Investigating the effects of laryngeal contrasts on vowel fundamental frequency in Central Swedish stop consonants.

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Introduction

Vowels following phonologically *voiceless* stops have a higher mean fundamental frequency (F0) than vowels following *voiced* stops. Understood to be partly driven by physiological dynamics when producing the contrasts (e.g. /d/ vs. /t/), this effect is termed *consonant-intrinsic F0* (CF0).

CF0 effects are robust cross-linguistically (e.g. Connell, 2022; Ting et al., 2023) but differ in character depending on the language.

Why Central Standard Swedish?

A good case for investigating the mechanisms behind CF0 effects because of:

1. Claims that Central Standard Swedish (CSS) is typologically unusual (Helgason & Ringen, 2008; Beckman et al., 2011 but see Lundeborg et al. 2012)
   - Voicing lead in /b d g/
   - Aspirated in /p t k/
2. Distinctive register with F0 as a phonological feature (limited tonal contrast).

Research aims

1. Describe the acoustic-phonetic cue distributions of stop consonants (/b d p t/) in CSS with a larger database. Specifically to estimate *prevalence* of pre-voicing and de-voicing (tokens with short-lag VOT) in phonologically voiced categories (/b d/)
2. Investigate character of CF0 effect that arises from the voicing contrast.

Talker recordings

1. Native speakers of CSS dialect (N = 44, F = 24; mean age = 30 years, SD = 6.8 years) productions of /b d p t/-initial word pairs.
2. 17 mono- and di-syllabic word pairs (5 reps each) in various vowel contexts (/iː ɪ oː ɵ ɑː a ɔ/). Word pairs were matched in stress, quantity, and tone accent.
3. Additional 14 /m n/-initial words with corresponding vowel contexts for baseline F0 trajectory comparisons.

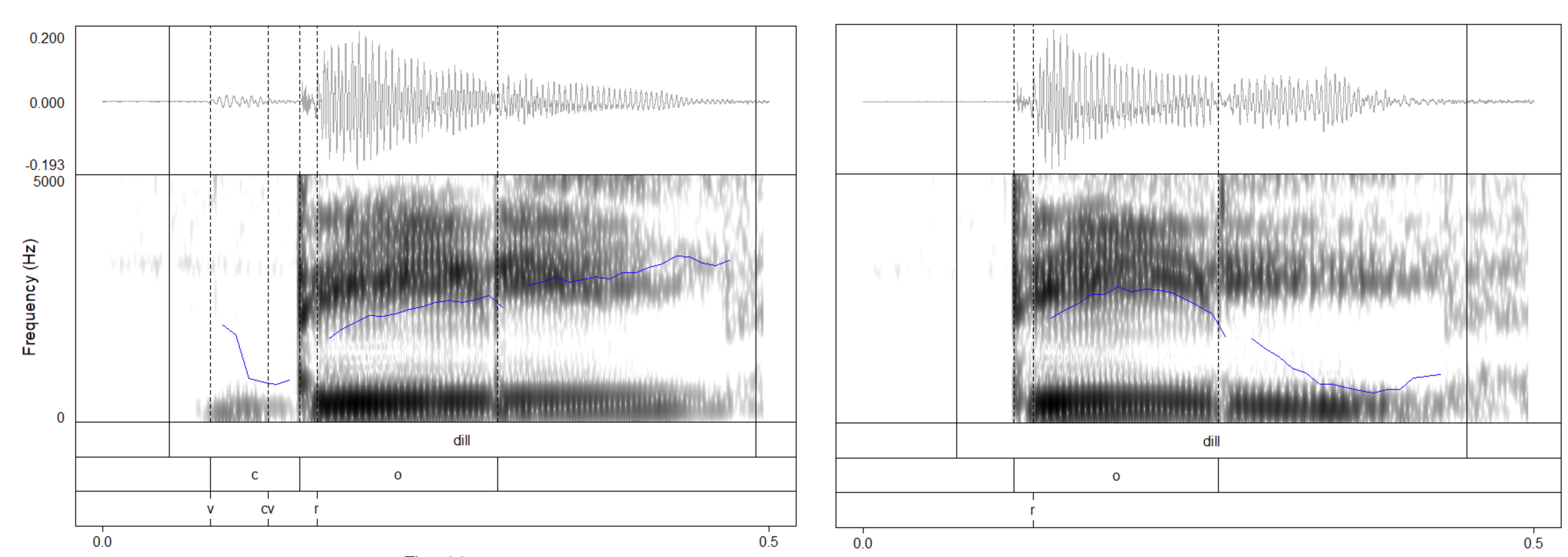


Figure 1: The phonologically voiced category was realised in two ways. Example of "dill" spoken with pre-voicing (left) and de-voicing (right) by the same talker.

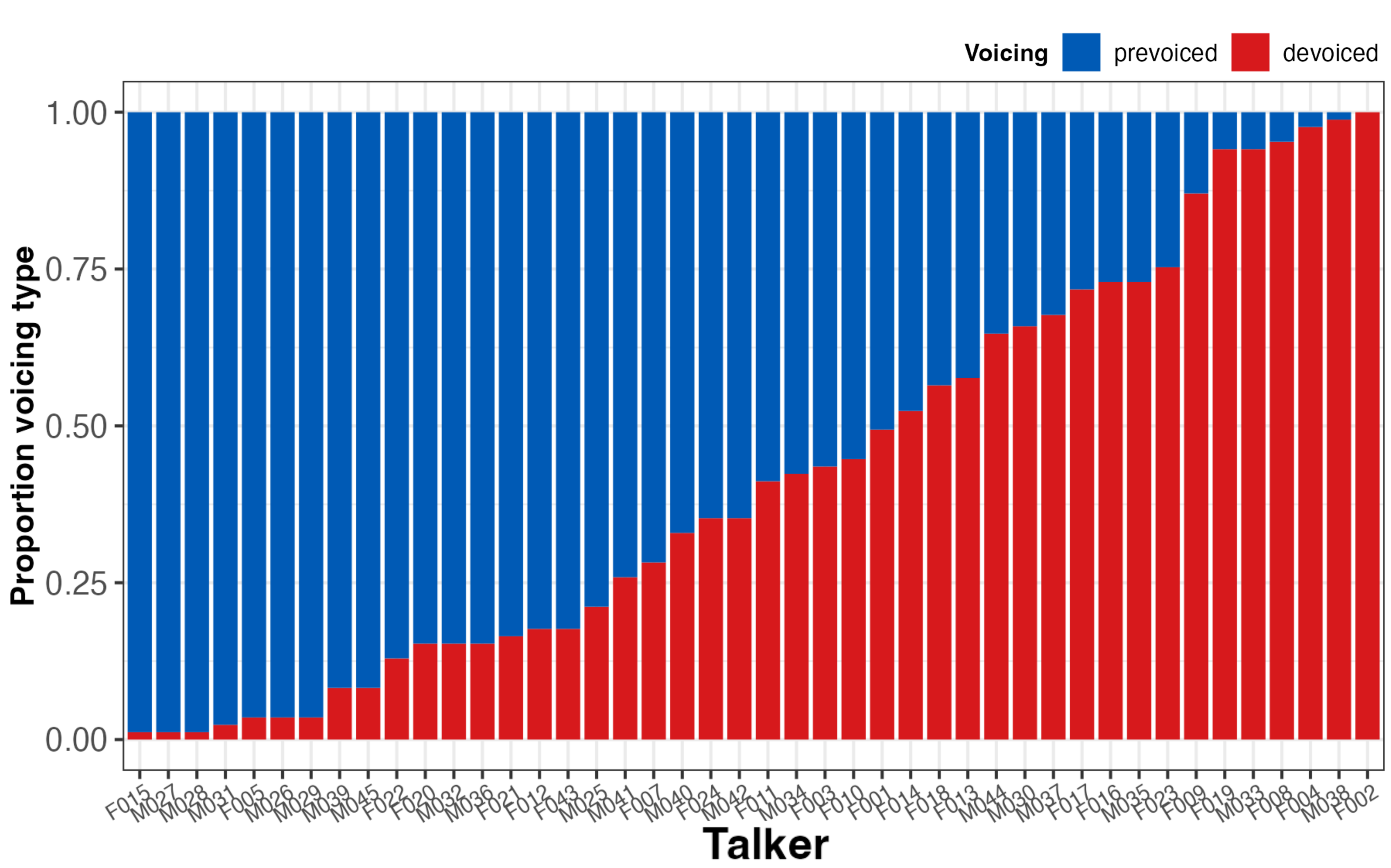
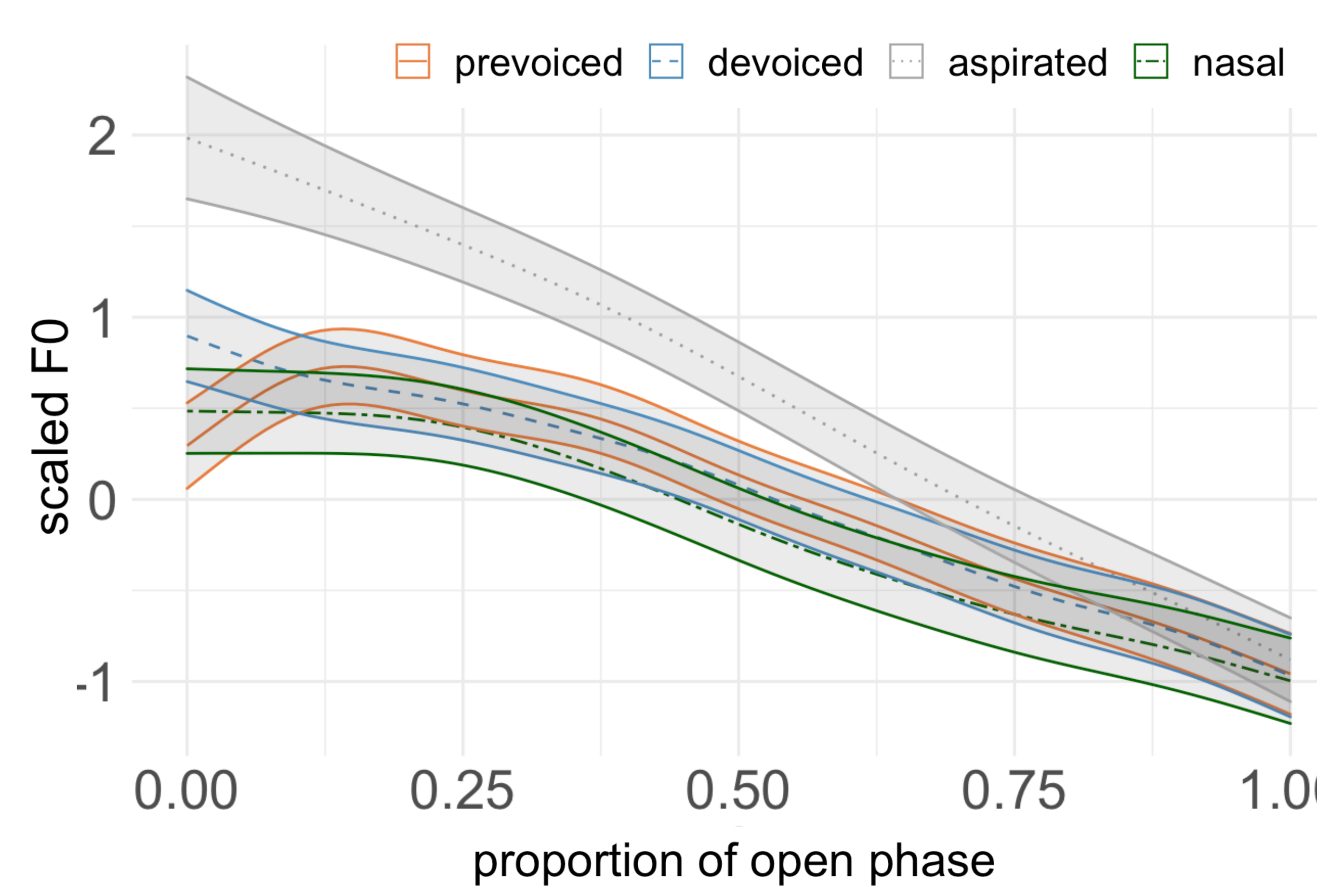


Figure 2: Proportion of phonologically voiced tokens that are pre-voiced and devoiced (short-lag VOT) by talker.

Figure 3: GAMM fit to talker-centred F0 values with phonetic realisation of the onset as predictor (pre-voiced, de-voiced, aspirated and nasal). Smooth terms for F0 trajectory over the open phase were applied for each of the four onset realisation types.



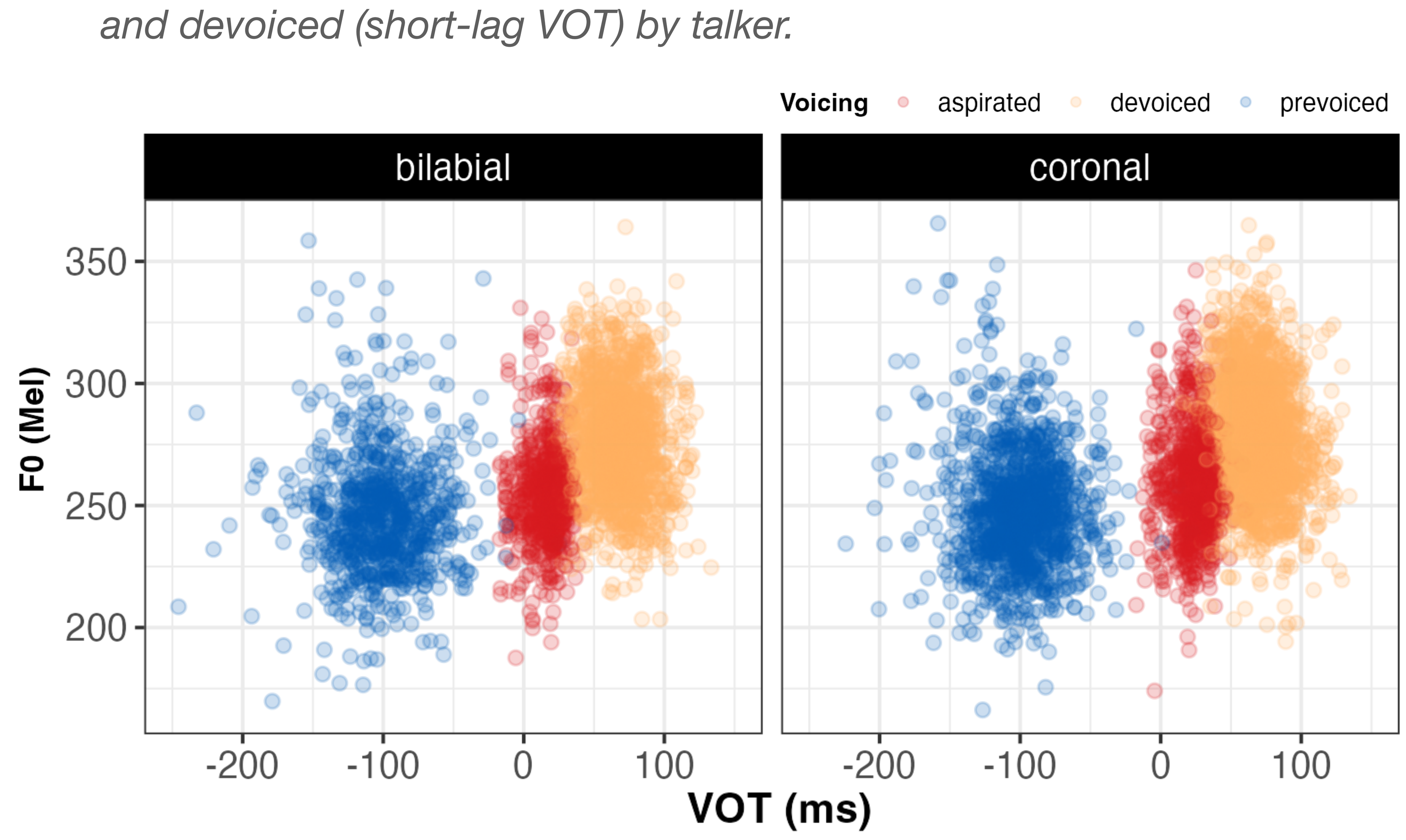


Figure 4: Distribution of VOT and F0 by place of articulation of 7,343 tokens by 44 male and female native speakers of CSS. VOT and F0 were centred relative to their overall means. Negative (pre-voiced) and positive VOT tokens were treated separately.

Take-home points

1. Prevalence of pre-voicing in CSS more variable than previously reported (Fig. 2).
2. No difference between pre-voiced and devoiced F0 trajectories, nor between pre-voiced and baseline nasal F0 trajectories.
3. Prevalence of pre-voicing did not alter trajectory of F0. Like other aspirating languages (e.g. English, German), CF0 effects in Swedish are driven by the articulatory mechanism responsible for aspiration in /p t/.