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PROGRAM & ABSTRACTS

The transient response to interaural time differences

Martinez M [1], Valderrama JT [2,3], Alvarez I [4], Vargas JL [1] and De la Torre A [4]

[1] ENT Service, University Hospital Complex of Granada, Spain;
[2] National Acoustic Laboratories, Hearing Australia, Sydney, Australia
[3] Department of Linguistics, Macquarie University, Sydney, Australia
[4] Department of Signal Theory, Telematics and Communications, CITIC-UGR, University of Granada, Spain

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Background: Binaural hearing allows many benefits in everyday listening environments such as the segregation of different sound sources, which is the key to understand speech in noise environments. Undurraga et al. (2016) [J Assoc Res Otolaryngol 2016; 17:591-607] presented a novel methodology that delivered a steady-state auditory evoked potential sensitive to binaural hearing. The present work escalates on the aforementioned methodology, and uses deconvolution to obtain the transient response associated with binaural-hearing neural processes.

Methods: In this work we generate a stereo stimulation signal that recreates a sound source that changes its location between two different points in space. The locations were separated from each other +/-90º (+/- 45º with respect to the midline). The sound source alternated its location randomly with a uniform probability distribution in the interval [1-2] seconds. The sound source consisted of a 520-Hz burst of windowed tones with a uniform Stimulus Onset Asynchrony of [5-20] ms (equivalent to a mean stimulation rate of 40 Hz). The spacing between source locations of ± 90.0 ° corresponds to an ITD of +/- 480 µs. This ITD was generated by advancing the carrier phase at one ear to 240µs and the carrier phase at other ear to -240µs. The envelope was diotic for both ears. To appreciate the effect produced by the change in ITD, the evoked response to a signal with ITD= 0µs was also recorded as a control measure (the sound source does not change position, located in midline). For both stimulation signals (ITD = +/- 480µs and ITD = 0µs), 5 recordings of 5 minutes duration each were recorded for each subject, with a stimulation intensity of 50 dB hearing level. The subject pool consisted of 6 normal-hearing listeners (3 females, [25-48] years).

Results: Through the deconvolution procedure previously developed by this research team, it has been possible to obtain both the evoked response associated with the windowed tones, and the evoked response associated with the change in location of the sound source. The windowed tones elicited a clear and reproducible MLR response. The change in location generated a novel evoked potential with a negative peak at approximately 100 ms and a positive peak at 150/200 ms in all six subjects.

Conclusion: In this preliminary study we have been able to obtain a reproducible auditory evoked potential associated with a binaural stimulus thanks to the stimulus design and the flexibility of the deconvolution methodologies. This finding represents an objective measure of neural activity associated with binaural hearing and could be used in assessing auditory processing disorders related with binaurality.

e-mail corresponding author: atv@ugr.es