

The perceptual spacing of Cardinal Vowels in naïve English and Spanish speaking listeners

Francis Nolan, Bryony Perks, and Kirsty McDougall

Phonetics Laboratory, University of Cambridge

fjn1@cam.ac.uk, bryony.perks1@gmail.com, kem37@cam.ac.uk

Jones (1972:32) describes the Cardinal Vowels (CVs) as ‘acoustically equidistant’, for which we would nowadays read ‘auditorily equidistant’; but it is implausible, given the way languages differ in the density and spacing of their vowel phonemes, that there would be universal agreement on the spacing of the CVs among naïve listeners (cf. Butcher 1976). This paper asks (a) does the perceptual vowel space confirm the overall disposition of vowels inherent in the vowel quadrilateral (e.g. is [a] more different from [i] than [e] is)? and (b) how is the perceptual spacing of individual vowel pairs affected by native language? The answers have implications for phonetic training and the status of the IPA framework.

Phonetically naïve listeners rated the distance (on a 9-point scale from 1 ‘very similar’ to 9 ‘very different’) between members of most possible pairings of the CVs produced by an experienced phonetician. Taking part were 20 natively English-speaking and 20 natively Spanish-speaking listeners. Multidimensional-scaling (MDS) was conducted on listeners’ ratings to derive a pseudo-perceptual ‘vowel space’ for each listener group. The answer to (a) is, broadly, ‘yes’: the overall arrangement of vowels in the pseudo-perceptual space bears a general resemblance to the IPA vowel space, or, rather an acoustic transformation of it. The answer to (b) is also ‘yes’: Spanish and English listeners differ notably in their perception of vowel similarity. The first three MDS dimensions reveal that English listeners discriminate most of the vowels, and their spacing of the vowels is generally compatible with what would be predicted from an acoustic vowel quadrilateral, while Spanish listeners show a strong tendency to cluster vowels. Both patterns may be consistent with the phonemes of the native language acting as perceptual magnets, but with the richer vowel inventory of English providing a finer auditory graticule.

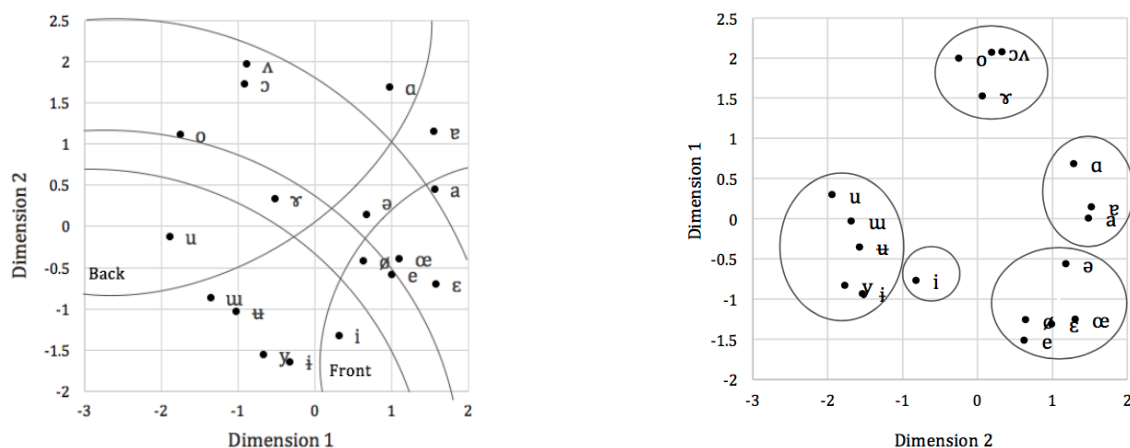


Fig. 1: Plots of the first two MDS dimensions showing how the perceptual space of English listeners (left) allows the superimposition of height and frontness classes, whilst Spanish listeners clump vowels (putative phoneme classes superimposed). The third MDS dimension (not shown) separates some wrongly proximate vowels.

References

- Butcher, A. (1976) The influence of the native language on the perception of vowel quality. *AIPUK* 6. Kiel: Institut für Phonetik.
- Jones, D. (1972) *An Outline of English Phonetics* (9th Edition). Cambridge: Heffer.