Bio: Tom Campbell has held a docentship in Cognitive Neuroscience at the University of Helsinki since 2007. He earned a Ph.D. in 2000 concerning his thesis at the University of Reading, England, UK. This research concerned the perceptual and cognitive processing of lipread material. He has held independent fellowships in Helsinki at the Cognitive Brain Research Unit from 2001 to 2003 and at Helsinki Collegium for Advanced Studies from 2004 to 2007. Both fellowships centred on the auditory neurocognition of distraction.

As a full specialist at University of California Davis from 2009 to 2010, he devised new techniques for using ordinary headphones, EEG, and computer hardware to measure the rostral brainstem’s response to speech sounds: the complex Auditory Brainstem Response. These techniques published in *Ear and Hearing* are applicable in nearly any hospital in the world.

As a visiting scientist at the Medical Physics section of The Carl von Ossietzky University of Oldenburg, Germany, from 2012 to 2013, he developed an interaural electrode pairing clinical research system for binaural cochlear patients. In collaboration with John Marsh, a recent theoretical offering to the emerging field of cognitive hearing science is the new early filter model. In cooperation with industry, current research interests concern ear canal acoustics alongside the use of hearing devices including headphones.
Abstract: Complex auditory environments containing multiple sound sources are ubiquitous, typically organising mentally into a few streams of multiple auditory objects via auditory scene analysis (Bregman, 1990). That analysis involves both peripheral and central processing. In turn, from such complex mixtures, the listener may selectively process aspects of such a stream. Such aspects could include the content of what one talker says at a “cocktail party” setting or the melody played on an instrument in an orchestra. With these complex mixtures, auditory spatialisation contributes not only to speech-in-noise intelligibility but also to the subjective aesthetic appeal and the perceptual experience of music (Lokki et al., 2016). The notion is that processing of binaural cues can improve auditory scene analysis as well as speech intelligibility in noise.

Binaural cochlear implants can, albeit with individual variability, improve spatial perception. A factor in this variability is the interaural mismatch in the surgical depth of insertion of cochlear implant electrodes. This mismatch necessitates interaural electrode pairing. That pairing facilitates the comparable stimulation of the tonotopic organisation of both cochleas. Here I review the potential for a candidate objective measure for matching interaural electrode pairing. This measure is the electrically evoked binaural interaction component (eBIC). That is, direct stimulation of an electrode in either ear elicits an electrically evoked auditory brainstem response (eABR). The eABR that binaural direct stimulation elicits exhibits a super-additivity beyond the addition of the corresponding two eABRs with direct stimulation of the left and right cochleas separately. That super-additive difference wave is the eBIC. The concept is the higher the amplitude of the eBIC, the better the match of electrodes (Hu et al., 2014). Further investigations (Hu & Dietz, 2015) also reveal the eBIC interaural electrode pairing does not always correspond to other subjective psychophysical interaural electrode-pairing methods.

Questions open to future investigation with larger populations concern which combination of eBIC and subjective measures optimises interaural electrode pairing. These questions are tractable with long-term measures of auditory spatial perception, speech-in-noise intelligibility, or even musical perceptual experience. Parenthetically, the binaural interaction component is subject to top-down attentional control (Ikeda, 2015). Also, learning lexical tones can also affect the brainstem processing of sound (Chandrasekaran, Kraus, & Wong, 2012) as does musicianship (Musacchia, Sams, Skoe, & Kraus, 2007). Further open questions thus also concern whether eBIC measures better predict the outcome of different forms of training to promote attention to binaural cues. A hypothesis is that musical training could promote such attention, as could generalise to attending one talker in a cocktail party setting.

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