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Introduction

Much research has been conducted on the integration of information of binaural lateralization cues over frequency. Macpherson and Middlebrooks (2002) showed that listeners weight interaural time differences (ITDs) more strongly at low than at high frequencies, while interaural level differences (ILD) are weighted more strongly at high frequencies. These findings were coherent with the proposed duplex theory of Lord Rayleigh (1907). Other studies have confirmed that binaural information is integrated over frequencies in the binaural system to lateralize sounds (Bluett and Hafer, 1991; Woods and Colburn, 1992) using a spectral weighting function (Ahrens et al., 2015). While these studies investigated the weighting of information over frequency in horizontal plane, no such weighting exists for vertical (elevation) localization.

In this study, we aimed to investigate if certain frequency areas are perceptually weighted higher than others. Furthermore, predictors of perceptual weights in the head-related transfer functions (HRTFs) were investigated.

Methods

- 11-2AFC (above/below decision task)
- 7 individual elevation HRTFs (ϕ=–60°:20°:60°)
- Azimuth angles (θ) at 15° and 45° (left)
- Wide and narrow frequency range (0.95–15 kHz, 3.2–12.4 kHz)
- Stimuli presented via equalized open headphones (Sony PFR 1550)
- 11 normal-hearing participants

Results are a perceptual extension to directional/boosted bands (Blauert, 1997) –

A narrow frequency range seems to lead to less reliable perceptual weighting results
- Results are a perceptual extension to directional/boosted bands (Blauert, 1997)
- Step towards a weighting function for computational models (e.g. Zoonooz et al., 2019)

Discussion & Conclusions

- The frequency band of 6.4 kHz is perceptually weighted largest with respect to elevation, however the intra-subject variation is large
- The magnitude variation predictability over the elevations of the individual HRTFs correlates with the perceptual weights

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References