Phrase-level obstruent voicing in Polish: a Derivational OT account

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1. Introduction

Polish distinguishes between two dialectal behaviours, one of which apparently involves presonorant assimilation across word boundaries. Although both Warsaw and Cracow/Poznań dialects present voice assimilation (VA, as in *chlebka* [xlɛ.pka] 'bread' dim. gen., *chleb Tomka* [xlɛp.tɔm.ka] 'Tom's bread' vs. *chleba* [xlɛ.ba] 'bread' gen.) and final devoicing (FD, as in *chleb* [xlɛp] 'bread' nom. sg.), only Cracow/Poznań admits voicing before sonorants across word boundaries (*brat Adama* [brad.a.da.ma] 'Adam's brother', *brat Magdy* [brad.mag.dɨ] 'Magda's brother'). Traditional pre-OT accounts of this phenomenon (Gussman 1992, Rubach 1996) rely on autosegmental *delinking cum spreading* which requires that word-final obstruents be distinguished from word-medial ones by the prior application of FD (underspecification). However, this is incompatible with the results of the latest phonetic studies.

As noted by Strycharczuk (2012), Cracow/Poznań voicing data suggest that FD is a phrase-final process: full neutralisation in voicing can only be observed prepausally. In all other cases final obstruents share the voicing specification with the following sound (*bra[t]* 'brother', *bra[d.a]dama* 'Adam's brother', *bra[d.m]agdy* 'Magda's brother', *bra[t.k]asi* 'Kasia's brother' and *bra[d.g]osi* 'Gosia's brother') to some extent. Moreover, there is variability in and across speaker productions, which puts the categorical nature of Cracow/Poznań voicing into doubt.

In view of these data, I argue that Cracow/Poznań Polish has no FD in the traditional sense. What is more, the apparent presonorant voicing should not be analysed as phonological assimilation. Given the well-established distinction between obstruents and sonorants (active vs. spontaneous voicing, respectively), and following Scheer (2016) in attributing presonorant voicing to phonetics rather than phonology, I assume that FD should be treated as positional lenition (phonological delaryngealisation) taking place at the phrase, and not the word level in Cracow/Poznań Polish. The general markedness of laryngeal features in obstruents is the driver of both neutralisation across a word boundary (with full laryngeal agreement before obstruents) and prepausally (devoicing). This is shown in a Derivational OT framework (Rubach 1997; Kiparsky 1999; Bermúdez-Otero 2003) where *LAR and AGREE constraints conspire at the phrase level. The resultant underspecification is then interpreted as the default value (voicelessness) by the phonetics component of the grammar, which gives rise to the 'emergence of the unmarked' (McCarthy & Prince 1994). The contrast between Cracow/Poznań and

Warsaw Polish can be interpreted as a difference in the domain of application of FD which is word- and not phrase-final in Warsaw.[1]

The paper is structured as follows. Section 2 presents the theoretical assumptions and a brief discussion of previous studies on Cracow/Poznań voicing. Section 3 discusses the phonetic evidence underlying this analysis and its implications for phonology. Section 4 provides a DOT analysis of the data. Section 5 shows general conclusions and hypotheses about the phonological differences between the two dialects.

2. Theoretical background

In this paper I assume modularity, which means that the outputs of phonology are fed into the phonetic component. Phonological processes are categorical but informed by phonetic facts such as acoustic and auditory cues, and coarticulation. Gradient changes and default 'rules' are dealt with by the phonetics. In this way variability and incomplete neutralisation can be explained.

Second, I assume a stratal approach to phonology based on the legacy of Jakobson (1931) and, later, Lexical Phonology (Kiparsky 1982; Booij and Rubach 1987). Crucially, there is a distinction between stem, word- and phrase-level processes which can explain a series of sandhi phenomena across the world's languages, as well as the fact that processes encountered across word boundaries are not necessarily replicated inside words despite the same phonetic environment, and vice versa.[2] The formal mechanism grasping this fact and adopted here is Derivational Optimality Theory (Rubach 1997, 2000, 2011), also known as Stratal OT (Kiparsky 1999, 2003; Bermúdez-Otero 2003, forthcoming). In this framework, different rankings are assumed for different levels of derivation, with parallel evaluation in each of them.

Third, I adopt Bermúdez-Otero's (2007) hypothesis of the life cycle of phonological processes, which dates back to Baudouin de Courtenay (1895). According to this assumption, synchrony and diachrony can be combined in theoretical terms. As gradient phonetic changes stabilise, they become legitimate phonological processes that apply categorically at the phrase level. With time, assuming that a given process is well generalised, it can be restructured and narrowed down to the lexical level, and therefore apply e.g. not only in prepausal, weak

[1] It must be noted that a distinction is made here between the *level* and the *domain* of application of phonological processes. More specifically, the domain may be phrase-final (prepausal) or word-final, as stated here, but the difference may be due to constraint ranking rather than level of application (e.g. both at the phrase level in DOT).
[2] For accounts of sandhi phenomena see e.g. Bermúdez-Otero (2007), Krämer (2001), Strycharczuk et al. (2014), Ramsammy (2013), Wiltshire (2002), Broś (2015, 2016) and many others. Phrase-level pesonorant voicing in Cracow/Poznań Polish should be considered one of such processes.

positions, but also word-finally, and even word-internally. Such domain narrowing was described in detail in Bermúdez-Otero and Trousdale (2012) using examples of English *ng* clusters and can be taken as a model of synchronic dialectal variation, given that dialects of the same language can differ in the types of phonological processes occurring in them, but also in the domains of application thereof. Cracow/Poznań and Warsaw Polish seem to be instances of the latter kind with respect to obstruent voicing specification. As will be illustrated in the next sections, Cracow/Poznań Polish seems to be more conservative: final devoicing applies only phrase-finally in this dialect, whereas it is word-final in Warsaw Polish. Such behaviour is confirmed by phonetic data.[3]

2.1. Data

In Polish, three processes are involved in the phonology of voiced and voiceless pairs of obstruents: final devoicing, voice assimilation and presonorant voicing. Final devoicing applies to all words ending in underlying voiced obstruents. This is illustrated in (1).

(1) Final devoicing in Polish

a.	*chleb* [xlɛp] ‘bread’ nom.	*chleba* [xlɛ.ba] ‘bread’ gen.
b.	*bóg* [buk] ‘god’ nom.	*bogiem* [bɔ.g’ɛm] ‘god’ instr.
c.	*wóz* [vus] ‘cart’ nom.	*wózek* [vu.zɛk] ‘cart’ nom. dim.
d.	*łódź* [wutɕ], ‘boat’ nom.	*łodzią* [wɔ.dʑi] ‘boat’ gen.
e.	*wiedz* [v’jɛts] ‘know’ 2nd p. sg. imper.	*wiedzą* [v’jɛ.dzɔ̃w̃] ‘know’ 3rd p. pl.
f.	*weź* [vɛɛ] ‘take’ 2nd p. sg. imper.	*weźmie* [vɛ.ʑm’jɛ] ‘will take’ 3rd p. sg.

As shown in (1), alternations in Polish stems show the process of devoicing in word-final position as opposed to word-internal contexts before a sonorant. Similar words without alternations can also be found in the language, e.g. *sklep* [sklɛp] ‘shop’ nom., *sklepu* [sklɛpu] ‘shop’ gen.; *wiec* [v’jɛts] ‘gathering’ nom., wiecu [v’jɛ.tsu] ‘gathering’ loc. or buk [buk] ‘beech’ nom., buku [bu.ku] ‘beech’ loc. At the same time, Polish obstruents undergo regressive voice assimilation in the environment of other obstruents. The process applies both inside words and across word boundaries.[4]

[3] Spanish dialectal variation is another example of domain narrowing in action. Whereas the well-known process of coda *s* aspiration is phrase-final in some dialects, it is narrowed down to the word level in others. The same applies to *s* elision – a more radical change taking place in more innovative varieties, such as Chilean. This process is blocked word-finally before a vowel, but not before a consonant. See Broś (2012, 2015) for a detailed analysis.

[4] Polish also has instances of a less productive process of progressive voice assimilation. I omit it here for reasons of space, but see e.g. Gussman (1992) and Rubach (1984).

(2) Polish voice assimilation

a. inside words	b. across word boundaries
chlebka [xlɛ.pka] ‘bread’ gen. dim.	*chleb polski* [xlɛp.pɔl.ski] ‘Polish bread’
wózka [vu.ska] ‘cart’ gen. dim.	*chleb żytni* [xlɛb.žɨ.tni] ‘rye bread’
łódka [wu.tka] ‘boat’ nom. dim.	*sklep sportowy* [sklɛp.spɔr.tɔ.vɨ] ‘sports store’
babski [ba.pski] ‘woman-like’	*sklep warzywny* [sklɛb.va.žɨ.vnɨ] ‘grocery store’
krewki [krɛ.fki] ‘impetuous’	*brat Kasi* [brat.ka.ɕi] ‘Kasia’s brother
słodki [swɔ.tki] ‘sweet’	*brat Wandy* [brad.van.dɨ] ‘Wanda’s brother’

In (2), we can see that both underlying voiced and underlying voiceless obstruents agree with the voicing of the consonant that follows regardless of the word boundary. Thus, voice assimilation supersedes final devoicing (e.g. *chleb żytni*). Voicing agreement is more important than opting for the unmarked feature (voicelessness) at the end of the word.[5] In Warsaw Polish, all other instances of word-final obstruents surface obligatorily as voiceless. In Cracow and Poznań areas, however, this is not so. Let us examine the cases of presonorant voicing.

(3) Cracow/Poznań presonorant voicing

a. *chleb Adama* [xlɛb.a.da.ma] ‘Adam’s bread’
b. *sklep Adama* [sklɛb.a.da.ma] ‘Adam’s store’
c. *chleb Magdy* [xlɛb.ma.gdɨ] ‘Magda’s bread’
d. *brat Magdy* [brad.ma.gdɨ] ‘Magda’s brother’

Note that this process is strictly limited to the phrase level. Word-internally, the underlying specification of the obstruent does not change under the influence of sonorants: *ko[p]nąć* ‘to kick’ perf., *ko[p]ać* ‘to kick’ imperf. What is more, full contrast can be observed in such contexts, e.g. *śle* [ɕlɛ] ‘sends’ 3rd p. sg. vs. *źle* [ʑlɛ] ‘badly’. Underlying voiced obstruents remain voiced: *pochlebny* [pɔ.xlɛ.bnɨ] ‘flattering’, *pochlebiać* [pɔ.xlɛ.b’jatɕ] ‘to flatter’.

2.2. Previous analyses

Bethin (1984) provides a rule-based account of voice assimilation with the use of two rules.

[5] Of course, examples of underlying voiceless stops can be analysed in different ways depending on the adopted framework and the assumed ‘rule ordering’. Here, they simply remain unchanged before a voiceless sound or a pause, or redundantly undergo FD. I put them under the voicing assimilation headline to show variation. As will be argued in the next sections, I assume that an agreement relationship ensues between Polish obstruents rather than an active process of assimilation (feature spreading).

The first one applies to all obstruents followed by contrastively voiced obstruents word-medially and (in fast speech) across word boundaries, and the second one is restricted to coda obstruents before any voiced sound (Cracow Polish). Gussman (1992) offers a slightly different, autosegmental analysis of assimilation, according to which word-medial presonorant obstruents surface as onsets as opposed to obstruents followed by other obstruents. Meanwhile, laryngeal specifications are licensed in onset only and all coda obstruents undergo delaryngealisation. Voice assimilation is conceived of as feature spreading to an unspecified segment.

Rubach (1996) argues against syllable-based accounts. Crucially, he notes that certain word-medial clusters do not abide by Bethin's and Gussman's rules, and that false predictions about word-medial presonorant obstruents are made for the Cracow/Poznań dialect. Instead of the syllabic account Rubach therefore opts for laryngeal adjacency. The laryngeal node attached to the obstruent is delinked at the end of a phonological word (FD) or before another obstruent (in VA contexts) and the obstruent in question becomes unspecified for voice (Rubach 1996:77-78). This is followed by the spreading of the laryngeal specification of the following consonant. In the case of the Cracow/Poznań dialect, spreading starts from the sonorant, preceded by Sonorant Default, a rule that assigns voicing. Word-medial presonorant obstruents are 'saved' by the restriction of delaryngealisation to the edge of PW.

Naturally, the treatment of VA and FD as processes of autosegmental delinking and spreading is problematic in parallel frameworks, such as OT. Whereas the introduction of a ternary distinction in laryngeal specifications is not a challenge, the difference between sonorant and obstruent voicing specifications must be expressed otherwise than with the use of default feature assignment in the course of the derivation. Another issue is whether only positive feature values can spread and whether sonorants can take an active part in the process.[6] Furthermore, the treatment of VA as spreading is problematic for yet another reason: it is a two-stage operation difficult to effect without ordering. Finally, the derivational account creates Duke-of-York effects. For the obstruent in question to get its final feature specification, it has to be delaryngealised first. At the level of the phrase this means that the word *chleb* goes to [xlɛB] and then back to [xlɛb] in *chleb Wandy* 'Wanda's bread', and in *chleb Adama* 'Adam's bread' in Cracow/Poznań Polish.[7]

[6] I assume that [voice] is binary and do not discuss the nature of this feature, which has been widely debated in literature (see e.g. Lombardi 1999, 2001 or Wetzels & Mascaró 2001).

[7] As for VA itself, given the presence of default fill-in rules in derivational phonology, the double step from specified to unspecified voice and then spreading could be foregone in the voiceless set of obstruents in order to avoid the controversial spreading of [-voice]. In this way, delaryngealisation would be simply followed by a default rule at the end of phonology. Alternatively, it could be assumed that unspecified segments are interpreted as voiceless in the phonetic component or when passing from the phonological component to phonetics. This

The conclusion to be drawn based on all the traditional analyses of the VA/FD problem with respect to presonorant voicing is that word-medial and word-final obstruents followed by sonorants must be distinguished by phonology. This is effected by assigning delaryngealisation to the word level. Such a move is also possible in OT under the assumption that there are derivational cycles (strata). The analysis presented in this paper partially follows this line of reasoning, although with an attempt to avoid Duke-of-York derivations. What is more, phonetic factors provided by Strycharczuk (2012) are taken into account and used as a point of departure for a change in the preliminary assumptions about what truly happens in phonology as opposed to phonetics, which, naturally, affects the order of application of the observed processes.

3. The phonetics of Cracow/Poznań voicing

As mentioned above, in autosegmental analyses a ternary distinction is assumed to ensure a feeding relationship between FD and presonorant voicing. The spreading of voice and sharing the LAR node is a common approach. In OT terms, it can be expressed by prosodic licensing (Itô & Mester 1993) or by AGREEMENT. The precedence of FD, however, needs to be expressed differently under the assumption that the voicing specification of a given obstruent has to be delinked before sonorants in across-word contexts.

A fairly recent phonetic study by Strycharczuk (2012) shows that attributing Cracow/Poznań voicing entirely to preceding delaryngealisation is not the correct line of reasoning. Variability in inter- and intraspeaker productions and the differences in the degree of voicing in obstruents followed by sonorants depending on the underlying voicing specification lead the author to the conclusion that this relationship is not necessarily categorical, although she deems voicing a categorical but optional process. More specifically, based on two acoustic experiments of the Cracow/Poznań dialect, Strycharczuk finds that a) there is full obstruent agreement in voice specifications in obstruent sequences, b) final devoicing is a phrase-final phenomenon, and c) full neutralisation can be observed only pre-pausally. The most disturbing fact about this variety is that the surface realisations of underlyingly voiced and voiceless segments are asymmetric. In Strycharczuk's words, "underlyingly voiced presonorant stops [tend to] have significantly more voicing than stops followed by voiceless obstruents [and] significantly less voicing than stops followed by voiced obstruents" (2012:87). Underlyingly voiceless stops, in turn, "typically surface with very little voicing, becoming phonetically indistinguishable from stops followed by voiceless obstruents" (2012:88). This supports

simplification, however, would cause an asymmetry in the treatment of VA depending on the underlying segment (spreading or no spreading).

Jansen's (2004) hypothesis that neutralised (underspecified) obstruents have more voicing when followed by a sonorant than by a voiceless obstruent, but less than before an actively voiced obstruent. There are several interpretations of these facts. First of all, presonorant voicing is non-neutralising, i.e. it does not lead to the loss of contrast. Second, in phonological terms the process is either phonetic or phonological but optional, hence variation. Interestingly, there tends to be variation in production, but two clear paths can be distinguished. There is a clear bimodal distribution of the voicing duration and of the voicing ratio, which means that underlyingly voiced segments fall into one of two categories: partially voiced or fully voiced, with a very strong bias toward the latter. Underlyingly voiceless sounds, on the other hand, are never fully voiced before sonorants. When the voiced-voiceless contrast is maintained, the difference is very robust.

The dialect demands further research to confirm the data, especially that only selected obstruents were tested and two different studies gave slightly diverging results, but it can be assumed that if the underlyingly voiced segments are more likely to be voiced before a sonorant as opposed to underlyingly voiceless sounds (which are only partially voiced if at all), it is possible that no final devoicing takes place at the word level. In other words, we can imagine that underlyingly voiced obstruents simply remain voiced when fed into the phrase level, while underlyingly voiceless sounds may be phonetically voiced to some extent at the phonetic level. This avoids unnecessary Duke-of-York derivations whereby segments are first devoiced only to be voiced again under the dubious influence of the right-hand sonorant, something that does not happen word-medially. The motivation for voicing under the influence of a sonorant in Polish only across word boundaries is unclear, unlike in other languages which exhibit voicing before sonorants also word-medially (e.g. Spanish or Catalan). The only explanation would be to see it as a result of filling underspecified segments with voicing features (as analysed by Rubach), but this seems to be driven by the need to distinguish word-final presonorant obstruents from word-medial ones in formal terms rather than by a well-grounded phonetic or phonological fact.

Thus, we can assume that in Warsaw Polish, the process of final devoicing is a word-final neutralisation process applied along the lines of Rubach (1996). In Cracow/Poznań, in turn, where underlyingly voiced but not voiceless obstruents are voiced before a sonorant, we can assume an 'earlier' (or less innovative) stage of the process where FD proceeds only phrase-finally (phonological delaryngealisation) and has not stabilised at the level of the word. In phonetic terms, before a pause, when there is no right-hand voicing cue and the sound is in a weak final position, the voicing cannot be retained, whereas before other sounds, contextual

influence plays a role.[8] The presence of another obstruent demands feature agreement (gestures are aligned and vocal fold vibration retained or lost accordingly). The presence of a sonorant does not inhibit voicing, which is done at no additional cost. This turn of events will be referred to as Scenario 1 – the stable option. As reported by Strycharczuk (2012), a dichotomy between a stable contrast in obstruents in presonorant position and partial voicing strategies can be observed in Cracow/Poznań dialect speakers. The stable option therefore resembles voicing to some extent, but is merely an instance of a lack of devoicing before sonorants. At the same time, an unstable, gradient process is taking place in the dialect consisting in the transition to a system with devoicing in all word-final obstruents. We can imagine a trajectory in line with the life cycle of phonological processes here: first, a phonetic change is driven by gestural and positional cues and happens gradually – a gradient phonetic change which then stabilises into a phonological process and categorically delinks laryngeal specifications at the end of a phonological phrase (Scenario 1). The process then narrows down to the word-level (end of phonological word), but has not stabilised. In the phonology, this takes the form of delaryngealisation and underspecification left for further interpretation at the level of phonetics, which means that passive voicing is able to occur, rendering partial voicing in both underlyingly voiced and voiceless obstruents, as reported by Strycharczuk. I shall dub this second option Scenario 2. Note that both scenarios correspond to phonetic reality and reflect variation in speaker productions. They are also in line with recent studies on voicing phenomena, e.g. Scheer (2016) who attributes all kinds of presonorant voicing to phonetics, triggered by positional delaryngealisation in the phonology component, providing evidence from a series of language families. In this way, he argues, certain inconsistencies in voicing patterns, especially intervocalic voicing, can be explained.

The idea that Cracow/Poznań 'voicing' should be attributed to phonetics rather than phonology has also been taken up by Cyran (2012, 2014). One of his assumptions is that phonological representations must be phonetically interpretable (Harris & Lindsey 1993), which means that there may be no default feature-filling and sonorants cannot be specified for voice. Cyran seeks inspiration in the theory of laryngeal realism (Iverson & Salmons 1995; Jessen & Ringen 2002), according to which the true voicing contrast corresponding to a given language (short vs. long VOT lag) should be reflected in phonology. He proposes *laryngeal*

[8] This goes back to Ohala (1983), Westbury & Keating (1986) and the theory of articulatory gestures (Browman & Goldstein 1990). Certain studies have shown that obstruents tend to undergo laryngeal changes under the influence of sonorants only after they have lost their own articulatory targets, which is the case in delaryngealisation. See the discussion of voicing targets and passive voicing in Jansen (2004). See also Steriade (1997) for observations concerning the relative richness of phonetic cues and neutralisation loci.

relativism in which Cracow/Poznań Polish is a [spread glottis] system. The class of so-called neutral obstruents in this variety can undergo phonetic voicing under the influence of a sonorant, which is spontaneously voiced. Final devoicing in this case takes the form of element suppression in the phonology whereas voicing assimilation is an interface phenomenon. From the point of view of the argument of this paper, such an account is attractive given the assumption of spontaneous phonetic spreading of voice. What is more, the analysis provided in section 4 is similar in some respects. Nevertheless, no direct evidence for treating Cracow/Poznań Polish as a [spread glottis] system has been provided so far.

To summarise, given the phonetic facts about the Cracow/Poznań dialect, I assume that there is no phonological presonorant voicing in this dialect and no final devoicing in the traditional sense. Instead, we are dealing with a lack of devoicing until the end of phonology and delaryngealisation which only takes place prepausally. In Scenario 1 presonorant word-final obstruents are not affected and preserve their UR specification, whereas in Scenario 2 delaryngealisation encompasses all word-final obstruents unless superseded by cluster agreement. This is ensured by the interaction of markedness and faithfulness constraints at the phrase level. As a result, phonetically interpretable underspecification ensues. The analysis couched in the DOT framework is presented in the next section.

4. Formal representation of Cracow/Poznań obstruent behaviour

As argued above, in Cracow/Poznań Polish full laryngeal agreement is ensured in obstruents across words and devoicing ensues before a pause. In a DOT account, this requires a conspiracy between the constraints *LAR and AGREE. The definition of the former is close to the one proposed by Lombardi (1999).[9] Voice assimilation is understood as a requirement on agreement in feature specifications in adjacent obstruents rather than feature spreading.

(4) * LAR – obstruents must have no specification for voice
AGREE CC(C) – adjacent obstruents must agree in voicing

Two crucial faithfulness constraints interact with the above.

[9] Apart from the general OT *LAR constraint, Lombardi (1999) proposes that laryngeal features are not licensed in obstruents unless they are adjacent to a sonorant, be it a consonant or a vowel. This means that positional faithfulness constraints such as IDENTONSET[LAR] are not violated by a segment that is not adjacent to a sonorant (e.g. *z* in *jezdnia* 'road surface'). As a result, the onset faithfulness constraint used by Lombardi has an effect of Rubach's presonorant faithfulness discussed below. Despite the name, the constraint resembles a string-based positional restriction.

(5) IDENT[LAR] – the input laryngeal specification must be preserved in the output
IDPRESON[LAR] – the input laryngeal specification of a presonorant segment must be preserved in the output (Rubach 2008:439)[10]

Crucially, AGREE is practically inviolable in Polish so it must be ranked really high. At the same time, laryngeal specifications are marked but preferred over underspecification in Cracow/Poznań. In most of the cases, the underlying specification is preserved unless superseded by cluster agreement. To ensure delaryngealisation, we must rank * LAR higher than faithfulness. Positional faithfulness protects presonorant obstruents. The resultant ranking for voicing agreement and delaryngealisation is therefore AGREE CC(C), IDPRESON[LAR] >> *LAR >> IDENT[LAR]. The ranking is responsible for rendering pre-pausal delaryngealisation only, as in the stable option of the Cracow/Poznań dialect (Scenario 1).

(6) Scenario 1: phrase-level evaluation of the input *chleb* 'bread' in various configurations[11]

/xlɛb/	**AGREE**	**IDPRESON[LAR]**	*** LAR**	**ID[LAR]**
a. ☞xlɛB				*
b. xlɛb			*!	
c. xlɛp			*!	*
/xlɛb + tɔm.ka/				
a. ☞xlɛp.tɔm.ka			**	*
b. xlɛb.tɔm.ka	*!		**	
c. xlɛB.tɔm.ka	*!		*	*
/xlɛb + a.da.ma/				
a. ☞xlɛb.a.da.ma			*	
b. xlɛp.a.da.ma		*!	*!	*
c. xlɛB.a.da.ma		*!		*

[10] In his 2008 article, Rubach maintains his 1996 stance in rejecting syllable-based analyses of Polish voicing assimilation and related issues. Crucially, he argues that onset faithfulness is insufficient to account for Polish cluster behaviour and makes incorrect predictions about such words as *Francuzka* 'Frenchwoman' in which the cluster *zk* is syllabified as an onset, hence no devoicing before [k] is predicted contrary to the actual surface form. In order to ensure voicing agreement in multiple obstruent clusters, in which Polish abounds, presonorant faithfulness needs to be applied instead of onset faithfulness. In this way the trigger of devoicing (the segment adjacent to the sonorant) is protected and the undergoer is in a weak position regardless of syllabification. This chief contribution to directionality and positional effects in cluster behaviour is adopted here. Unfortunately, the argument cannot be presented in more detail due to space limitations, but see Rubach (2008) for an in-depth discussion.

[11] I only count *LAR violations incurred by the segments under scrutiny (VA or FD targets). Also, note that a ternary distinction in voicing specifications is assumed here (0 LAR, LAR[-vd], LAR[+vd]) unlike in Lombardi (1999), hence the violation count diverges from her analysis.

As illustrated in (6), *LAR >> ID[LAR] ensures delaryngealisation, which is restricted to prepausal position. Before an obstruent, AGREE requires that adjacent obstruents have the same laryngeal specification, while before a sonorant IDPRESON[LAR] protects the segment from losing its voice. The ranking works equally well for underlying voiceless segments.

(7) Scenario 1: phrase-level evaluation of the input *sklep* 'store' in various configurations

/sklɛp/	**AGREE**	**IDPRESON[LAR]**	*** LAR**	**ID[LAR]**
a. ☞sklɛB				*
b. sklɛp			*!	
c. sklɛb			*!	*
/sklɛp + van.dɨ/				
a. ☞sklɛb.van.dɨ			**	*
b. sklɛp.van.dɨ	*!		**	
c. sklɛB.van.dɨ	*!		*	*
/sklɛp + a.da.ma/				
a. ☞sklɛp.a.da.ma			*	
b. sklɛb.a.da.ma		*!	*	*
c. sklɛB.a.da.ma		*!		*

In (7), we can see voicing agreement mandated by the second segment, which is protected by IDPRESON[LAR], as well as no change in presonorant contexts across a word boundary. This is in line with the phonetic report according to which underlying voiceless obstruents are not voiced on the surface in presonorant position while underlying voiced segments are voiced in the same environment (stable non-voicing option for Cracow/Poznań).

It is worth mentioning that the role of IDPRESON[LAR] is even greater than illustrated here. As already mentioned, the directionality problem in cluster behaviour requires the operation of such a constraint. This was mentioned by Rubach (2008). For instance, in *sklep Wandy* 'Wanda's store', feature agreement is governed by the second segment and not the first one.[12] This is illustrated in (8).

[12] For this reason, in traditional analyses, the process is called regressive voice assimilation, see e.g. Rubach (1984, 1996).

(8) Phrase-level evaluation of the sequence *sklep Wandy* with a full spectrum of candidates

/sklɛp + van.dɨ/	**AGREE**	**IDPRESON[LAR]**	***LAR**	**ID[LAR]**
a. ☞sklɛb.van.dɨ			**	*
b. sklɛp.van.dɨ	*!		**	
c. sklɛB.van.dɨ	*!		*	*
d. sklɛp.fan.dɨ		*!	**	*
e. sklep.Van.dɨ	*	*!	*	*
f. skleB.Van.dɨ		*!		**

Scenario 2 is both more complicated and more interesting as it combines phonological computation with fine acoustic detail. Naturally, phonological processes are strictly categorical and operate on phonological features. The output of phonology is subjected to phonetic implementation. Crucially, underspecification is predicted at the end of phonology, which is then interpreted phonetically based on the immediate context of each underspecified sound. In presonorant contexts, voice spilling takes place, hence partial voicing in presonorant obstruents, whereas in the prepausal environment there is no voicing target on the right and hence no need to set the vocal folds into motion. The 'default' obstruent specification is produced. Here, we can talk of the emergence of the unmarked in the sense of McCarthy & Prince (1994). Obstruent clusters have no ambiguous or partial voicing since their featural specifications are filled at the level of phonology. This is interpreted phonetically as full voicing or voicelessness, depending on the sound in question. In OT terms, the state of affairs described above can be expressed by the demotion of IDPRESON[LAR]. In this variant of Cracow/Poznań speech, presonorant obstruents are protected only in the onset (as in word-medial syllabifications). Given that they occupy the coda position in word sequences, they are delaryngealised due to high-ranked *LAR.

(9) Scenario 2: phrase-level evaluation of the input *chleb* 'bread' in various configurations

/xlɛb/	**AGREE**	***LAR**	**IDPRESON[LAR]**	**ID[LAR]**
a. ☞xlɛB				*
b. xlɛb		*!		
c. xlɛp		*!		*
/xlɛb + tɔm.ka/				
a. ☞xlɛp.tɔm.ka		**		*
b. xlɛb.tɔm.ka	*!	**		
c. xlɛB.tɔm.ka	*!	*		*

/xlɛb + a.da.ma/				
a. xlɛb.a.da.ma		*!		
b. xlɛp.a.da.ma		*!	*	*
c. ☞xlɛB.a.da.ma			*	*

As illustrated in (9), word-final *b* is delaryngealised as mandated by *LAR. The same applies to underlying voiceless obstruents.

(10) Scenario 2: phrase-level evaluation of the input *sklep* 'store' in various configurations

/sklɛp/	**AGREE**	***LAR**	**IDPRESON[LAR]**	**ID[LAR]**
a. ☞sklɛB				*
b. sklɛp		*!		
c. sklɛb		*!		*
/ sklɛp + van.dɨ/				
a. ☞sklɛb.van.dɨ		**		*
b. sklɛp.van.dɨ	*!	**		
c. sklɛB.van.dɨ	*!	*		*
/sklɛp + a.da.ma/				
a. sklɛp.a.da.ma		*!		
b. sklɛb.a.da.ma		*!	*	*
c. ☞sklɛB.a.da.ma			*	*

In (10), the underlying *p* is delaryngealised unless it has to agree with the following obstruent in terms of voicing. The ranking AGREE >> *LAR >> IDPRESON[LAR] yields the correct results. Most importantly, this process is not extended to word-internal position, where syllabification is different. The tableau in (11) illustrates that onset faithfulness still plays a role in this dialect. The constraint banning changes to onsets must be ranked high – above *LAR.[13]

[13] According to Rubach & Booij (1990), the core/preferred syllabification is V.CCV as Polish maximises onsets. The researchers report, however, that some speakers vary in their choices and VC.CV can also occur. According to my study of speaker intuitions conducted among several groups of first-year university students, Polish speakers are not systematic in their syllabifications, which may lead to two conclusions: either both syllabifications are correct (which raises the question of whether word-internal consonants are ambisyllabic) or speakers do not make the best judgments about syllable structure. Given the fact that no phonological process points to non-canonical syllabification of consonants or ambisyllabicity, I am willing to select the second option as more viable. Speaker intuitions are not particularly reliable and constitute a mixture of school instruction, prescriptive corrections and variability. First, Polish speakers learn how to read by syllabifying, then they are taught about dividing words in writing at the end of the line and often more than one possibility is provided. Thus, their adult 'intuitions' are often confused or hesitant reproductions of their teachers' instructions. As for the present analysis, there are no data showing Cracow/Poznań dialect users' syllabifications, hence I assume that the default applies, i.e. V.CCV.

(11) Phrase-level evaluation of words with presonorant obstruents: *brudny* 'dirty'

/bru.dny/	AGREE	IdOns[LAR]	* LAR	IDPRESON[LAR]	IDENT[LAR]
a. ☞bru.dny			*		
b. bru.tny		*!	*	*	*
c. bru.Dny		*!		*	*

5. Concluding remarks

In this paper, I provided a reanalysis of the so-called Cracow/Poznań presonorant voicing data based on new insight provided by phonetic studies. As argued above, the acoustic analysis of speaker productions mandates a revision of the initial assumptions concerning what really takes place in the dialect. Given the undeniable relation between phonetic surface forms and their phonological representations, in order to be adequate, any phonological analysis of linguistic data needs to account for inter- and intra-dialectal variability, as well as accommodate phonetic measurements. As Cracow/Poznań productions are not 100% stable, two sets of assumptions are necessary to account for the data, corresponding to two different scenarios. One of them assumes that obstruents are delaryngealised only prepausally and otherwise rendered faithfully or subjected to cluster agreement. The second scenario presupposes partial voicing produced at the level of phonetics after phonological delaryngealisation takes place in phrase-level phonology. The latter process applies only at word edges. The ranking responsible for Scenario 1 is AGREE CC(C), IDPRESON[LAR] >> *LAR >> ID[LAR]. Scenario 2 is governed by AGREE CC(C) >> *LAR >> IDPRESON[LAR] >> ID[LAR]. At the stem and word levels, *LAR is ranked lower than ID[LAR] in both Cracow/Poznań varieties as it does not play a role. This may not be the case in the Warsaw dialect in which FD in the traditional sense does take place. It is a word-edge process affecting all obstruents. Given its categorical status and no voice spilling in any context in word sequences, no phonetic effect is predicted in this dialect. FD is phonologised and the SPEC constraint mandating that all segments be fully specified must be ranked high and active for Warsaw speakers at the level at which FD takes place.[14] Apart from that, the

[14] There are several problems to overcome in the analysis of FD in Warsaw Polish that will only be mentioned briefly due to space limitations. It is tempting to posit FD at the word level in DOT, yet the decision is not straightforward. First, prefixed words are often said to be syllabified with no resyllabification across the prefix boundary, which suggests that FD should take place at the word-level, where such structures are protected by high-ranked IDPRESON[LAR]. This would give rise to a Duke-of-York effect in DOT, with sandhi voicing agreement at the phrase level. Besides, such a move does not solve another problem: the behaviour of prepositions forming part of clitic structures which do not devoice before words beginning with sonorants, contrary to the expectations. This

constraint ranking is the same as in phrase-level Scenario 1 shown in the previous section. Thus, the activity of the SPEC constraint marks the crucial difference between the Cracow/Poznań variety and central Polish. No underspecification is allowed in the Warsaw variety, hence no phonetic effects. With a demotion of SPEC in Cracow/Poznań Polish, on the other hand, gradient effects in the form of passive voicing ensue. Furthermore, it can be concluded that Scenario 2 of the Cracow/Poznań dialect is an in-between case, i.e. an unstable system partially resembling Scenario 1 and 'heading' toward the establishment of categorical word-final devoicing. Whether this is a sign of an ongoing transition from one system to another, phonological levelling, a frequency-based phenomenon or other type of phonetic/lexical change requires further study. There are no quantitative data on the number of users of this system compared to Scenario 1 and therefore nothing can be said about the status of neither of them in the Cracow/Poznań regions.

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problem was solved by Rubach (1996) in a non-OT analysis by using PW node deletion. Under OT, word-level FD would devoice all prepositions before the right-hand context appears at the phrase level. One solution is to treat prepositions as lexical exceptions to FD. Otherwise, in the absence of an additional clitic level (but confer Rubach 2011), an extended version of CONTIGUITY may be applied. CONTIGPW banning deletion/insertion has already been proposed on several occasions (e.g. Rubach 2011, Broś 2015). Here, feature deletion would have to be banned inside prosodic words as opposed to word edges. This would generate correct forms for all prepositions in clitic position and prefixed words with FD at the phrase level in one go, assuming that such structures are joined under the PW' node. What is more, the parallel in the behaviour of prefixes and prepositions in Polish would be captured. With these facts in mind, I assume that FD in Warsaw is a word-edge process assigned at the phrase and not the word level, and mandated by high-ranking *LAR.

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