

Left-right asymmetry in tongue-palate contact during speech

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Electropalatography (EPG) is an instrumental technique for depicting tongue-palate contact during speech. Published palatograms frequently show left-right asymmetry in the amount of tongue-palate contact. This could arise due to several factors, including the speaker's anatomy, handedness, and language lateralisation, as well as asymmetries in the electropalate manufacture. This study investigated the direction of asymmetry in two groups of speakers categorised according to handedness.

Ten native speakers of English (5 left-handed, 5 right-handed) carried out various speech tasks, including sentence-reading and delivering a monologue. The sentence stimuli consisted of a phonetically balanced set of 460 semantically meaningful sentences (example: *An official deadline cannot be postponed*) taken from an online speech corpus (Wrench, 2019). The speech data were recorded while the speakers wore a custom-made electropalate with 62 electrodes. Left-right asymmetry in the EPG data was measured by calculating an index of asymmetry for each utterance. The index provided information about both the direction and size of the asymmetry.

The main finding was that the direction of asymmetry was such that there was more extensive tongue-palate contact on the left-hand side in four out of five speakers in both handedness groups. This observation is not consistent with the hypothesis that handedness may be a causative factor. The finding of greater contact on the left-hand side is entirely consistent with research on lip opening during speech: Graves et al. (1982) carried out a series of observational experiments which indicated that 150 out of 196 participants (76%) showed more lip contact on the left-hand side and greater lip separation on the right. It seems likely that the asymmetries in both of these articulatory mechanisms are caused by the same underlying principle – for example, language lateralisation, which holds that in most speakers, the left hemisphere of the brain is language-dominant (Knecht et al. 2000). The presentation will discuss several possible mechanisms that could cause greater tongue-palate contact on the left-hand side.

References

Graves, R., Goodglass, H. & Landis, T. (1982). Mouth asymmetry during spontaneous speech. *Neuropsychologia* 20, 371-381.

Knecht, S., Dräger, B., Deppe, M. et al. (2000). Handedness and hemispheric language dominance in healthy humans. *Brain* 123, 2512-2518.

Wrench, A. (2019). Mocha-Timit Multichannel Articulatory Database: English.

<http://www.cstr.ed.ac.uk/research/projects/artic/mocha.html>.