

Effect of Articulation Rate on the Articulatory to Acoustic Onset Interval in Delayed Naming

Pertti Palo^{1,2}, Sonja Schaeffler¹, and James M. Scobbie¹

¹Queen Margaret University, ²University of Strathclyde

pertti.palo@taurlin.org, SSchaeffler@gmu.ac.uk, and JScobbie@gmu.ac.uk

We study the acoustic and articulatory timing of speech initiation, where one of the key concepts is the Articulatory onset to Acoustic onset Interval (AAI). An acoustic study by Rastle et al. (2005) showed, that the place and manner of the first consonant in a target affects acoustic Reaction Time (RT). Their data also exhibits an inverse correlation between acoustic onset consonant duration (OD) and acoustic RT, meaning that the longer the onset consonant's acoustic duration is, the shorter the acoustic RT is likely to be.

In contrast, in an articulatory study Kawamoto et al. (2008) showed that there is no comparable correlation of OD and the articulatory RT of the lips. In their data, neither the type nor duration of the onset consonant affected articulatory RT in any significant way. Palo et al. (2015) replicated Rastle et al. utilising Tongue Ultrasound Imaging (UTI). In their data, both acoustic RT and AAI were inversely correlated with OD, but onset consonant and its duration had no effect on the articulatory RT of the tongue. In summary, these articulatory studies suggest that the inverse correlation of OD and acoustic RT is caused by the varying length of the AAI.

In other words, AAI and OD seem to behave as if they were part of the same phonetic timing unit. If AAI and OD are part of the same unit, then the AAI could perhaps be considered part of the onset consonant. If this is the case, articulation rate should affect the length of the AAI – in utterances with greater articulation rate the AAI should be shorter and vice versa.

To test the hypothesis that AAI is part of the onset consonant, we have analysed UTI and acoustic data from a delayed naming experiment with three participants. The statistical models repeat the earlier results on acoustic RT and AAI being inversely correlated with OD. They further show a positive correlation effect between rate of articulation and the AAI. This leads us to conclude that the AAI could be considered part of the onset consonant.

References

Kawamoto, A. H., Liu, Q., Mura, K., Sanchez, A. (2008). Articulatory preparation in the delayed naming task. *Journal of Memory and Language* 58(2), 347 – 365.

Palo, P., Schaeffler, S., and Scobbie, J. M. (2015). Effect of phonetic onset on acoustic and articulatory speech reaction times studied with tongue ultrasound. In *Proceedings of ICPhS 2015*, Glasgow, UK.

Rastle, K., Harrington, J. M., Croot, K. P., Coltheart, M. (2005). Characterizing the motor execution stage of speech production: Consonantal effects on delayed naming latency and onset duration. *Journal of Experimental Psychology: Human Perception and Performance* 31(5), 1083 – 1095.