Effects of visuoauditive integration on motor system in speech perception: A TMS study

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Introduction.– Recent studies have shown that speech perception involves the motor system of the lips and tongue [1], integrating the idea developed by Rizzolatti et al. [2] about the existence of mirror neurons in humans. This perception can engage only auditory system or visual-auditory systems, involving various systems of integration and interaction. The aim of this study is to investigate the influence of the integration of the perceptual system on the motor system and the modulation effects of timing mismatch between the auditory and visual signals.

Materials and methods.– Seven healthy volunteers (six men, one woman, 35-64 years) were included. The motor threshold of evoked potentials (MEP) at rest has been measured by transcranial magnetic stimulation (TMS) on the motor cortex of the left and right orbitocular oris. The amplitudes of MEP after a 120% of motor threshold stimulation were measured during various states: at rest, listening a speech, lip reading of the speaker filmed in close-up, listening and watching the speaker with multiple levels of timing synchronization between the auditory and visual signal: synchronized, desynchronized of 25, 50, 100 and 300ms, and listening and watching the same film shown reversed (“non-speech”).

Results.– It is noted that the MEP amplitude after stimulation of the left cortex varies significantly in different tasks unlike the right stimulation. It contested a significant increase of MEP amplitude compared to the rest (165%) or the task of “non-speech” when subjects listened and watched the movie. The amplitude decreases with timing mismatch between the visual and auditory signal.

Discussion.– These results confirm the influence of the perceptual system on cortical excitability of the motor system. This influence is not only an epiphenomenon and differs with the meaning of the signal (speech versus “non-speech”) but also according to the timing congruence of visual and auditory input. These results suggest the interaction and the possible involvement of the motor system in integrating visual-auditory perception and speech.

References
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Metaphor’s and idiom’s understanding in traumatic brain injury
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Introduction.– Language deficits reported in patients with traumatic brain injury (TBI) mainly concern the understanding of figurative language [1]. The aim of our study was to demonstrate the difficulties of understanding in figurative language of patients with TBI, to specify them with various figures of speech (metaphors and idioms), and to determine the origin of these deficits (working memory, inhibition, semantic and linguistic abilities).

Patients and methods.– A group of 41 TBI patients was matched for sex, age and the educational level with a group of 41 respective controls (11 women, 30 men, mean age 32 years ±13, average educational level: 11 years of study ±3). Participants filled a questionnaire composed of 48 comprehension expressions put into context: 16 verbal metaphors such as “Installed on the sunbed, Paul nibbled existence.”, 16 idioms such as ambiguous semantically transparent “Given the situation, Aline was forced to lay down their weapons.”, 16 not semantically transparent such as “Until the shipment arrives, Elodie touched wood.” and 16 literal sentences (control items); and the verbal subtests of the WAIS-III for assessing semantic and language abilities, the Stroop test, the Hayling and Brixton tests for assessing executive functions.

Results and conclusion.– Consistent with the literature, the results showed a deficit in understanding figurative language in TBI. Correlations indicated that the understanding of the three types of figurative expressions were positively and significantly correlated with semantic and language abilities (VIC), with the working memory index (IMT) and with performances at executive functions’ tests. Specifically in TBI patients, VIC was the significant predictor of metaphors and nondecomposable idioms understanding, while verbal inhibition abilities measured by the Hayling test was the significant predictor of decomposable idiom understanding.

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Bilingualism and executive functions
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