LISTENING TO DISORDERED SPEECH RESULTS IN EARLY MODULATIONS OF AUDITORY EVENT-RELATED POTENTIALS

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In the last decade, research on motor speech disorders has increasingly taken into account the bidirectionality between speaker and listener. Listening to disordered speech (e.g., dysarthria) may result in substantial phonemic uncertainty. In turn, a larger set of potential word target candidates may be activated—contributing to intelligibility deficits. To resolve this uncertainty, a combination of both bottom-up and top-down processes are thought to play a role (Liss, 2007). The goal of the present study was to investigate the contribution of these processes by analysing listeners' neurophysiological processing when listening to dysarthric speech.

Thirty healthy native English speakers (12 males, 18-44 years) participated in a speech perception experiment while undergoing 32-channel EEG recording. Similarly to Obleser and Kotz (2011), we focused on the auditory N100 as a marker for earlier sensory processing and the N400-like peak representing information on later cognitive-linguistic processes. Participants listened to 55 moderate hypokinetic dysarthric sentences and 55 control sentences. The experiment was repeated one week later to investigate the effects of repeated exposure to disordered speech. The amplitudes and latencies of the event-related potentials over Cz were analysed.

Repeated measures GLM statistics of the N100 with speech type (dysarthria vs. control) and test session as independent variables showed a main effect of speech type, with increased amplitude ($F_{ampl}(28)=12.18$, $p<.01$) and decreased latency ($F_{lat}(28)=6.77$, $p=.02$) when listening to dysarthric versus control speech. There was no significant main effect of test session or interaction effect. In contrast, no significant effects of speech type and test session were observed on the amplitude of the N400-like peak. For latency, only a significant interaction effect was present ($F_{lat}(28)=4.16$, $p=.05$), evidenced by decreased latency for dysarthric sentences during the first test session, and the reverse during the second session.

The N100 results show that the quality of the auditory signal in naturally degraded dysarthric speech influences early sensory auditory processing, indicating an increase in the initial allocation of neurophysiological resources (Obleser & Kotz, 2011). The N400 latency results show that later, more cognitive-linguistic processes are not only influenced by the degradation of the signal itself but also by the amount of exposure to that signal, a finding consistent with previous behavioural research on dysarthric speech (Borrie et al., 2012).

References

Liss, J.M. (2007). The role of speech perception in motor speech disorders. In G. Weismer (Ed.), Motor speech disorders: Essays for Ray Kent (pp. 195-231). San Diego, CA: Plural.

Obleser, J. & Kotz, S.A. (2011). Multiple brain signatures of integration in the comprehension of degraded speech. *NeuroImage, 55*(2), 713-723.

Borrie, S.A., McAuliffe, M.J., Liss, J.M., Kirk, C., O'Beirne, G.A., and Anderson, T. (2012). Familiarization conditions and the mechanisms that underlie improved recognition of dysarthric speech. *Language and Cognitive Processes, 27*(7-8), 1039-1055.