The effect of interaural-time-difference fluctuations on apparent source width

For the perception of spaciousness, the temporal fluctuations of the interaural time differences (ITDs) and interaural level differences (ILDs) provide important binaural cues. One major characteristic of spatial perception is apparent source width (ASW), which describes the perceived width of a sound image. The temporal fluctuations of the binaural cues cause the signals at a listeners’ ears to be decorrelated. Therefore, ASW has traditionally been measured by using the interaural cross-correlation (IACC). In particular, ITD fluctuations (below 2kHz) have been suggested to be the dominant cue for the perception of ASW. However, the contribution of the ITD statistics on the percept of ASW has not yet been clarified. In the present study, the impact of ITD fluctuations in different frequency bands on the perceived ASW was investigated. In a psychoacoustic evaluation, a source signal was convolved with individual binaural room impulse responses (BRIRs) and presented to the listener via headphones. The obtained signals were passed through a gammatone filterbank with an analysis and synthesis stage which enabled the modification of the ITD fluctuation statistics in individual frequency bands. The ITD fluctuations of broadband noise stimuli were compressed while the effect of this compression on the ILD statistics was kept minimal. The IACC was kept the same for stimuli with compression below 2kHz and for the uncompressed noise which should lead to the same ASW percept in the two conditions. However, the psychoacoustic data showed a reduced ASW for the modified signals, particularly in conditions with an applied compression around 1 kHz. In contrast, above 2kHz, the compression had no effect on ASW, whereas the IACC increased. The results suggest that the broadband IACC can be a misleading objective measure of ASW and that ITD fluctuations around 1kHz are crucial for ASW perception.

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