The dominance of ILD cues when tracking talkers in real-room reverberation

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Introduction

- Listeners can selectively attend to (‘track’) a single talker in the presence of other, simultaneous talkers, even in reverberant conditions.
- Diverse signal characteristics can help listeners track a speech message over time (e.g., a filtering difference; Spith and Webster, 1955).

Experimental paradigm

- Listening task where cues from talker- and spatial-differences are in conflict, and where listeners’ responses indicate which cue they’re tracking.
- Based on Darwin and Hukin’s (2000) paradigm, where listeners hear two simultaneous messages played in a (simulated) room.

Design

- Diverse room-position pairs were used, varying the distance between listener and talkers (0.65, 1.25, 2.5, and 5 m), the bearing separation between talkers (+/-25° and +/-5°, and both (e.g., a 0.65 m distance at +5° with a 5 m distance at -5°).
- Listening was either dichotic, or diotic with the L or R channel presented to both ears and matched to the dichotic level.

Results: Talker differences

- Talker-difference tends to dominate over room-position, particularly for the different-sex pair.
- However, room position is not always ignored, and can be dominant for same-sex pairs in dichotic conditions.

BRIR processing

- To investigate which cues from position are responsible for this dichotic effect, the BRIRs were processed to limit the cues available to listeners as follows:

  |
  | rotate all FFT components to cosine phase
  | signal-correlated convolve
  | spectral-only ‘SO’ BRIRs:
  | - all ITDs and temporal-envelope ‘tails’ are removed
  | - leaves only spectal-envelope and level (e.g., ILD) info.
  | spectral-plus-temporal-envelope (‘SO+T’) BRIRs:
  | - as ‘SO’ but with ‘tails’ restored

Spectral distance between BRIRs

- In dichotic conditions, when listeners track by room-position, do they ‘select’ the ear with the bigger spectral-distance between the two messages?
- An ‘auditory’ (gammatone) filter-bank analysis allows calculation of monaural spectral distances (d) between the BRIRs in an ear (Euclidean distance, d = the rms of the pairwise dB differences in frequency channels).