Doris Mücke & Anne Hermes

How much variability is allowed in a phonological system? An EMA-study with patients treated with deep brain stimulation.

Chronic deep brain stimulation (DBS) of the nucleus ventralis intermedius (VIM) is an effective treatment for patients with medication resistant Essential Tremor (ET). However, these patients report that stimulation has a deleterious effect on their speech, severely impacting their quality of life and social functioning. Previous acoustic studies on VIM-DBS in patients with multiple sclerosis (Pützer et al. 2007) and essential tremor (Mücke et al. 2014) report an increase of voicing across the entire syllable cycle, as well as frication during the consonantal constriction in stops, indicating both a reduced degree of glottal abduction and an imprecise oral articulation. The present study investigates gestural coordination patterns in the speech motor system by using Electromagnetic Articulography to capture stimulation-induced effects in terms of intragestural and intergestural variability. We analyse onset coordination patterns in syllables with low and high complexity, such as /li/ and /kli/, within the coupling hypothesis of syllable structure (Browman & Goldstein 2000; Nam et al. 2009). We aim to quantify the effects of DBS on speech regulation mechanisms of oral gestures. We further aim to understand how much variability is tolerated in a phonological system before the system gets instable and patterns of syllable organisation break down.

Browman, C. P., & Goldstein, L. (2000). Competing constraints on intergestural coordination and self- organization of phonological structures. Bulletin De La Communication Parle?e, 5, 25–34.

Mücke, D., J. Becker, M.T. Barbe, T.B. Roettger, I. Meister, L. Liebhart, L. Timmermann, & Grice, M. (2014). The effect of Deep Brain Stimulation on the speech motor system in Essential Tremor Patients. Journal of Speech, Language, and Hearing Research 57:1206-1218.

Nam, H., Goldstein, L., & Saltzman, E. (2009). Self-organization of syllable structure: A coupled oscillator model. In F. Pellegrino, E. Marisco, I. Chitoran, & C. Coupe (Eds.), Approaches to Phonological Complexity (pp. 299–328). Mouton de Gruyter, Berlin.?

Pützer, M., Barry, W. J. & Moringlane, J. R. (2007). Effect of deep brain stimulation on different speech subsystems in patients with multiple sclerosis. Journal of Voice 21(6):741-753.