

Higher voice pitch reveals bilingual language experience

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The aim of this study is to test whether bilingual language background influences voice pitch across formal and informal speaking contexts. Voice pitch is sometimes reported to be higher when bilinguals speak their home language compared to their societal language [1, 2]. Given that both the home and societal language are produced within a shared bilingual speech-production system [c.f. 3, 4], pitch raising in the home language need not reflect language-specific phonetic conventions, but may instead reflect bilingual language experience more generally. Under this view, similar pitch raising may also be observed in the societal as in home language.

We tested this prediction based on the narrations from the multilayered RUEG corpus [5]. The residents of the US, either monolingually raised speakers of American English ($N = 32$; mean age = 20.8, $SD=6.53$) or bilingually raised speakers of American English and Russian ($N = 53$; mean age = 22.8, $SD=6.37$) were asked to imagine calling either a friend (informal context) or a police officer (formal context) to report about a car accident as a witness. To obtain a more controlled estimate of pitch level, we analysed pitch at the two levels. We extracted F0 maxima and minima from manually annotated intonation phrases (IPs) using the convex hull algorithm [6]. Within each IP, baseline F0 was defined as the intercept of a regression line fitted to F0 minima, and topline F0 as the intercept of a regression line fitted to F0 maxima (see Fig. 1.). The converging pattern of baseline and topline F0 would indicate shifting pitch register while diverging pattern would suggest expansion of the speech range.

To confirm the contribution of language background (monolingual vs. bilingual) and formality (informal vs. formal) on voice pitch, the intercepts of the regression lines were submitted to linear mixed-effects regression analysis that controlled for the position of the IP in the communicative unit, duration of the IP and gender by treating them as nuisance variables. The analysis revealed a main effect of language background, with bilingual speakers showing overall higher topline F0 than monolingual speakers ($\beta = -0.265$, $SE = 0.106$, $t = -2.499$, $p < .05$). The formality did not show an effect on topline F0 ($\beta = 0.101$, $SE = 0.085$, $t = 1.182$, $p = .241$), and no interaction between formality and language background was observed ($\beta = -0.051$, $SE = 0.085$, $t = -0.600$, $p = .551$). Baseline F0 fully reflected the results of the topline F0 (see Fig. 2) in that there was a main effect of language background ($\beta = -0.182$, $SE = 0.091$, $t = -2.003$, $p = .05$), no effect of formality ($\beta = 0.052$, $SE = 0.079$, $t = 0.656$, $p = .514$), and no significant interaction between the factors ($\beta = 0.084$, $SE = 0.078$, $t = 1.080$, $p = .285$).

Formality manipulation did not influence pitch level in American English and in this respect, the bilingual speakers did not differ from monolingual speakers. Crucially, compared to monolingual speech, the converging baseline and topline measurements indicated higher pitch register in the bilinguals' societal language. This finding, together with earlier results for the home language [1, 2], supports the hypothesis that pitch raising reflects properties of bilingual language experience rather than language-specific phonetic conventions. Future analyses are planned to examine pitch level in monolingually raised speakers of Russian alongside the same monolingual and bilingual speakers of American English, to exclude cross-linguistic influences on English in the current sample.

References

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Figures and Tables

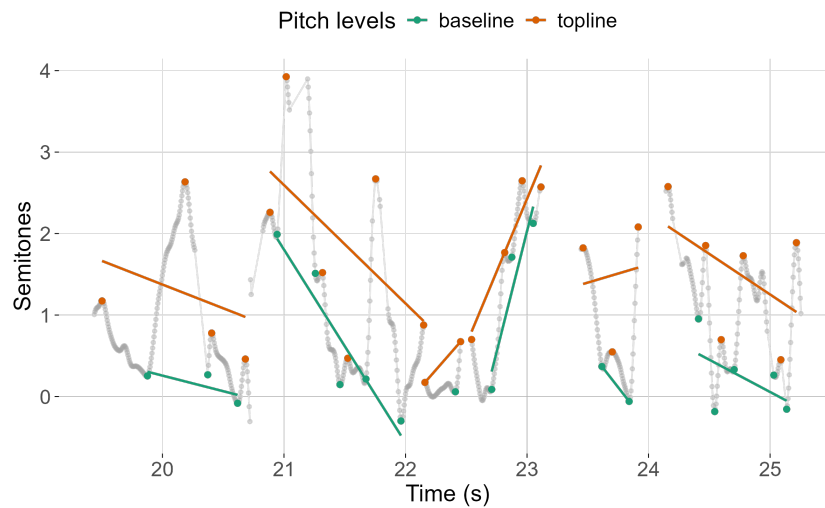


Figure 1: Grey points show the pitch contour of a communicative unit. Green and orange points indicate F0 minima and maxima respectively. Lines show regressions fitted to F0 minima and maxima.

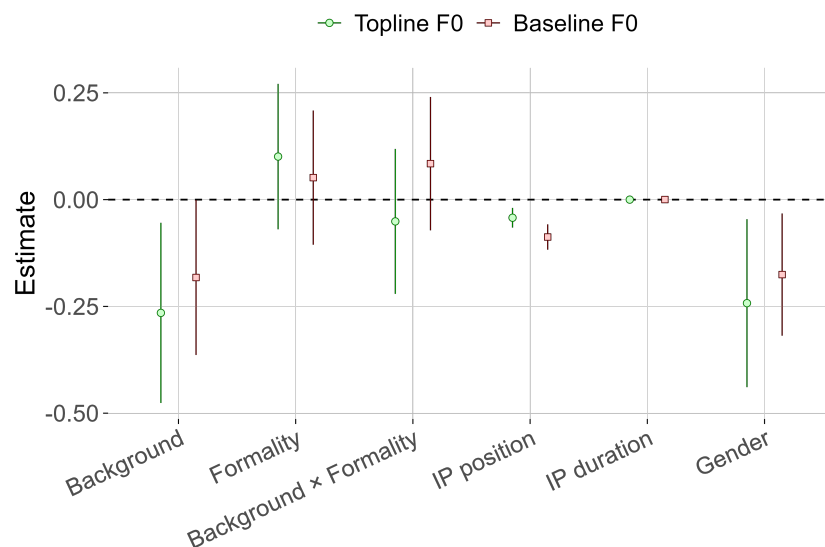


Figure 2: Fixed-effect estimates ($\pm 95\%$ CI) from the mixed-effects regression models of baseline and topline F0.