Spectral Weighting of Binaural Cues: Effect of Bandwidth and Stream Segregation

Ahrens, Axel; Joshi, Suyash Narendra; Epp, Bastian

Publication date: 2015


General rights
Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.
Spectral Weighting of Binaural Cues: Effect of Bandwidth and Stream Segregation
Axel Ahrens, Suyash Narendra Joshi, Bastian Epp
Hearing Systems, Technical University of Denmark, Lyngby, Denmark
aahr@elektro.dtu.dk

Introduction
It is hypothesized that binaural information is integrated over frequencies in the binaural system to lateralize sounds (Buell and Hafter, 1991; Woods and Colburn, 1992) using a spectral weighting function. Furthermore, it is hypothesized that this weighting is not fixed but can vary depending on the signal properties and on the acoustical context of the sound.

Hypothesis
An open question is, however, how ITD and ILD information is integrated over frequency, other sound sources by forming auditory objects. This is commonly referred to as thecock-tailing phenomenon. The ITD and ILD cues combine to give information about the distance and motion of the sound sources.

Method and Stimuli
- Perceptual weights (mean ± standard error) for ITD (condition 1b)
- Streaming leads to increase of on-frequency weight
- Streaming leads to an increase in weights
- Weighting of frequency bands depends on spectrally near content
- Content on only one spectral side leads to high weight (condition 1b)
- Uncorrelated noise on the other side does not change the weight (condition 1a to 1c)
- Listener’s judgement of lateral location of sound is biased by binaural cues on the most outer frequency bands
- Spectrally most outer bands play a special role
- Weighting of frequency bands depends on spectrally near content
- Streaming leads to an increase in weights
- Release from interference?
- Increase in width only when binaural information available

Results obtained different to what would be expected from the duplex theory

Discussion and conclusions

Literature
- Ahrens, A. & Hafter, E. L. (1991). An open question is, however, how ITD and ILD information is integrated over frequency, other sound sources by forming auditory objects. This is commonly referred to as thecock-tailing phenomenon. The ITD and ILD cues combine to give information about the distance and motion of the sound sources.
- Woods, W. S., & Colburn, H. S. (1992). Perceptual weights for ITD and ILD (condition 1b) determined with 10 subjects. The large and small squares represent the conditions with 11 and 7 gaps, respectively. The experiments show the conditions with noise on the single and double-mueter outer side bands. The weights are normalized relative to their mean value.
- Streaming leads to an increase in frequency weight
- Off-frequency weights mainly decrease
- Effect only at low frequencies for ITDs
- Increase for all frequencies for ILDs
-不确定在频率偏移时的权重

- Streaming leads to an increase in weights
- Release from interference?
- Increase in weight only when binaural information available
- At low frequencies for ITD
- At all frequencies for ILD

- Spectrally most outer bands receive highest weights
- Lowest frequency band for ITD
- Highest frequency band for ILD
- Reduction of overall stimulus bandwidth results in change of weights
- New spectrally most outer bands receive highest weight
- Uncorrelated noise on most outer bands does not lead to change in weights
- Flat weighting function (equal weights)

- Streaming leads to increase of on-frequency weight
- Off-frequency weights mainly decrease
- Effect only at low frequencies for ITDs
- Increase for all frequencies for ILDs

- Spectrally most outer bands receive highest weights
- Lowest frequency band for ITD
- Highest frequency band for ILD
- Reduction of overall stimulus bandwidth results in change of weights
- New spectrally most outer bands receive highest weight
- Uncorrelated noise on most outer bands does not lead to change in weights
- Flat weighting function (equal weights)

- Streaming leads to increase of on-frequency weight
- Off-frequency weights mainly decrease
- Effect only at low frequencies for ITDs
- Increase for all frequencies for ILDs

- Spectrally most outer bands receive highest weights
- Lowest frequency band for ITD
- Highest frequency band for ILD
- Reduction of overall stimulus bandwidth results in change of weights
- New spectrally most outer bands receive highest weight
- Uncorrelated noise on most outer bands does not lead to change in weights
- Flat weighting function (equal weights)

- Streaming leads to increase of on-frequency weight
- Off-frequency weights mainly decrease
- Effect only at low frequencies for ITDs
- Increase for all frequencies for ILDs

- Spectrally most outer bands receive highest weights
- Lowest frequency band for ITD
- Highest frequency band for ILD
- Reduction of overall stimulus bandwidth results in change of weights
- New spectrally most outer bands receive highest weight
- Uncorrelated noise on most outer bands does not lead to change in weights
- Flat weighting function (equal weights)

- Streaming leads to increase of on-frequency weight
- Off-frequency weights mainly decrease
- Effect only at low frequencies for ITDs
- Increase for all frequencies for ILDs

- Spectrally most outer bands receive highest weights
- Lowest frequency band for ITD
- Highest frequency band for ILD
- Reduction of overall stimulus bandwidth results in change of weights
- New spectrally most outer bands receive highest weight
- Uncorrelated noise on most outer bands does not lead to change in weights
- Flat weighting function (equal weights)

- Streaming leads to increase of on-frequency weight
- Off-frequency weights mainly decrease
- Effect only at low frequencies for ITDs
- Increase for all frequencies for ILDs