Abstract

This article reports model experiments where vocal tract profiles of high and mid unrounded front and high rounded back vowels were systematically modified to simulate small constriction shifts along the hard or soft palate, in order to test A. M. Bell's century-old proposal that small shifts of tongue arch fronting or retraction would yield audible shifts of vowel timbre. Such differences were claimed to explain audible differences of vowel timbre between dialects or between languages. The claim has never been validated and is contradicted on several counts: the Bell model provides an inaccurate account of articulatory activity for vowels, tongue arch position is irrelevant for tuning vocal tract resonances, the Bell model is based on the single resonance theory and cannot accommodate several formants, and quantal theory suggests that local shifts of constriction location should not yield any audible spectral shift in F2. The results confirmed that F2 of all these vowels was insensitive to fronting and retraction in Bell's sense. However, F3 of the unrounded front vowels fell steadily from fronted to retracted, as expected from perturbation theory (the fronted position is near a volume velocity antinode for F3 and the retracted position is close to a volume velocity node). This explains the often reported sharpness of, say Swedish and, Russian prepalatal front vowels, and the dullness of, say, English midpalatal front vowels.