

## Tonogenesis in Afrikaans: Transferring phonological contrast through enriched representations

Afrikaans historically contrasted prevoiced /b, d/ and voiceless unaspirated /p, t/ [1], but recent research has found that women are producing underlying voiced obstruents as their voiceless counterparts at increasing rates, and differences in F0 of the following vowel are becoming larger [2]. Additionally, when listening to a young woman in a perception task, women are relying on both F0 and prevoicing to identify word-initial plosives [2]. The current study expands on this work with a perception and production experiment with 34 native speakers, split into two gender-balanced age groups (ages 20-24; n=20 and 60-83; n=14). Additionally, the perception task includes speakers varying in age and gender, as we might expect perception to vary depending on a speaker's social characteristics [3, 4, 5].

Perception task stimuli were continua varying in F0 and prevoicing: /pad/-/bad/ ('road', 'bath') and /tal/-/dal/ ('quantity', 'valley'). Four native speakers of Afrikaans produced the tokens: two males and two females, with one older and one younger speaker in each pair. Continua were constructed using a voiceless token as the base. There were four types of continua: (1) no prevoicing and F0 varying, (2) full prevoicing and F0 varying, (3) ambiguous F0 and prevoicing amount varying, and (4) F0 and prevoicing amount varying, and in conflict (i.e. high F0 paired with 100% prevoicing). Each continuum had five steps.

Participants underwent a two-alternative forced-choice task presented in PsychoPy [6], where they heard a stimulus word and had to choose if they heard *pad* or *bad*, or *tal* or *dal*. Stimuli were blocked by speaker, and participants were given the age and gender identity of each speaker. The order of speaker blocks was randomized, as was the order of all tokens. The experiment was conducted entirely in Afrikaans in Potchefstroom, South Africa.

Results show that in the absence of prevoicing, following F0 is a strong cue for all participants, as tokens with the lowest F0s were identified as "voiced" and the highest F0s as "voiceless" (Figure 1). Additionally, at the highest F0s, older speakers' productions are perceived as less "voiced" than younger speakers', and specifically the older population relies least on F0 when judging the older male speaker (Figure 1). Overall, when any amount of prevoicing is present, it is the dominating cue and overrides F0 in all participant and speaker demographic combinations (Figures 2 and 3).

In the production task, participants read a randomized word list and paragraphs containing the token words in balanced phonological environments. Preliminary results from the word list (4 speakers, one of each demographic) show differences in age and gender. Younger participants have a much higher devoicing rate (81% for a female participant; 86% for a male) in comparison to older participants (22% and 17%, respectively). Female speakers produce larger F0 differences between plosive categories (average of 44 Hz for the younger participant and 32 Hz for the older) in comparison to male speakers (average difference of 13 Hz and 19 Hz, respectively). Thus, there is evidence that the voicing contrast is not changing uniformly. There are differences in perception and production, and by speaker and listener demographics.

These results have implications for distinctive feature theory and ultimately argue for enriched lexical representations. Afrikaans is undergoing voicing neutralization, but the [voice] contrast is not lost; it's shifting from the primary cue to the secondary cue. Secondary cues are generally considered redundant since they're by-products of the primary cue, and thus they get excluded from representations. However, in order to absorb a phonological contrast, they must be present in the representation at some stage. This paper proposes that in the process of a sound change, features should be represented as bundles of secondary cues, which would allow a re-weighting of cues as the phonological contrast is transferred from the primary to the secondary cues.

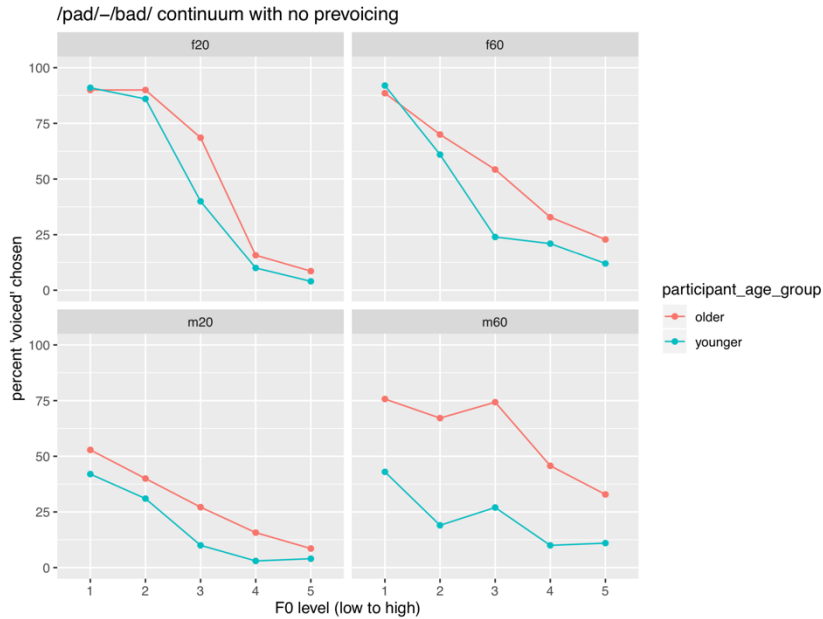


Figure 1 (left): /pad/-/bad/ continuum showing effects of F0 by participant age group and speaker identity

(f20 = younger female speaker; f60 = older female, m20 = younger male, m60 = older male)

Figure 2: /pad/-/bad/ with 100% prevoicing

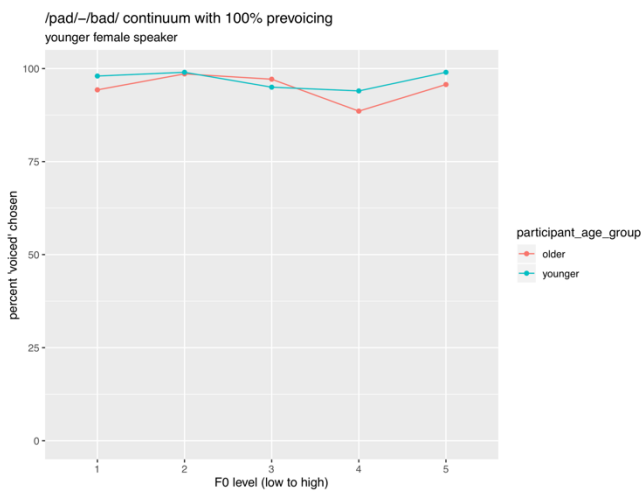
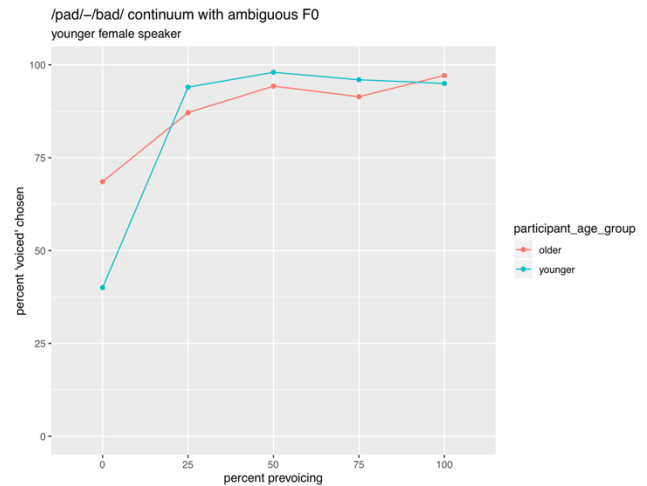


Figure 3: /pad/-/bad/ with ambiguous F0



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