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Watkins, M.M.

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Tonogenesis in Seoul Korean? Counter-evidence from a conversational speech corpus

Seoul Korean (SK) has a linguistically uncommon laryngeal tripartite series, all of which are voiceless in initial position. Originally, aspirated (**A**) were long in VOT and mid-high for F0, lenis **(L**) intermediary for VOT and low in F0, and fortis **(F**) short for VOT but high in F0, with **F** and **L** at times overlapping for VOT [**1,2**]. Recently, **A** has shortened to merge in VOT with **L** and enhanced in F0 to maintain the **A-L** distinction, while **F** remains short for VOT [**3,4,5**]. This has been suggested to be a gender-led change and evidence for 'quasi-tonogenesis' (incomplete tonogenesis) [**5,6**]. However, **F** still overlaps with **L** in internal position for VOT and F0 [**7**], and evidence suggests that there are voice quality differences between the stop types [**8**]. The above studies have typically looked at clear and/or read speech productions in initial position, but for the tonogenesis argument to hold one would expect the same to be true phrase-internally in conversational speech. In contrast [**9,10**] argues that instead of tonogenesis this is a prosodic shift, with F0 enhancement occurring to demarcate phrase types. Therefore, here we attempt to evaluate if the above observations can be reconciled within a single speech corpus.

Speakers (N = 30) were taken from a Korean conversational speech corpus [**11**], with all participants in the age category that shows the sound change (age range:18-58 years). F0, VOT, and H1-H2 (using the newly implemented H1-H2 measure) were measured in Praat [**12**]. F0 ratio, which identifies creaky to modal transitions through the presence or absence of pitch jumps, was also calculated as described in [**13**]. A statistical analysis was run in R [**14**] using the *lme4* package [**15**]. The results are summarized as follows:

1. In phrase-initial position, **L** and **A** are robustly distinguished by F0, and VOT mostly overlaps, as found in [**3,4,5,6,7**]
2. **A** and **F** are distinguished by VOT but *not* F0, across all positions.
3. **L** shows strong effects for prosodic position, not observed in **F** or **A**. Phrase-internally, **F-L** are poorly distinguished compared to initially (following **[10, 11]).**
4. Older male speakers are weaker than all the other groups in the F0 enhancement of aspirated stops, with a tendency to produce VOT differences instead (**Fig. 3** OM1/OM2). Younger female speakers show the greatest trend towards incorporating F0 enhancement, consistent with [**5**].
5. A group of female **F** tokens (~30% of all female **F** tokens) show systematic pitch jumps supporting [**13**].
6. H1-H2 suggests that **F** is creakier than the other two, while **L** is breathier than **F**. (Fig. 1)

The findings in point 3 above suggest that a prosodic interpretation of F0 enhancement is a stronger argument than tonogenesis, given the amount that lenis shifts across phrase position (as found in **[10,11]**). Point 4 above supports **[5]**, which suggested a stronger effect in younger female speakers. Point 5 and point 6 provide evidence that voice quality may be used as a contrastive cue, although this requires further perceptual testing to validate.

In summary, prosody appears highly relevant for the distinction and the findings here move away from tonogenesis and instead towards a prosodic explanation. While VOT and F0 are important, for the **L** and **F** distinction we suggest that voice quality may be an additional cue, given the phrase-internal overlap. These results, drawn entirely from spontaneous data, highlight that corpus data can reconcile findings from separate production experiments while revealing patterns (such as voice quality differences) that controlled settings may obscure.

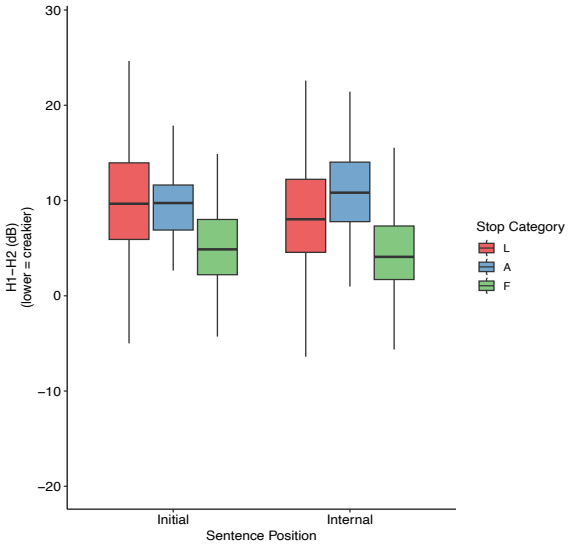

Figure 1: H1-H2 differences across sentence positions.

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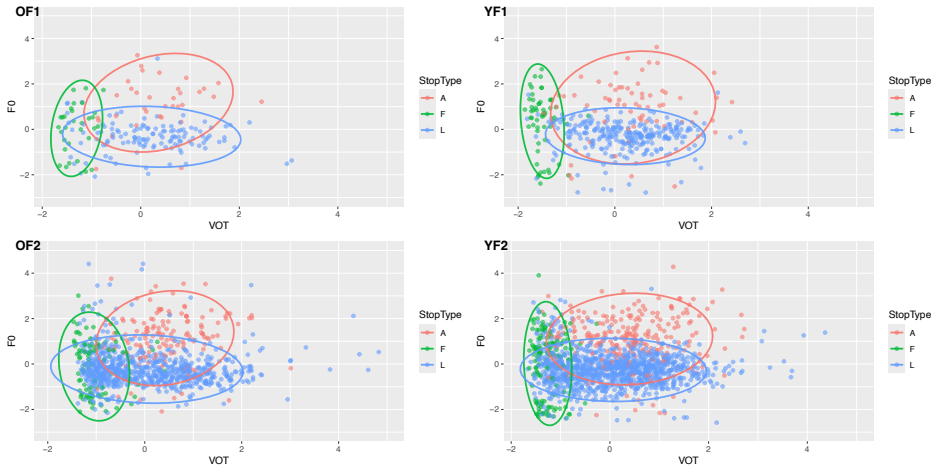

*Figure 2: **Female** speakers: Older (OF) and Younger (YF). Top two panels (**OF1**, **YF1**) show phrase-initial position, bottom two (**OF2**, **YF2**) phrase-internal. Log transformed VOT and F0.*

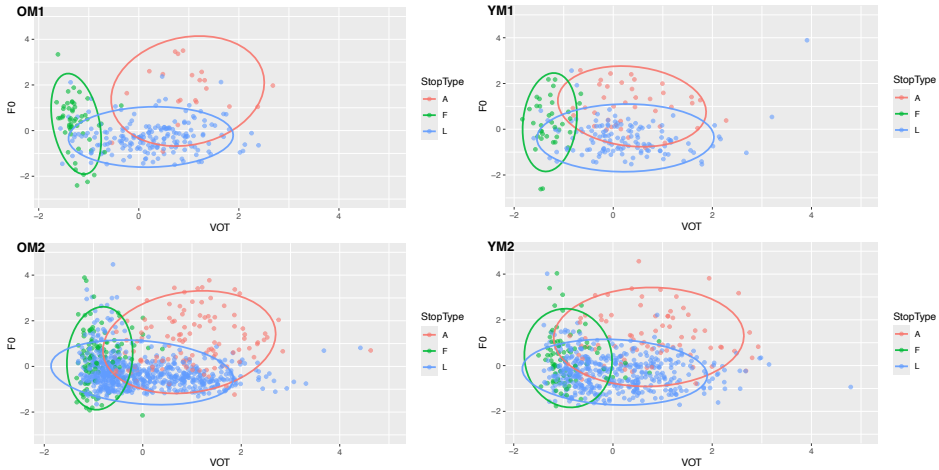

*Figure 3: **Male** speakers: Older (OM) and Younger (YM). Top two panels (**OM1**, **YM1**) show phrase-initial position, bottom two (**OM2**, **YM2**) phrase-internal. Log transformed VOT and F0.*