

Abstract for the 3rd Workshop on "Cognitive neuroscience of auditory and cross-modal perception" in Kosice, 29 - 31 Mai 2017.

Oral presentation preferred.

Auditory Looming Bias in Behavioral and Neural Responses Demonstrates Effect of Spectral Cue Salience on Sound Externalization

Robert Baumgartner^{1,2}, Darrin K. Reed², Brigitta Tóth³, Virginia Best⁴, Piotr Majdak¹,
H. Steven Colburn², Barbara Shinn-Cunningham²

¹ Acoustics Research Institute, Austrian Academy of Sciences, Vienna, 1040, Austria;

² Department of Biomedical Engineering, Boston University, Boston, MA 02215, USA;

³ Institute of Cognitive Neuroscience and Psychology, Hungarian Academy of Sciences, Budapest, 1117, Hungary;

⁴ Department of Speech, Language & Hearing Sciences, Boston University, Boston, MA 02215, USA

Sound sources are naturally perceived as externalized auditory objects located outside the head. When listening via headphones or hearing-assistive devices, sounds are often heard inside the head, presumably because individual spectral cues become inconsistent with normal experience. The present study evaluated the consequence of changes in spectral cue salience on sound externalization. Listeners judged differences in externalization while the salience of spectral cues was varied by modifying the spectral contrast of listener-specific head-related transfer functions (HRTFs). Behavioral results showed strong individual differences, but, on average, smaller spectral contrasts were judged to be less external. In simultaneous electroencephalographic recordings, spectral changes caused event-related potentials characterized by an early fronto-central negativity (N1) around 120 ms and a later fronto-central positivity (P2) around 220 ms. N1 and P2 magnitudes were larger the more the spectral contrast changed. Moreover, decreasing spectral contrasts lead to larger P2 magnitudes and higher behavioral response consistency than symmetrically increasing spectral contrasts. This is consistent with previous reports on the perceptual salience of looming auditory objects, usually attributed to sounds increasing versus decreasing in overall sound intensity. The auditory looming bias arguably reflects increased alertness for approaching objects and thus confirms that reduced salience of spectral cues markedly degraded sound externalization.