words like *vä*/g-t/ 'weigh-SUP' and *kö*/p-d/*e* 'buy-PAST,' realized as *vä*[ʰ]kt] and *kö*[ʰ]pt]*e*, where the laryngeal element spreads from affix to stem and vice versa, but the same processes can be observed in compounds like *hö*/g-t/*id* 'festival' and *ti*/s-d/*ag* 'Tuesday' as well (Lombardi 1999: 285).[11]

In voicing languages, on the other hand, it is precisely the compulsory leftward spreading of voicing that is considered to characterize this type of laryngeal system (e.g. French or Hungarian) (see van Rooy & Wissing 2001). But does voice assimilation necessarily take place, and is its direction fixed? Ringen & Helgason (2004) and Hunnicutt & Morris (2016) hold the feature [voice], or, alternatively, the element |L|, responsible for the full voicedness of the lenis obstruents in Swedish and Southern American English, which does not trigger voice assimilation (see footnote 8). These laryngeal systems can also be analyzed as ordinary aspirating languages, and the voicing of their lenes simply as the result of "go[ing] for maximal dispersion rather than for sufficient phonetic distance," as suggested by Cyran (2017: 484, 501–502) and Balogné Bérces (2017: 153–154, 159). This decision can be further supported in the case of Swedish by the fact that whereas voicing is phonologically inactive in the language, fortisness exhibits spreading. At this point, we should also mention Italian, which might be more challenging to analyze because one of its obstruent series is fully voiced independently of the context, without systematically triggering voice assimilation, and, at the same time, its voiceless obstruents are only mildly aspirated (see Huszthy 2019a: 74–78,

[11] It could be argued (in line with analyses like that of Cyran (2017: 493–494)) that such bidirectional devoicing is not the result of phonological spreading but a phonetic (i.e. coarticulatory) phenomenon, in which the lenis obstruents of the clusters simply do not undergo passive voicing due to the lack of a voicing environment. Although, certainly, there are laryngeal systems in which such an analysis can be easily applied, this scenario seems rather unlikely in a language like Swedish. First, in *vä*/g-t/ → *vä*[ʰ]kt], the possibility of the preaspiration of the /g/ suggests that it has actually become a fortis obstruent. As for the /d/ in *kö*/p-d/*e* → *kö*[ʰ]pt]*e*, its occurrence in a postfortis environment may not be so strong an argument for the complete absence of passive voicing in a language whose lenis obstruents are fully voiced even in word-initial position, which is not an ideal voicing environment either. Therefore, I treat bidirectional laryngeal assimilation as a potential instance of phonological spreading.

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2019b).[12] Regardless of how this language is analyzed phonologically, it provides evidence for the existence of laryngeal systems with phonetic voicing and no aspiration where voicing does not spread. Finally, Oromo, a language spoken in Eastern Africa—although not a two-way laryngeal system as its consonant inventory contains ejectives and an implosive besides plain voiceless and voiced obstruents—seems to prove that progressive voice assimilation is not impossible either (although this consonant harmony is an instance of allomorphic alternation and limited to the interaction of /ɓ, ɗ, ɠ/ and /t/): for example, /ʧʼab-t-e/ 'break-3SG.F/2SG-PRF' and /ɟiig-t-e/ 'run-3SG.F/2SG-PRF' become [ʧʼabde] and [ɟiigde] (Geshe & Devardhi 2013: 335–336).[13]

In sum, we have seen that both the nonspreading and the spreading of both aspiration and voicing have been attested, and in the latter case, the process can be regressive as well as progressive. This means that even though we can differentiate between more or less typical patterns, a laryngeal property can possibly exhibit any behavior, depending on the given linguistic system.

[12] Phonologically speaking, Italian can also be categorized as an aspirating language like English or Swedish, with the assumption that the difference only lies in how the two obstruent series are phonetically realized (see Balogné Bérces & Huszthy 2018 and Huszthy 2019a, 2019b). This can account for why laryngeal behavior in this language does not conform to the pattern that characterizes the other Romance languages, regarded as typical L-systems.

[13] Hansson (as cited in Finley 2017: 4) states that "[c]onsonant harmony shows a relatively strong bias towards right-to-left directionality, which has been explained in terms of speech planning, as the speaker harmonizes in anticipation of an upcoming segment." That is, the rightward spreading of both aspiration and voicing is expected to be less common across languages. As for the relative frequency of the two, progressive voice assimilation has been attested but is a rarer phenomenon than the rightward spreading of fortisness, which might have phonetic bases. I hypothesize that one reason might be that a prototypical obstruent is a voiceless segment (this is what the fact that most languages have obstruents of this type suggests (Szigetvári 1996: 98)), which is why it might be easier for a fortis obstruent to turn another obstruent following it into a fortis than for a voiced obstruent to trigger voicing in a following voiceless one. In addition to that, the implementation of fortisness often involves some degree of postaspiration, i.e. the offset of the laryngeal gesture (the abduction of the glottis) follows that of the oral constriction, as opposed to voicing, which normally takes place during the constriction phase of the obstruent (cf. Steriade 1997: 61–63). Consequently, a fortis obstruent might be more likely to influence the laryngeal property of another segment following it.

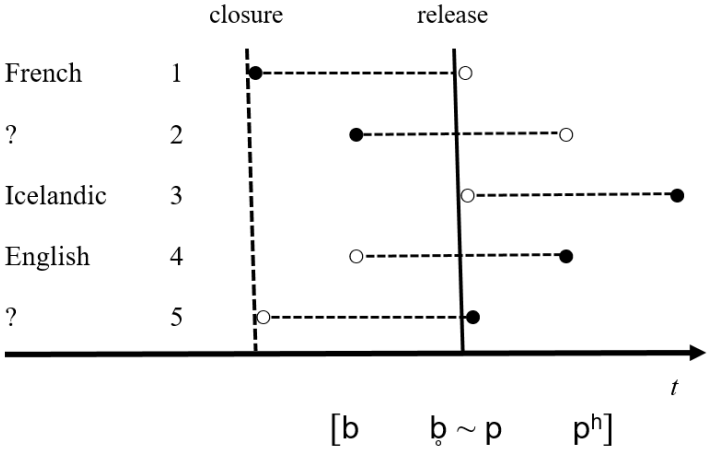
4. An alternative laryngeal analysis

4.1. Laryngeal Relativism and its consequences

In the previous section, it was shown that the physical realization of obstruents specified for |L| or |H| as well as of their unmarked counterparts may vary along a relatively large scale. Such phonetic differences between identical laryngeal systems and potentially the phonetic equivalence of different laryngeal systems can be accounted for if we accept Cyran's (2011, 2014, 2017) Laryngeal Relativism.

The label "Laryngeal Relativism" indicates the position of the approach relative to the "narrow interpretation of [voice]" dubbed "Laryngeal Realism" by Honeybone (2005: n. 13): whereas in Laryngeal Realism, the presence of |L| and |H| in the phonological representation of obstruents is necessarily accompanied by vocal cord vibration and spread glottis, respectively, the Laryngeal Relativism view states that the phonetic form of an obstruent does not reveal its laryngeal specification in the phonology because the relationship between the two should be considered arbitrary. It is, if fact, only through the behavior of the segments in a given linguistic system that their phonological makeup can be identified. The figure in (3) illustrates this loose relationship between phonology and phonetics. The filled circles denote the phonologically marked plosives and the empty circles their unmarked counterparts. The position of the circles along the horizontal dimension represents when vocal cord vibration begins relative to the release of the plosive.

(3) The phonological markedness of plosives and their phonetic realization in terms of VOT in two-way-contrast systems (Cyran 2011: 60)



If we compare, say, language types 1 and 5, we can see that their two plosive categories have the same phonetic characteristics but their phonological specification is just the opposite in the two laryngeal systems. Furthermore, an important principle regarding the physical realization of plosives is that a sufficient phonetic distance should be kept between the two categories so that they can be distinguished. This general distance is marked by the horizontal dashed lines.

Now, let us examine a specific case, which Cyran uses to support the Laryngeal Relativism view: Warsaw Polish (WP) and Cracow Polish (CP), the two main dialects of the language. The words in (4), from Cyran (2011), show how plosives are pronounced and how they behave in both Polish dialects.

(4) a. [p^{j}]ić ‘to drink’
[b^{j}]ić ‘to hit’
o[k]nie ‘window-LOC’
o[g]nie ‘fire-PL’
by[k]a~by[k] ‘bull-GEN-SG~bull-NOM-SG’
wa[g]a~wa[k] ‘scale-NOM-SG~scale-GEN-PL’
ka[d]ra~ka[t]r ‘personnel-NOM-SG~personnel-GEN-PL’

b. rzu/t b/agnetem [d b] ‘bayonet throw’
ra/d g/łupich [d g] ‘silly advice-GEN-PL’
rzu/t p/oziomy [t p] ‘horizontal plan’
ra/d p/rzyjacielskich [t p] ‘friendly advice-GEN-PL’

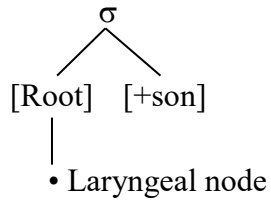
We can see in (4a) that, phonetically speaking, both dialects contrast plain voiceless plosives with voiced ones before (a sonorant plus) a vowel and display word-final laryngeal neutralization. If we also consider the regressive voice assimilation observable in (4b), it seems reasonable to take Polish to be an L-system.

Actually, voice assimilation is symmetrical in Polish, that is, both voicing and voicelessness can exhibit spreading. From a phonological point of view, however, it has to be modeled as an asymmetrical phenomenon in a framework applying privative elements, in which the laryngeal contrast is not encoded as the specification of a segment for the opposite values of the same feature but as the presence vs. absence of a melodic element. The two processes that need to be assumed for accounting for voice assimilation in a privative model are delaryngealization and spreading.

An obstruent is considered to undergo delaryngealization if it occurs in an environment in which its laryngeal element is not licensed. According to

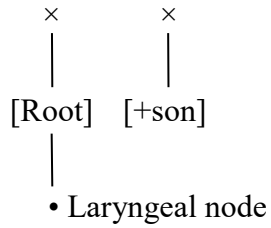
Lombardi (1995, 1999), the licensed position in a number of languages (e.g. in German) is the one shown in (5), i.e. the laryngeal element of an obstruent is delinked, so neutralization takes place unless the obstruent is immediately followed by a sonorant in the same syllable. It seems that this constraint needs to be slightly modified in some cases in order to fit the data in other languages. For instance, the words *ha*[ɲm]*a* 'onion' and *fi*[cm]*ál* 'sneer at' indicate that the constraint in Hungarian is less restrictive since to maintain its laryngeal identity, it is enough for an obstruent to be simply followed by a sonorant segment, which does not need to form a syllable with it (see Siptár & Törkenczy 2000: 201). The Laryngeal constraint applying in Hungarian is, therefore, the one represented in (6a). In Polish, on the other hand, as the delaryngealization in the word *kadr* and the lack of laryngeal neutralization in *waga* and *ognie* (see (4a)) suggest, a laryngeal element of an obstruent can be licensed only by a vowel following it in the same syllable (with the possibility of an intervening sonorant consonant) (also see Cyran 2014: 142–145). These conditions are represented in (6b).

(5) Laryngeal Constraint[14]

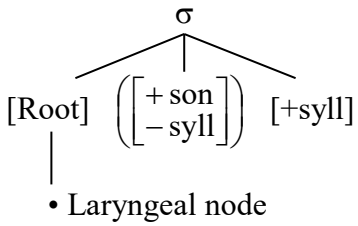


(6) Laryngeal Constraint, modified versions

a.



b.



[14] Of course, this constraint can be used in different theoretical frameworks too and transformed accordingly; for example, in Strict CV Phonology (Lowenstamm 1996), a framework which does not assume suprasegmental structures, syllable structure will be replaced by lateral relations holding between adjacent segments.

Although, as we have just seen, the environments in which a laryngeal element can be licensed may vary to some extent cross-linguistically, we are going to refer to these contexts uniformly as presonorant position for the sake of simplicity. More important is the divide between languages in which the Laryngeal Constraint is active and those in which laryngeal licensing is independent of the context. This characteristic of languages will be discussed in detail in the subsequent subsections and will serve as a basis for the establishment of the alternative laryngeal typology proposed in subsection 4.3.[15]

So, the regressive voice assimilation in Polish exemplified in (4b) can be analyzed with reference to delaryngealization in unlicensed positions and the spreading of the laryngeal element in the following way: The final obstruent of both *rzu*/t^0/ and *ra*/d^0/[16] will be pronounced voiceless because they are unmarked, lacking the element |L|—either originally (*rzu*/t^0/) or as the result of delaryngealization in final position (*ra*/d^L/ → *ra*/d^0/). If these segments are followed by a word beginning with a voiced, i.e. laryngeally marked, obstruent, |L| can spread to them and make them voiced. As for what we can perceive as the spreading of voicelessness in the other cases, it will not be analyzed as phonological spreading but simply as the final obstruent remaining laryngeally unmarked and thus pronounced voiceless.

So far, the two Polish dialects, WP and CP, have shown the same pattern. The difference that sets apart the two varieties is how the word-final and thus

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[15] Languages in which the Laryngeal Constraint is active can be further divided: we can distinguish Polish-type languages with systematic final neutralization and laryngeal systems in which obstruents undergo delaryngealization in word-internal unlicensed positions but not word-finally. Lombardi (1995: 64–66) accounts for the latter language type, which includes Yiddish, Serbo-Croatian and Romanian, using the constraint Final Exceptionality, which allows obstruents to maintain their laryngeal specification at the end of a word:

Lar]$_W$

Actually, the Hungarian data show that some languages may require us to modify the constraint. Cross-word voice assimilations (e.g. *fo*/g#h/*ívni* → *fo*[k h]*ívni* 'will call') show that it is, in fact, only in utterance-final position that the laryngeal identity of an obstruent is protected (see Siptár & Törkenczy 2000: 201):

Lar]$_U$

[16] The "0" in superscript denotes that the segment is laryngeally unspecified; the superscript "H" and "L" show that the obstruent contains the given element.

laryngeally unmarked obstruents behave before a sonorant in the next word: CP displays cross-word (sandhi) presonorant voicing, whereas WP does not:[17]

(7)		WP	CP	
	rzu/t ɔ/ka	[t ɔ]	[d ɔ]	'glimpse'
	ra/d ɔ/jcowskich	[t ɔ]	[d ɔ]	'fatherly advice-GEN-PL'

This difference has led Cyran to reanalyze CP as an H-system while continuing to consider WP an L-system. Even though the two series of obstruents have exactly the same phonetic properties in the two dialects, their phonological representations do not need to be identical according to the Laryngeal Relativism view. It is, in fact, the behavior of the obstruents that can inform us (e.g. during language acquisition) about their phonological makeup. If we only take phonological behavior into account, things appear to fall into place if CP is taken as an H-language, in which voiceless obstruents form the marked series, containing |H|, and the voiced ones constitute the laryngeally unspecified set. Unlike in regular H-languages such as English, the presence of the element |H| in the phonological representation does not involve phonetic aspiration, only stable voicelessness. So the phonetic realization of /pʲ^{H}/*ić* and *o*/k^{H}/*nie* will be [pʲ]*ić* and *o*[k]*nie*. As for voicing in obstruents, the laryngeally unspecified ones will undergo passive voicing if they occur in a voice-inducing environment, i.e. in presonorant position. Of course, we can talk of passive voicing only in a phonological sense as its occurrence can be accounted for with reference to a phonological environment, just like in English, but, unlike in English, it is phonetically manifested as the full voicedness of the obstruent, which Cyran labels as "enhanced passive voicing." So, the final obstruents of *rzu*/t^{0}‖/, *ra*/d^{0}‖/ and *ka*/d^{0}r‖/ will be voiceless because they are not subject to enhanced passive voicing,[18] but the ones in /bʲ^{0}/*ić* and *o*/g^{0}/*nie*, will be voiced by the following vowel. So will the

[17] It should be noted here that word-final devoicing in Polish has been reported to be an incomplete process (see Cyran 2017: 485 and references therein). Strycharczuk, however, has found that in CP, final neutralization before sonorants in the sandhi context is optional rather than gradual (2012: 87–88). What this means to the phonological analysis is simply that speakers who do not neutralize the laryngeal contrast in word-final obstruents before a sonorant in the next word apply the Laryngeal Constraint in (6a) instead of the one in (6b).

[18] The voicelessness of the /t^{0}/ and /d^{0}/ in *rzu*/t^{0} p^{H}/*oziomy* and *ra*/d^{0} p^{H}/*rzyjacielskich* may be explained in two ways. First, it can be the result of the lack of enhanced passive voicing—as unmarked obstruents occurring in a nonvoicing environment, they will be phonetically voiceless (Cyran 2017: 493–494). The alternative analysis is a phonological one, in which |H| can be assumed to spread to the unmarked obstruents from the /p^{H}/ (Cyran 2011: 73–74).

obstruent clusters in *rzu*/t^0 b^0/*agnetem* and *ra*/d^0 g^0/*łupich*, where the voicing of /t^0/ and /d^0/ can be considered to be the result of coarticulation triggered by the phonetically strongly voiced [b] and [g] following them in the next word. Similarly, the originally unmarked or delaryngealized final obstruents in the phrases *rzu*/t^0 ɔ/*ka* and *ra*/d^0 ɔ/*jcowskich* also become voiced. That is, sandhi voicing before sonorants in CP is a direct consequence of analyzing the dialect as an H-system: it is the phonetic interpretation of an unmarked obstruent as a voiced segment due to the voicing environment and not the result of phonological spreading. Cyran notes that in WP, and other L-systems in general, a final laryngeally unspecified obstruent cannot be voiced; passive voicing is not characteristic of this language type so that the sufficient phonetic distance can be kept between actively voiced obstruents possessing |L| and their unmarked counterparts.

To summarize up to this point, by categorizing WP as an L-system and CP as an H-system representing language types 1 and 5, respectively, in the figure in (3) and by assuming the same phonological processes, namely delaryngealization and spreading, in both systems, Cyran can explain the different behavior of final obstruents in the two dialects. As for the phonetic equivalence between WP and CP, whose obstruents have different phonological representations, and the phonetic difference between phonologically identical laryngeal systems like CP and English, such variances are expected in the Laryngeal Relativism view, whose main principle is that the relationship between the phonological representation and its phonetic realization should be regarded as arbitrary;[19] the only criterion that needs to be met is the maintenance of a phonetic distance great enough for the contrast to be perceived.

Now, let us examine the possibility of reanalyzing the Warsaw dialect too as an H-system, which would also be a significant step toward reconsidering the way we treat many other languages traditionally categorized as L-systems. If WP is taken as an H-language, then the laryngeally specified obstruents (e.g. in /p^{jH}/*ić* and *o*/k^H/*nie*) are pronounced voiceless, just like the unmarked ones occurring in nonvoicing environments (e.g. in *rzu*/t^0‖/, *ra*/d^0‖/ and *ka*/d^{0}r‖/ and also in *rzu*/t^0 p^H/*oziomy* and *ra*/d^0 p^H/*rzyjacielskich*). The |H|-less obstruents in /b^{j0}/*ić* and *o*/g^0/*nie* as well as in *rzu*/t^0 b^0/*agnetem* and *ra*/d^0

[19] Of course, this does not mean that |L| and |H| can be matched with *any* phonetic quality. In the case of obstruents, |L| is regularly associated with voicing, and |H| marks aperiodic noise (Backley 2011: 124, 151). Even if Laryngeal Relativism allows a certain degree of freedom regarding their physical realization, if the plosives with the lower VOT values form the marked set, they will be specified for |L|, otherwise, if the plosives having the greater VOT values are the marked series, they will be taken to contain |H|.

g^0/*łupich* will undergo enhanced passive voicing. However, unlike in CP, the word-final unmarked obstruents in *rzu*/t^0 ɔ/*ka* and *ra*/d^0 ɔ/*jcowskich* will fail to be interpreted as voiced segments. I argue that this dialectal difference is phonetic in nature, and that the two varieties are phonologically identical systems.

It appears that in WP, a sonorant cannot induce sandhi voicing in an unmarked obstruent while a voiced obstruent can, suggesting that the latter provides a stronger voicing context. This is not surprising if we think of the fact that a sonorant is a spontaneously voiced sound whereas an obstruent, which is voiceless by default, can only be actively voiced as a result of "a kind of compensation for the intra-oral air pressure build-up arising due to obstruent stricture, which has an inhibitory effect on vocal fold vibration, by means of an active gesture or a set of gestures offsetting this effect" (Cyran 2014: 25). The difference in the voicing capacity of actively voiced obstruents and spontaneously voiced sonorants is detectable in CP as well: Strycharczuk's research into laryngeal assimilation in CP has shown that a word-final obstruent tends to be more prone to undergo voicing before a voiced obstruent than before a sonorant in the next word (2012: 81–88).[20] So the claim that a voiced obstruent has a stronger voicing capacity than a sonorant is supported by phonetic facts in terms of the physiological characteristics of the triggers, on the one hand, and their cross-dialectally observable different effects on a preceding obstruent, on the other. The varying impacts of voicing environments of different strengths can be found in other languages too—see paragraph 3 of subsection 3.1.

As to the question why the /d^0/ remains voiceless in *ra*/d^0 ɔ/*jcowskich* when the /bʲ^0/ in /bʲ^0/*ić* and the /d^0/ in *ka*/d^0/*ra* are voiced via enhanced passive voicing in WP, the difference between the two cases may be explained with reference to phonetic analogy. /bʲ^0/*ić* and *ka*/d^0/*ra* are lexical items which only exist in the phonetic forms [bʲ]*ić* and *ka*[d]*ra*, but the normal realization of *ra*/d^0/ in isolation is *ra*[t], a form whose final voiceless obstruent seems to require a stronger effect, namely that of an actively voiced obstruent, to

[20] In order to account for the difference between the two cases of voicing, one might want to distinguish between these phenomena by assigning them to different levels of analysis: the stable voicing before voiced obstruents could be thought of as a proper phonological process, i.e. the spreading of |L|, while the unstable voicing before sonorants could be treated as the result of coarticulatory effects, so a purely phonetic process. Nevertheless, besides the fact that this would be incompatible with the principle of Laryngeal Relativism stating that passive voicing does not occur in L-systems, we should bear in mind that the degree of voicing in an obstruent might not necessarily be an indicator of the presence or absence of |L| in the segment—think of the different phonetic qualities of lenis obstruents in the same environment in the languages mentioned in paragraph 3 of subsection 3.1.

override its tendency to preserve its voiceless quality so that it will change to [d] (cf. Steriade 2000).[21] That is, we could assume coarticulatory effects causing phonetic assimilations in both CP and WP, but in WP, the phenomenon starts to occur in a stronger voicing environment due to the phonetic analogy effects.[22]

In conclusion, I believe that both CP and WP can be analyzed as H-languages if we accept the Laryngeal Relativism approach to the relationship between phonology and phonetics and the claim that the different behavior of final obstruents in the two dialects does not have to be treated as a phonological issue but can be accounted for at the phonetic level. In the rest of the paper, I will aim to show that other L-languages can also be recategorized and discuss the details of the alternative analysis proposed.

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[21] The same effect is held responsible for the failure of the first /t/ in *militaristic* [mɪ́lətəɹɪ́stɪk] to undergo flapping in General American English, as opposed to the one in *capitalistic* [kʰǽpərəlɪ́stɪk]. Even though all the conditions are met in both derivatives for the /t/'s to turn into [ɾ], they tend to preserve the phonetic properties they have in the roots [mɪ́ləthɛɹi] and [kʰǽpərəl], making the phonetic forms of the members of the paradigm more uniform. Another instance of a case when phonetic analogy comes into play can be found in French. The coda-/ʁ/ in *bar trouvé* [baʁtʁuve] 'bar found' is weaker than the onset-initial-/ʁ/ in *bas retrouvé* [baʁətʁuve] 'stocking found again' and also tends to double the length of the vowel preceding it. The schwa in *bas retrouvé* [baʁətʁuve] can be dropped, and the new form, *bas r'trouvé* [baʁtʁuve], appears to become homophonous with *bar trouvé* [baʁtʁuve]. However, the phonetic qualities of the /ʁ/ and the vowel preceding it are carried over to the new form (see Steriade 2000). I assume that phonetic analogy causes the /d^0/ in *ra*/d^0 ɔ/*jcowskich* in WP to retain the characteristics it has when *ra*/d^0/ is pronounced in isolation, an effect that seems not to play a role in CP.

[22] If the two Polish dialects are now regarded as phonologically identical laryngeal systems, and thus the different behavior of their final obstruents does not fall out from CP being considered an H-language and WP an L-language as in Cyran's analysis, the occurrence of presonorant sandhi voicing in CP but not in WP might appear at first glance to be an idiosyncratic property of the dialects, which results from the presence vs. absence of an SPE-type arbitrary phonological rule (see Chomsky & Halle 1968). However, in the present analysis, this dialectal variation has nothing to do with the phonological component of the grammar. The difference between CP and WP is of the same nature as the one between, say, standard English and Icelandic—although there is little disagreement about their representing phonologically the same laryngeal system, in the former, intersonorant position provides a strong enough environment for an obstruent to undergo phonetic voicing, whereas in the latter, obstruents in this position resist passive voicing. As for phonetic analogy effects, like the ones mentioned in footnote 21, they also fall outside the scope of phonological rules.

4.2. All we need is |H|

I argue that one laryngeal element, namely |H|, is enough to represent the binary opposition in both aspirating and voicing languages, which, in turn, will no longer be regarded as two separate phonological systems. I propose instead that the typology of these two-way-contrast systems be established based on the phonological processes operating on |H|. The phonetic differences in the realization of the obstruent series across languages should not concern us as the relationship between phonological representation and its physical implementation will be considered arbitrary as assumed in Laryngeal Relativism.

First, let us examine what can justify and seem to even call for such an analysis. Let us look into the issues discussed in section 3—the phonetic realization and the spreading of the laryngeal elements. Even if we do not rush to adopt the principle of Laryngeal Relativism regarding the relationship between phonology and phonetics, if we take into account the examples provided in section 3, we have to realize that a view in which the laryngeal elements must have direct association with exactly defined phonetic qualities *and* are bound to exhibit specific phonological behaviors is not tenable.

If we accept that |L| represents active voicing, and |H| marks fortisness, we will also need to assume, for example, that |L| is present in the lenis obstruents of Swedish and Southern American English, which are strongly voiced (cf. Beckman & Ringen 2004 and Hunnicutt & Morris 2016); but then it follows that the behavior of the laryngeal elements will be unpredictable (e.g. |L| spreads from right to left in languages like Hungarian but does not cause any kind of assimilation in Swedish and Southern American English; |H| is phonologically not active in standard dialects of English but spreads in both directions in Swedish). Furthermore, however faithfully a representation is intended to reflect phonetic reality, it is actually inevitable to allow space for a significant degree of arbitrariness in the phonology–phonetics relationship (e.g. an obstruent specified for |H| is realized before an unstressed vowel as an aspirated segment in Icelandic but as a plain voiceless sound in English; the extent to which obstruents can undergo passive voicing in H-languages, and the environment that can function as a voicing context show a considerable variation). If we acknowledge the phonetic differences across identically treated laryngeal systems, we are already headed toward Laryngeal Relativism, which can therefore be supported not only on a theory-specific ground but should be to a certain extent necessarily assumed independently of the framework one works in.

Instead of using the laryngeal elements only to strictly encode the phonetic characteristics of obstruents (their behavior should then be regarded

as unpredictable), we can decide to associate certain fixed phonological behaviors with them based on the observed cross-linguistic tendencies. Then, all the languages that do not display a particular pattern will need to be excluded from the given language type even though the phonetic characteristics of their obstruents might suggest otherwise. This means that the phonetic implementation of the laryngeal specifications will be necessarily arbitrary—and we are not far from the Laryngeal Relativism view. Furthermore, it is unavoidable to assume arbitrariness in relation to the laryngeal elements and their behaviors too. Taking standard English, Yorkshire English and Swedish as examples, we have no reason to consider either of them as an L(-only)-system. This leaves us with the option of analyzing all three as having |H|, which does not spread in standard varieties of English, but in the Yorkshire dialect, as fortisness (and only fortisness) triggers regressive assimilation, it appears to spread leftward, while in Swedish, it exhibits spreading in both directions. This can prove that the way a laryngeal element behaves in a system is not an inherent characteristic of the element but has to be stipulated.[23]

All in all, if we take the phonetic variations across laryngeal systems into consideration and do not sweep the phonological patterns that do not conform to the general tendencies under the rug, any analysis applying both |L| and |H| to encode two-way oppositions needs to involve arbitrariness and stipulation. Therefore, it seems that we do not gain much if binary laryngeal oppositions are represented by two elements. On the contrary, I argue that it is even more advantageous to use only one element, |H|, for this purpose.

Now, let us continue with why an H-only analysis can fare better than a two-element approach. As we are going to see in detail in the next subsection, both voicing and fortisness appear to display virtually any phonological behavior: we can find instances of both properties being licensed in any

[23] In the analyses of Balogné Bérces (2017) and Huszthy (2019a), the difference between languages like standard English or Italian (lacking laryngeal activity) and languages like Yorkshire English (displaying laryngeal assimilation) is already encoded in the phonological representation. The authors apply the obstruency-marking non-laryngeal element |h|, considered to be incapable of spreading, to represent the opposition between the obstruent series in English or Italian and use the mobile |H| in the case of Yorkshire English. Adopting this idea to the present analysis and thus re-increasing the number of melodic elements recognized in standard versions of ET (see Backley 2012: 66–67) would be a disadvantageous step from the point of view of economy. Also, it would not solve the problem of unpredictability regarding the behavior of |H|: even though the issue of nonspreading vs. spreading would be accounted for, the direction of spreading would still remain a language-specific property of |H| that needs to be stipulated anyway if we accept the arguments in footnote 11 and assume phonological assimilation, for instance, in Swedish.

position as well as of their licensing being limited to presonorant position; moreover, their spreading can be blocked or required, and in the latter case, the direction of assimilation is also language-specific. Thus, the application of one element will not involve more stipulation than has been necessary all along anyway. Plus in a comprehensive analysis, assuming a certain degree of arbitrariness in the relationship between phonological representation and phonetic realization is already supposed to be unavoidable. That is to say, the simplification resulting from the reduction in the number of laryngeal elements will not need to be compensated for in other areas of the analysis, so its overall complexity will also decrease. This is a desirable step from the viewpoint of the principle of economy and is intended to contribute to the enterprise of reducing redundancy in the phonological representation in Element Theory (for details about the changes in the element inventory of ET as well as in the role of elements in the system, see e.g. Backley (2012)).

Another advantage of the laryngeal analysis proposed here is that it treats the obstruent series falling closer to the "aspiration" end of the VOT scale uniformly in both Hungarian- and English-type languages, taking them to contain |H|. In other words, the phonological representation of laryngeal contrasts is generalized cross-linguistically, whereas the phonetic realization of the opposition, "defined relatively, as more or less voicing" (Keating 1984: 286), is to be ignored in the phonology. As a result, rule equivalence across languages (and language types) can now be accounted for just like in the analysis of Keating (1984), who mentions three cases (292–294), two of which are relevant and I summarize using the obstruent categories of the present analysis: (i) vowel duration tends to be shorter before an obstruent containing |H| than before an unmarked one, and (ii) the fundamental frequency of vowels following an obstruent specified for |H| is normally higher than after an |H|-less segments.

In sum, I have aimed to show that applying both |L| and |H| as laryngeal elements in binary systems is unnecessary, and that it can be even more beneficial to assume only |H| in any of these languages.[24] The following subsection discusses the details of this analysis.

[24] In three- and four-way-contrast systems such as Thai and Hindi, respectively, we might, of course, need both |L| and |H| to represent laryngeal oppositions (Thai has voiceless aspirated plosives (marked with |H|) and voiced unaspirated plosives (containing |L|) besides the unmarked category (|Ø|), in addition to which Hindi has a voiced aspirated series too (presumably specified for both |H| and |L|)). In light of this, an analysis in which only |H| is available for two-way systems suggests that |L| as a laryngeal element in a language implies the presence of |H| in the system. This idea is actually justified by language acquisition data, namely that in both Thai and Hindi, voiced plosives are learned later than voiceless aspirates (Vaux & Samuels 2005: 409). Also, as Péter Szigetvári has

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4.3. The alternative laryngeal typology

In this part, I provide an example of all possible types of laryngeal systems, which will be analyzed in the H-only approach and categorized based on the phonological processes that can target the element |H|, and the consequent laryngeal typology will also be introduced.

As has been mentioned in connection with current analyses applying two laryngeal elements in the Laryngeal Realism view, the behavior of both |L| and |H| must be considered language-specific even in these approaches. Practically, any combination of the application and nonapplication of the relevant phonological processes, delaryngealization and spreading (rightward and leftward), can be attested. The categories that can be established accordingly are summarized and exemplified in (8).

(8) A typology of languages with two obstruent series which can be established in current analyses using two laryngeal elements (or features)

Licensing of the laryngeal element	Spreading of the laryngeal element	Example of an H-language	Example of an L-language
independent of position	none	English	Italian
	unidirectional (regressive)	Meccan Arabic	Ukrainian
	bidirectional	Swedish	?
before sonorants	none	German	(Hungarian)
	unidirectional (regressive)	(German)	Hungarian
	bidirectional	not possible	not possible

pointed out (personal communication), |L| is more natural in nonprototypical consonants, representing nasality in sonorants, whereas voicelessness/aspiration and frication, features generally associated with |H|, are more characteristic of obstruents (see e.g. Backley 2011: 161). That is, |L|-containing obstruents are more marked than those specified for |H|, which can be a reason why laryngeal systems applying only |L| may be considered unexpected.

The table shows that the major division is between languages whose laryngeal elements are licensed in any environment (i.e. there is no delaryngealization) and those in which licensing is possible only in presonorant position. The words in (9b) containing fortis+lenis and lenis+fortis consonant clusters (based on the examples in Szigetvári 2020: 47) show that in standard dialects of English like Standard Southern British English, licensing is not context-dependent, plus the laryngeal element does not spread since no assimilation can be observed. The same applies to Italian; see (10b), from Huszthy (2019a: 44, 48). The difference between the two languages is that in English, the opposition in word-initial position is between aspirated and unaspirated voiceless plosives, whereas Italian contrasts plain voiceless obstruents with voiced ones (see Balogné Bérces 2017: 151); compare the words in (9a) and (10a). The general principle of Laryngeal Realism dictates that English should therefore be regarded as an H-language and Italian as an L-language.[25, 26]

(9) a. Paul [pʰoːl] – ball [poːl~b̥oːl]

b. foo/tb/all
vo/dk/a

(10) a. Paolo [paolo] – ballo [ballo]

b. foo/tb/all
vo/dk/a

There are also languages in which licensing is independent of the context, just like in English and Italian, but the laryngeal element appears to spread leftward. Examples of such linguistic systems include Meccan Arabic (de Lacy 2002: 337–338) and Yorkshire English (Wetzels & Mascaró 2001: 227),

[25] English is often mentioned as a language in which progressive laryngeal assimilation occurs: its past tense/past participle morpheme /d/ and its plural/possessive/3rd person singular present tense morpheme /z/ turn into their fortis counterparts if they follow a fortis consonant, e.g. in *stopped* /stɔp-t/ and *stops* /stɔp-s/. However, I ignore these allomorphic alternations here. In fact, it is not even necessary to assume any kind of assimilation in these cases: following Szigetvári's analysis stating that the most marked fortis+fortis clusters are prohibited in English, we must analyze these words as /stɔpd/ and /stɔpz/, taking the voiceless realization of the suffixes to be the result of the lack of passive voicing word-finally and prefortis clipping to be due to the presence of a fortis in the obstruent clusters (2020: 48).

[26] Throughout the paper, I use the CUBE system for transcriptions for current Standard Southern British English (Lindsey & Szigetvári 2013).

in which |H| can be considered the phonologically active laryngeal element, as well as Ukrainian (de Lacy 2002: 307–308) and Durham English (Cyran 2014: 201–202), where it is |L| that seems to cause assimilation. The absence of delaryngealization before obstruents combined with the spreading of |H| and |L| in the analysis results in what we can perceive as asymmetrical assimilation, i.e. the spreading of either voice or voicelessness/fortisness. Some examples of regressive laryngeal assimilation in Meccan Arabic and Ukrainian are given in (11) and (12),[27] respectively.

(11)	/ʔakbar/	>	[ʔakbar]	‘older’
	/matʤar/	>	[matʤar]	‘shop’
	/ʔagsam/	→	[ʔaksam]	‘he made an oath’
	/ʔabtahal/	→	[ʔaptahal]	‘he supplicated’
(12)	o/sʲ-d/e	→	o[zʲd]e	‘here/there’
	vo/k-z/al	→	vo[gz]al	‘station’
	vi/d-p/ovidaty	>	vi[dp]ovidaty	‘answer-INF’
			ri[dk]o	‘rarely’

Among the languages with context-independent licensing, we find a few in which the laryngeal element can spread both left- and rightward. The words in (13) show that fortis obstruents trigger bidirectional assimilation in Swedish (Ringen & Helgason 2004: 60 and Lombardi 199: 285); also, the words in (13b) prove that this phenomenon is not simply an instance of allomorphic alternation. Other languages exemplifying the bidirectional spreading of |H| include Afrikaans (Wissing 2020) and Frisian (Visser 2020a, 2020b).

(13)	a.	vä/g-d/e	>	vä[gd]e	‘weigh-PAST’
		vä/g-t/	→	vä[kt]~vä[ʰkt]	‘weigh-SUP’
		kö/p-d/e	→	kö[pt]e~kö[ʰpt]e	‘buy-PAST’
		kö/p-t/	→	kö[pt]~kö[ʰpt]	‘buy-SUP’
	b.	hö/g-t/id	→	hö[(h)kt]id	‘festival’
		ti/s-d/ag	→	ti[st]ag	‘Tuesday’

Whether languages displaying bidirectional |L|-spreading as a clear phonological process exist remains a question, although there may be no phonological reason why such a laryngeal system should be impossible.

[27] The symbol “>” means ‘phonetically realized as’; and “→” represents phonological changes.

Oromo is the only language that I am aware of in which voice seems to cause regressive as well as progressive assimilation (Geshe & Devardhi 2013: 335–336, 341); see (14). It should be noted (besides the fact that it is not a two-way-contrast system) that regressive assimilation might be limited to /k/ as the target of the process and might not always take place (see (14a)), while in its progressive version, it might be only /t/ that undergoes voicing due to a preceding /b, d, g/, and the process can also be simply analyzed as a case of morphophonological alternation (see (14b)). Moreover, the words in (14c) exemplify the leftward spreading of voicelessness, instead of the rightward spreading of voicing, in case /g/ or /b/ is followed by /s/ in the next morpheme. The rarity of L-languages with bidirectional assimilation compared to their H-system counterparts, to the extent that they might even be practically nonexistent, might have psychological and phonetic reasons (see footnote 13).

(14) a. /waak'gaarii/ → [waaggaarii] '(name)'
/waak'gaʃʃaa/ → [waaggaʃʃaa] '(name)'
/waak'ʤiraa/ → [waakʤiraa] '(name)'

b. /ʧ'ab-t-e/ → [ʧ'abde] 'break-3SG.F/2SG-PRF'
/fid-t-an/ → [fiddan] 'bring-2PL-PRF'
/fiig-t-e/ → [fiigde] 'run-3SG.F/2SG-PRF'

c. /ʤig-s-e/ → [ʤikse] 'fall-CAUS-1SG/3SG.M-PRF'
/ʧ'ob-s-e/ → [ʧ'opse] 'pour-CAUS-1SG/3SG.M-PRF'

In accordance with Hansson's statement about the strong bias toward leftward directionality in the case of consonant harmonies (see footnote 13), it seems that progressive laryngeal assimilation in a given language implies its regressive counterpart. Therefore, I assume the absence of laryngeal systems with the spreading of the laryngeal element as an exclusively progressive phonological process.

The second major category of laryngeal systems contains languages in which licensing is limited to presonorant position, i.e. those with the Laryngeal Constraint in (5) or (6). German appears to belong to the subcategory in which the laryngeal element is |H| and does not spread; see (15) (based on Wetzels & Mascaró 2001: 208 as well as Jessen 1998: 67–68).

(15) a. [pʰ]aul 'Paul' – [p]all 'ball'
ba[k]en~ba[k] 'bake-INF~bake-2SG-IMP'
sa[g]en~sa[k] 'say-INF~say-2SG-IMP'

(15)	b.	ba/k^{0}-b^{0}/ar	>	ba[kp]ar	‘bakeable’
		ba/k^{0}-t^{H}/e	>	ba[kt^{h}]e	‘bake-1SG-PAST’
		sa/g^{0}-b^{0}/ar	>	sa[kp]ar	‘sayable’
		sa/g^{0}-t^{H}/e	>	sa[kt^{h}]e	‘say-1SG-PAST’

As a matter of fact, it seems to me that German could also be analyzed as an aspirating language with context-dependent licensing and H-spreading (listed in the appropriate cell of the table in parentheses). The only way of phonetically implementing the fortisness of a German plosive is via the aspiration of the segment—unlike in languages like Swedish and English, which use preaspiration and prefortis clipping, respectively, as phonetic cues. This means that there might be no way of showing whether *ba*[kt^{h}]*e* and *sa*[kt^{h}]*e* are the physical realizations of *ba*/k^{0}-t^{H}/*e* and *sa*/g^{0}-t^{H}/*e* (without |H|-spreading) or of *ba*/k^{H}-t^{H}/*e* and *sa*/g^{H}-t^{H}/*e* (after the spreading of |H|) since in this position, both an unmarked and a marked plosive is expected to be pronounced voiceless and unaspirated.

The words in (16) suggest that Hungarian is a typical example of laryngeal systems with presonorant licensing and L-spreading (see Siptár & Törkenczy 2000: 199–200). The Laryngeal Constraint active in the language along with the spreading of the laryngeal element insures that both voice and voicelessness spread symmetrically in the system.

Similarly to the German-type languages, L-systems like Hungarian could also be categorized differently: as a language with context-dependent licensing but not displaying |L|-spreading (see it in the table in parentheses). This reanalysis would mean that the unmarked coda obstruents in *fo*/k^{0}-b^{L}/*ól* and *fo*/g^{0}-b^{L}/*ól* undergo voicing as a result of coarticulatory (i.e. phonetic) assimilation (see Cyran 2017: 493–494).

(16)	a.	[p]ál	‘Paul’	–	[b]ál	‘ball’
		a[p]a	‘father’	–	A[b]a	‘Aba (proper noun)’
		jó[t]	‘good-ACC’	–	jó[d]	‘iodine’

b.	fo/k^{0}-b^{L}/ól	→	fo[gb]ól	‘degree-ELA’
	fo/g^{0}-b^{L}/ól	→	fo[gb]ól	‘tooth-ELA’
	fo/k^{0}-t^{0}/ól	>	fo[kt]ól	‘degree-ABL’
	fo/g^{0}-t^{0}/ól	>	fo[kt]ól	‘tooth-ABL’

Finally, the combination of the Laryngeal Constraint and the bidirectional spreading of |H| or |L| is logically impossible: if the laryngeal element of the

first member of an obstruent cluster is delinked due to the lack of a following sonorant, it cannot spread rightward.[28]

Now, having surveyed the typological categories that can be distinguished in current two-element frameworks, let us examine the alternative typology in the H-only analysis, discussing the phonological and phonetic properties of the revised categories. So, if we take any binary system contrasting obstruents along the VOT continuum to be an H-language, we can establish the categories summarized in (17). Actually, this is the result of merging the two columns of the table in (8) listing the L- and H-language types separately.

(17) An alternative typology of languages with two obstruent series

Licensing of |H|	Spreading of |H|	Example
independent of position	none	English Italian
	unidirectional (regressive)	Meccan Arabic
	bidirectional	Swedish
before sonorants	none	German Ukrainian
	unidirectional (regressive)	Hungarian
	bidirectional	not possible

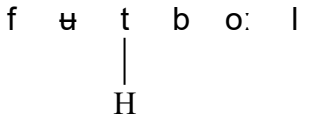
Again, the difference between the languages of the two major categories is whether their laryngeal element is licensed in any position or only before

[28] In many laryngeal analyses (e.g. in Lombardi 1999: 268–269, Lombardi 1995: 67, Wetzels & Mascaró 2001: 208, 225 and de Lacy 2002: 364), word/utterance-final neutralization vs. the application of Final Exceptionality (discussed in footnote 15) is a dimension along which languages can be further divided. This is what, say, Russian and Hungarian differ in: the former exhibits the final neutralization, while the latter has Final Exceptionality, i.e. does not display delaryngealization at the end of an utterance. This difference, which is relevant in the case of languages where the licensing of the laryngeal element is restricted to presonorant position, I consider to be of relatively minor importance and thus ignore here.

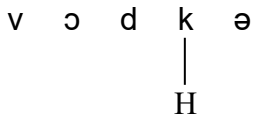
sonorants. Furthermore, we can create subcategories in both groups based on the characteristics of the spreading of |H|.

To begin with, according to this new table, English and Italian represent the same language type from a phonological point of view. |H| is always licensed in their obstruents, regardless of their position, and it does not spread; compare (18) and (19). The difference between the two systems is purely phonetic: the marked plosives are aspirated in English, and the unmarked ones are plain voiceless, whereas in Italian, this laryngeal contrast is shifted toward the "voiced" end of the VOT scale as the marked plosives are realized as plain voiceless segments, and the unmarked ones are fully voiced.

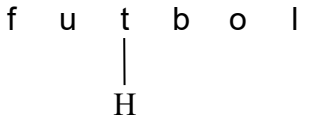
(18) a. English *foo*/tb/*all*



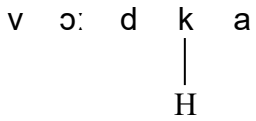
b. English *vo*/dk/*a*



(19) a. Italian *foo*/tb/*all*

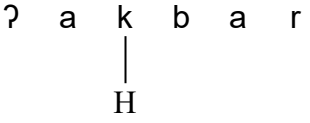


b. Italian *vo*/dk/*a*

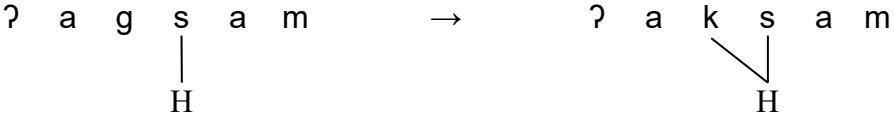


In the next language type, including Meccan Arabic and Yorkshire English, fortisness is a stronger property in the sense that besides its being licensed in any context, it exhibits (leftward) spreading as well. Practically speaking, fortis obstruents cause but do not undergo assimilation, which is therefore an asymmetrical process.

(20) a. Meccan Arabic /ʔakbar/ > [ʔakbar] 'older'

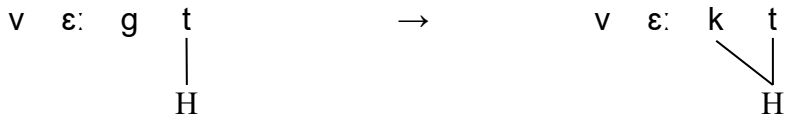


b. Meccan Arabic /ʔagsam/ → [ʔaksam] 'he made an oath'

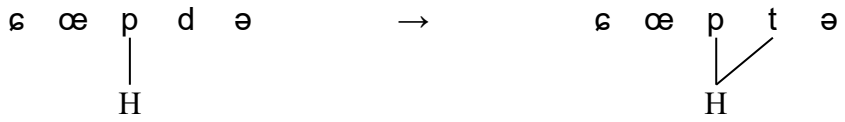


Fortisness has the most dominant role in the third subcategory of languages with context-independent licensing such as Swedish, Afrikaans and Frisian as it can trigger the assimilation of another obstruent regardless of its position relative to it:

(21) a. Swedish *vä*/g-t/ → *vä*[$^{(h)}$kt] 'weigh-SUP'

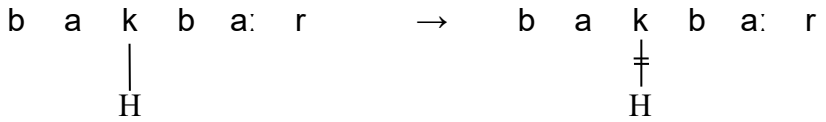


b. Swedish *kö*/p-d/*e* → *kö*[$^{(h)}$pt]*e* 'buy-PAST'

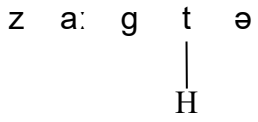


A most typical representative of the first subcategory of laryngeal systems in which the licensing of |H| is tied to presonorant position while the element does not spread is German. As far as the precise phonetic realization is concerned, the examples in (22) show that both members of the obstruent cluster in words like *ba*/k^{0}b^{0}/*ar* are pronounced voiceless because none of them occurs in intervocalic position. This is also true of the first member of the cluster in words such as *sa*/g^{0}t^{H}/*e*, whose second member tends to be aspirated.

(22) a. German *ba*/k-b/*ar* → *ba*[kp]*ar* 'bakeable'



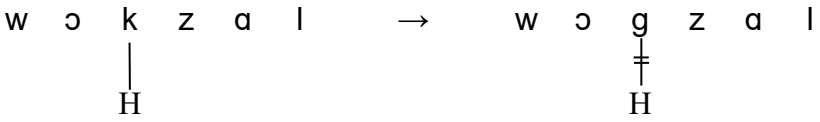
b. German *sa*/g-t/*e* > *sa*[kt^{h}]*e* 'say-1SG-PAST'



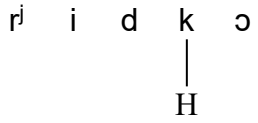
If we compare the representations in (22) with the ones in (23), it becomes clear that phonologically speaking, Ukrainian belongs to exactly the same

category as German.[29] The reason why one might have the impression that the two languages are typologically different is because of the surface dissimilarity: in Ukrainian, an unmarked obstruent is fully voiced in any position, and the implementation of fortisness does not involve aspiration.

(23) a. Ukrainian *vo*/k-z/*al* → *vo*[gz]*al* 'station'

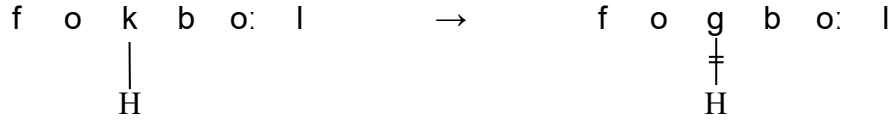


b. Ukrainian *ri*[dk]*o* 'rarely'

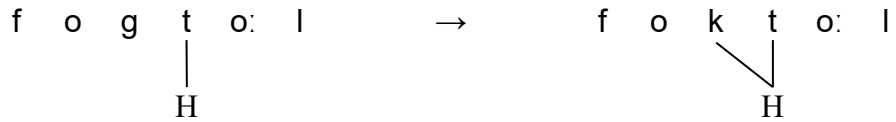


Examples of laryngeal systems whose obstruents undergo neutralization in non-presonorant position, and in which the |H| spreads leftward include Hungarian and Russian.[30] In these languages, just like in Ukrainian, unmarked obstruents are realized as fully voiced segments independently of their position, while the laryngeally specified ones are pronounced as plain voiceless consonants. Laryngeal phenomena in such systems are illustrated in (24).

(24) a. Hungarian *fo*/k-b/*ól* → *fo*[gb]*ól* 'degree-ELA'



b. Hungarian *fo*/g-t/*ól* → *fo*[kt]*ól* 'tooth-ABL'



Finally, as has been mentioned before, languages in which the Laryngeal Constraint is active may not exhibit bidirectional spreading since obstruents in

[29] The only difference is that Final Exceptionality is active in Ukrainian but not in German.

[30] For the difference between the two languages, see footnote 28.

such systems undergo delaryngealization if followed by another obstruent, that is, they are unable to keep their |H| and spread it rightward.

In sum, I have attempted to show that both voicing and aspirating languages can be analyzed as H-systems, and how these two-way-contrast systems can be grouped into typological categories.[31] In this laryngeal typology, languages are actually distinguished based on how strong phonologically voicelessness/consonantalness is in the systems (one extremity can be exemplified by Swedish, in which |H| is never delinked and can spread in both directions; at the other end of the scale, we can find languages like Ukrainian, where licensing is context-dependent, and the laryngeal element does not spread). For this analysis to be possible, no more stipulation and arbitrariness are needed than have been necessary anyway (concerning whether the laryngeal element triggers assimilation, and if so, what the directionality of the process is, as well as how the different obstruent categories are physically realized). As a desirable result, the number of laryngeal elements in VOT-based binary-contrast systems has been reduced to one, leading to a more uniform laryngeal analysis of such languages.

4.4. Placing the present approach

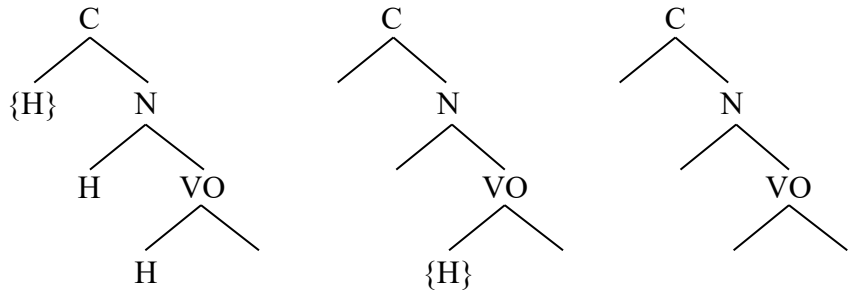
Now that the analysis of the present study has been discussed in detail, let us see in what ways it resembles and differs from other approaches in the phonological literature.

First of all, the analysis is carried out in Element Theory, which implies that it is a privative model, i.e. one in which a contrast in represented as the presence vs. absence of an element and not as the positive vs. negative specification of a two-valued feature. However, it differs from Laryngeal Realism and Laryngeal Relativism in that it makes use of only one laryngeal element (|H|) instead of two (|L| and |H|). In this respect, it is rather similar to traditional approaches referred to as the "broad interpretation of the feature [voice]" and advocated for by authors like Keating (1984); however, in the present analysis, it is the voiceless/fortis obstruents that constitute the marked category. As for the cross-linguistic variance in the physical properties of the obstruent series, it is taken to fall outside the domain of the phonological component and should be accounted for in the phonetics. This is possible if the relationship between phonological representation and phonetic realization is considered largely arbitrary, a view which the present approach shares with Laryngeal Relativism.

[31] For different laryngeal typologies assuming one distinctive feature, namely [(±)voice], see e.g. the references in footnote 28.

There are two laryngeal analyses that are worth mentioning here as both of them treat the relatively more voiceless obstruent series as the marked category. However, unlike the present approach, they encode the voicing–aspirating language division in the phonology (Cyran, personal communication). One of the advantages of these models is that they seem to be able to effectively account for optional/incomplete word-final neutralization and presonorant sandhi voicing. One of them can be found in Schwartz (2016), where sound segments are represented as "hierarchical structures of phonetic events" (116). The trees in (25) show the differences between the three plosive categories assumed in aspirated and voicing languages; "C" is shorthand for Closure, "N" for Noise (= release burst) and "VO" for Vocalic Onset, all of which are relevant phases for this segment type, and "{H}" indicates where the laryngeal element enters the tree and trickles down from. Aspirating languages like English contrast the plosives in (25a) with those in (25c), whereas voicing languages like Hungarian have the series represented in (25b) and (25c). In the case of an aspirated plosive in (25a), |H| is assigned to the Closure level and therefore occupies the Noise node, meaning that the segment is aspirated, as well as the Vocalic Onset node. The presence of |H| at the Vocalic Onset node and the underspecification of the Closure and the Noise node in (25b) is how unaspirated voicelessness is represented. The trees of voiced/lenis plosives in (25c), which can be found in both voicing and aspirating languages, lack |H| completely. That is, in Schwartz's (2016) model, phonetic differences between voiced and aspirating languages are encoded in the phonological representation as well.

(25) a. [p^h, t^h, k^h] b. [p, t, k] c. /b, d, g/



The other analysis in which the voiceless/fortis obstruents are considered to form the laryngeally marked set in aspirating as well as voicing languages is that of van der Hulst (2015). As can be seen in (26), the two obstruent categories in, say, Hungarian and English are identical at the phonemic level. What the two systems actually differ in is what redundancy rules they apply to

enhance the contrast between the two series: in Hungarian, the unmarked obstruents are enhanced with [voice], whereas in English, the fortis series is supplemented with [spread] in the onset of a stressed syllable, processes which take place in the phonological component (Cyran 2017: 504–505). So, the separation of voicing and aspirating languages are encoded phonologically in this model too, and as laryngeal assimilation is triggered by the redundant properties assigned to [Ø] and [fortis], it is connected to the phonological specification of the segments (see van der Hulst 2015 and Cyran 2019: 148–152).

(26)	/b/	/p/
Hungarian	[Ø] (→ [voice])	[fortis]
English	[Ø]	[fortis] (→ [spread] / onset)

As has been shown in the previous subsection, in the analysis proposed here, languages are not distinguished by different laryngeal specifications in the phonology but according to the different processes operating on the laryngeal element (and based on the phonetic implementation of the element, with which the element has an arbitrary relationship). Furthermore, as far as these processes are concerned, we have seen that almost all possible versions of their application are observable across languages, regardless of whether one or two laryngeal elements are used in an analysis: the nonspreading of the element as well as its spreading, in which case its direction can be right-to-left or left-to-right. As a consequence, accounting for laryngeal phenomena in the present approach—and, I suppose, in most comprehensive analyses in general—appears to support the necessity for the freedom provided for the phonological component in a framework like Substance Free Phonology (SFP) (see Hale & Reiss 2000 and Reiss 2017). It is argued in this theory that "the best way to gain an understanding of the computational system of phonology is to assume that the substance of phonological entities is *never* relevant to how they are treated by the computational system, except in *arbitrary*, *stipulative* ways";[32] and it is claimed that the goal of generative linguists is therefore solely "to define the set of *computationally possible* human grammars" (Hale & Reiss 2000: 162, emphases in original). This unrestrictive phonological theory seems to be exploited by the cross-linguistically

[32] The assumption made in Keating's analysis is also in harmony with this view: as phonological rules apply to the values of phonological features prior to the assignment of phonetic categories to them (see paragraph 4 of section 2), "the occurrence of a phonological rule in a language should not depend on, or be correlated with, the phonetic details of the language" (1984: 292).

observable behaviors of |H| (or |H| and |L|). As to which patterns are the most frequent (e.g. the rightward spreading of voicing), which are marginal (e.g. the bidirectional spreading of voicelessness), and which are unattested (phonologically conditioned progressive laryngeal assimilation without its regressive counterpart), such tendencies can be explained with reference to extragrammatical factors and should be considered irrelevant to phonological analysis (Hale & Reiss 2000: 162). According to Reiss, a phonological theory "should not account for generalizations about statistics of attested or attestable patterns of phonetic substance, even those that are presumed to be absolute, such as the (assumed here) impossibility of final voicing" (2017: 425).

Cyran (2016) examines the possibility of analyzing the two Polish dialects in a substance-free approach as well. He suggests using the same feature/element in both dialects to mark one of the obstruent series; however, in contrast to the present analysis, he continues to specify the voiced category in WP and the voiceless one in CP (explaining the difference in the implementation of the feature/element in the two laryngeal systems with the principle of Laryngeal Relativism stating that the relationship between the feature/element and its phonetic realization is arbitrary).

5. Conclusion

In the present paper, I have presented an alternative approach to laryngeal analysis, the Same-Element-Different-Processes model, with the aim of showing that it might fare better than many current analyses.

One of the main assumptions in this study is that it is unnecessary to reserve both |L| and |H| for encoding laryngeal oppositions in VOT-based binary-contrast systems (i.e. voicing and aspirating languages). Instead, I propose applying only |H| to mark the obstruent series that falls closer to the "aspiration" end of the VOT scale in both language types. In this analysis, two-way laryngeal systems are considered to differ only in the processes operating on |H|: it can be licensed in any context or only in presonorant position, it can spread or not, and in case it exhibits spreading, its direction can be regressive or progressive. As for cross-linguistic variations in the physical realization of the marked and unmarked obstruent series, these differences can be explained if we adopt the principle of the Laryngeal Relativism view according to which the relationship between the phonological makeup of a segment and its phonetic qualities should be considered arbitrary.

As an advantage of this approach, abandoning |L| as a laryngeal element results in a simpler and more uniform representation. In addition, this reduction in the number of elements does not increase complexity in other areas: The present analysis only makes use of phonological processes which

have been supposed to be present all along even in two-element approaches—provided that they do not ignore lower frequency laryngeal patterns. Also, assuming a significant degree of arbitrariness regarding the assignment of phonetic qualities to phonological specifications is inevitable independently of the framework one works in.

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Péter Őri
Eötvös Loránd University
oripeter17@gmail.com