

The acoustic and articulatory outcome of /d/-vocalisation in Modern Standard Danish

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Lenition is common in both phonological and sound change processes [6]. In opening processes, which involve increasing aperture, labial and dorsal consonants tend to retain some labial or dorsal constriction even if they fully vocalise. It is less straightforward what happens with coronal consonants that vocalise, since vowel production rarely involves the tongue tip or blade. Vocalisation of coronal consonants often involves a reconfiguration of, or loss of, the coronal gesture, as in approximants like [j ɹ], both of which are attested outcomes of /d/-vocalisation in the traditional Danish dialect landscape [2]. This study considers the outcome of /d/-vocalisation in Modern Standard Danish (MSD). Our purpose is to investigate how complete this process is, and whether it still involves a coronal tongue gesture.

Danish has historically seen extreme lenition in the unaspirated stop series /b d g/ in prosodically weak positions. In MSD, the reflexes in prosodically strong positions are voiceless unaspirated [p t k], whereas in weak positions, the reflexes are typically semivocalic. /g/ either surfaces as [ɣ ɹ̥] or elides in weak positions, determined mostly by the identity of preceding vowels, which would have affected the precise point of occlusion in the historical velar stops [5]. /b/ variably surfaces as [p] or [ɸ] in weak positions. /d/ surfaces as a semivowel ('soft d') which is often transcribed as [ð̞], but is well-understood to be more open than a fricative, sometimes described as a 'velarized alveolar approximant' [1]. There has been a recent push to adapt [ɹ] in the phonetic annotation of the soft d [7], which matches the formant structure of the sound well [4], but which suggests a rather surprising tongue posture for a vocalised /d/.

We report the outcome of a controlled experimental study and a corpus study based on spontaneous speech. In the first study, we investigate the articulation of the soft d using electromagnetic articulography. We recorded five speakers of Danish, tracking the three-dimensional positions of tongue sensors during the production of words with soft d, /n/, or /l/ in different vocalic contexts embedded in carrier sentences. We used five tongue sensors, three along the centre of the tongue and two parasagittal sensors on the tongue sides. Participants read 5 repetitions of 75 sentences. In the second study, we investigate the formant dynamics of a range of vowel + soft d combinations in the Danish Phonetically Annotated Spontaneous Speech (DanPASS) corpus [3], comparing them with other secondary diphthongs in Danish in terms of trajectory. We analysed 1,820 relevant sequences.

Our results show that speakers produce the soft d with a lowered tongue body, i.e. a very open approximation. The tongue tip is very fronted, even in comparison with /n/ and /l/, and we find evidence of lateral grooving. Acoustically, the vowel + soft d transition is accompanied by increasing intensity and harmonicity. The quality of vowels preceding the soft d are heavily influenced by the soft d in terms of both tongue posture and formant frequencies. Vowel + soft d sequences show certain similarities with other secondary diphthongs, although trajectory distances are relatively short and the diphthong onsets are rather diffuse. The acoustic results confirm that the soft d is a typologically rare example of a coronal consonant where aperture has increased dramatically without affecting the horizontal position of the tongue. The stretching of the tongue body and grooving of the sides likely serves as an explanation for why formant frequencies are surprising given the tongue body height and backness.

References

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