Covariation between fine phonetic detail and outcomes of sound change in the microtypology of Jutland Danish dialects

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In this paper, we present a case of regional covariation between fine phonetic detail in one prosodic context and sound change in a different prosodic context. The case in question is the process of *stop gradation* in varieties of Danish spoken on the Jutland peninsula. Simply put, stop gradation resulted in stop phonemes acquiring radically different allophones in different prosodic contexts. Dialectal variation in stop gradation is well-described, but the mechanisms that caused this variation are not well-understood. Through acoustic-phonetic exploration of a legacy corpus of dialect speech, we show that the different regional outcomes of stop gradation correspond very well to variation in fine phonetic detail in stop realization throughout the peninsula.

In Modern Standard Danish, stop gradation is usually analyzed as a phonological process whereby /p t k/ are realized as voiceless aspirated [pʰ tʰ kʰ] in 'strong' position, and voiceless unaspirated [p t k] in 'weak' position, while /b d g/ are realized as voiceless unaspirated stops [p t k] in strong position and semivowels [o̯ ɤ̯ i̯] in weak position [1]. In this context, 'strong' position (SP) refers to the syllable-initial position before full vowels, and 'weak' position (WP) refers to the syllable-final position *or* the syllable-initial position before neutral vowels. See the following examples of WP–SP alternation with the proposed phonemes /t d/:

		/t/	**/d/**	
WP:	[væ**t**]	*vat*, 'cotton wool'	[so.ˈli**ɤ̯**ˀ]	*solid*, 'solid'
SP:	[væ.ˈ**tʰ**+eːˀɐ]	*vattere*, 'apply cotton wool'	[so.li.**t**iˑˈtʰ+eːˀt]	*soliditet*, 'solidity'

Dialectological research from the early 20th century has shown that stop gradation affected almost all parts of the Danish speaking area, but with various WP outcomes. In some areas, /b d g/ surface as semivowels in WP; in some areas, they surface as voiced fricatives in WP; in yet others, they surface as voiceless fricatives in WP. This is illustrated in Fig 1 (adapted from [2]), which maps WP /g/ after front vowels. SP variation has never before been considered, even though there are strong reasons to expect covariation between WP and SP. If we assume that the WP and SP allophones belong to a single phonological category, it follows that WP and SP allophones might covary in phonologically well-motivated ways. More specifically, Fig 1 shows a clear geographical pattern of highly sonorous WP allophones in the northern part of the peninsula, and less sonorous WP allophones in the southern part of the peninsula, with a seemingly gradual cline in between. We hypothesize that the precise phonetic implementation of the laryngeal contrast in SP stops should show a similar cline; in particular, we would expect that voicing is a relatively strong SP cue in areas with highly sonorous WP allophones, and that aspiration is a relatively strong SP cue in areas with less sonorous WP allophones.

Since much of the regional variation in Danish was leveled over the course of the past century [3], we test this hypothesis using a large legacy corpus of sociolinguistic interviews that was collected between 1971–1976. Using these recordings, we carried out an exploratory study of variation in SP stop acoustics in the traditional Jutland Danish varieties. Voice onset time (VOT) was measured from 10,650 tokens of SP /p t k/, and the presence or absence of continuous closure voicing was recorded for 6,854 tokens of SP /b d g/. The speakers come from 213 different locations in the peninsula.

The resulting measures were analyzed with spatial generalized additive mixed models. These models include two-dimensional smooth variables modeling geographical coordinates, allowing us to model a non-linear geographical effect. The models also include a host of other dependent

variables that are known to influence VOT and the relative likelihood of closure voicing, including e.g. place of articulation, speaker gender, and stress. The results of these models are plotted in Figs 2 and 3, respectively. In both cases, the models perform significantly better than corresponding non-spatial models.

Figs 1, 2, and 3 show striking similarities. Perhaps unsurprisingly, there is obvious covariation between VOT and closure voicing; when SP /p t k/ are cued with high VOT, SP /b d g/ are less likely to be voiced, and *vice versa*. These differences are gradient rather than categorical; it is not simply the case that varieties implement the SP laryngeal distinction with either aspiration or closure voicing. As predicted, we also see correspondences between VOT and voicing in SP, and regional outcomes of stop gradation in WP: where VOT is low and the likelihood of voicing is high in SP, stop gradation resulted in voiced fricatives or semivowels in WP; where VOT is high and the likelihood of voicing is low in SP, stop gradation resulted in voiceless fricatives in WP. There is congruence between SP fine phonetic detail and WP allophone selection: more voicing-prone areas lenite in a more distinctly sonorous direction, while more aspiration-prone areas lenite in a direction that is more likely to maintain voicelessness. In this respect, Jutland Danish provides an illuminating microtypology of how gradient variation in fine phonetic detail can feed directly into sound change and categorical phonology.

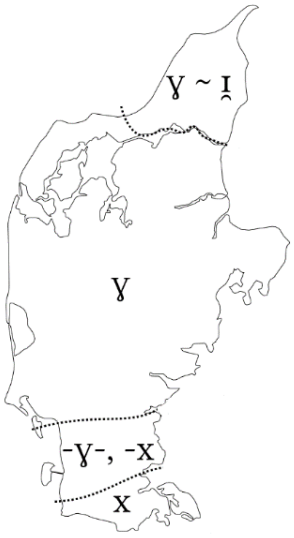

Fig 1

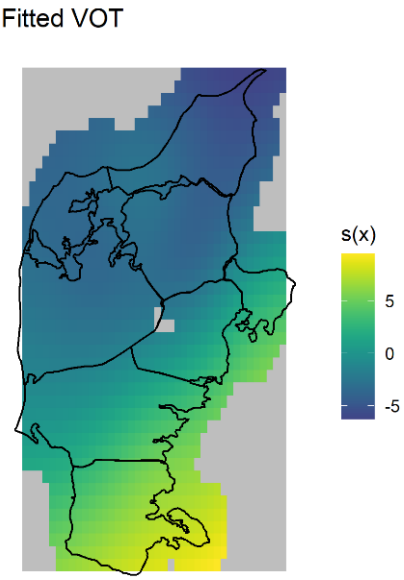

Fig 2

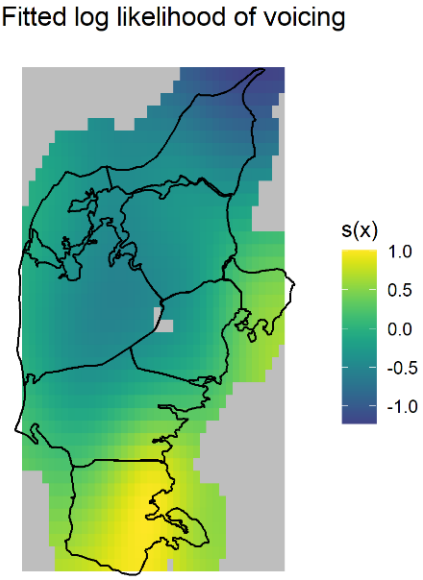

Fig 3

References

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