

Laryngeal realism and Polish voicing

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Introduction. Laryngeal realism (e.g. Halle & Stevens 1971, Iverson & Salmons 1995, Avery 1996, Avery and Idsardi 2001, Honeybone 2005, Beckman, Jessen and Ringen 2013) is devoted to two propositions: (1) many typological differences in the phonetics of voicing systems are ultimately due to differences in phonological representation and (2) languages with a principal contrast involving glottal tension ([voice], i.e. [slack vocal folds]; Polish, Spanish, Japanese) will often display different phonetic behaviors than languages with a principal contrast involving glottal width ([spread glottis]; German, Somali, Washo).

Issues. Polish voicing phenomena present several challenges to theories of laryngeal contrasts including laryngeal realism (Cyran 2011, 2014), especially as regards two common assumptions: (1) [spread] is realized as aspiration in plosives, and (2) voiceless sonorants are realized with [spread] (Lombardi 1991). As is well-known, Polish displays final devoicing (FD, which is variable, Tieszen 1997) and voicing assimilation in clusters (VA) (Rubach 1996). More importantly, sonorants can also be subject to both of these processes when they are “in the way” (but see Castellví-Vives 2003 and Strycharczuk 2012 on phonetic variability and further complications). This is unexpected behavior if voiceless plosives are unmarked (examples from Bethin 1992: 164f):

FD: bóbr [bupɹ] ‘beaver’, bojaźń [bojaśɲ] ‘fear’, ansambl [ansampɹ] ‘ensemble’

VA: jabłko [japwɹko] ‘apple’, mędrszy [mentɹʂi] ‘wiser’, Jędrka [jentɹka] ‘Andy gen sg’

Formal Proposal. To address these problems, we propose an analysis of Polish voicing which adapts the analysis of Japanese vowel devoicing offered by Avery & Idsardi (2001: 53f), in which the underlying contrast is privative, [slack]/∅, but this contrast is ultimately enhanced into an equipollent one, [slack]/[spread]. Furthermore, we argue that Polish lacks aspiration on [spread] stops because it differs from languages like English and German in the gestural coordination of laryngeal features, such that [spread] is timed in phase with the stop closure, as opposed to in phase with the stop release (Kingston 1985, 1990). Sonorant devoicing is then a result of realizing [spread] on the sonorant also. Because enhancement, phasing and timing are all part of the phonetic implementation component, we predict that they will not affect lexical phonological processes. We believe that the reported variability follows from the relative lack of specification for [spread] in neighboring segments interacting with the different aerodynamic conditions governing vocal fold vibration in sonorants and obstruents.

Proposed Experiment. Unfortunately, laryngeal posture is not always reflected acoustically (Smith 1997). In order to better understand the phonetic laryngeal implementation in Polish sounds we need to measure laryngeal posture across at least three degrees of freedom in the larynx: tilt, width and height (Ladefoged 1973). Electromyography (EMG) is invasive (transcutaneous) and the vocalis muscles are difficult to hook (Hirano & Ohala 1969). Electrolaryngography (ELG) and transillumination only provide information about the relative adduction/abduction of the vocal folds (Jessen 1998). So this leaves high frame rate magnetic resonance imaging (MRI) as the best tool currently available. We will examine the laryngeal posture of Polish voiced and voiceless plosives and sonorants from Polish and heritage Polish speakers using MRI. One important challenge is to develop an appropriate MRI acquisition protocol that balances axial, sagittal and coronal views, and a protocol to acquire a shifted and tilted transverse slice across the center of the vocal folds as they change position during articulation. Another technical challenge is the possibility of motion artefacts and blur due to vocal fold vibration during the capture of voiced segments.

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