ABSTRACT

The present study focused on the neural processes underlying the perception of silent visual speech and aimed to investigate whether silent articulatory cues could facilitate statistical learning, a mechanism shown to aid the perception and segmentation of continuous speech. Additionally, this thesis investigated whether this process could be affected by the participants' primary mode of communication. The neural activity of adult participants with normal and impaired hearing was measured with EEG as they were exposed to two silently mouthed syllable streams. The structured stream consisted of four repeating trisyllabic pseudo-words whose boundaries were cued merely by the transitional probabilities between the syllables. On the other hand, the random stream consisted of twelve syllables in pseudo-random order and did not contain any covert statistical structure. Inter-trial phase coherence at a syllable rate (3.3 Hz) and a word rate (1.1 Hz) was computed to assess the phase synchronisation of the recorded neural activity and the silent speech stimulus. A phase-locked activity at the word rate would indicate that the covert statistical words were detected as a result of statistical learning. The participants also took a post-exposure forced-choice task to assess their explicit knowledge of the learnt structures and thereby assess the effects of statistical learning behaviourally, and a lip-reading test to assess their ability to decode articulatory cues in a known language. The EEG results of adults with normal hearing showed that the phase synchronisation at the word rate increased throughout the exposure and was the largest during the exposure to the second block of the structured stream, indicating sensitivity to the statistical regularities in the observed silent speech. Although the EEG results showed effects of statistical learning, the forced-choice task failed to detect such effects, potentially highlighting the shortcomings of using only the behavioural assessment in some studies. Furthermore, the localisation of the increased neural activity indicated that there might be different processing strategies based on the participants' primary mode of communication and native language. The results of this study suggest that statistical learning during speech perception can be successfully measured online regardless of the language modality and could be affected by familiarity with the input, native phonotactics, and the brain's plasticity.

Keywords: *silent speech, statistical learning, speech perception, EEG*