Influence of signal enhancement algorithms on auditory movement detection in acoustically complex situations

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Hearing loss can negatively influence the spatial hearing abilities of hearing-impaired listeners, not only in static but also in dynamic auditory environments [4]. Thus, ways of addressing these deficits with advanced hearing aid algorithms need to be investigated. In a previous headphone-based study, we found that two simulated directional processing algorithms could substantially improve the detectability of left-right (L-R) and near-far (N-F) source movements in the presence of reverberation and multiple interfering sounds for a group of older hearing-impaired (OHI) listeners [5]. Here, we used a loudspeaker-based setup and wearable hearing aids to explore the effects of a set of directional hearing aid settings on movement detection and other aspects of spatial awareness perception. Our aims were:

1) To investigate the extent to which our earlier movement detection results obtained with a headphone-based setup and simulated HA settings can be transferred to a loudspeaker-based setup and head-worn devices (experiment 1)

2) To extend our earlier results towards other aspects of spatial awareness perception (experiment 2)

RESULTS

L-R and N-F movement detectability

![Graph showing movement direction and number of concurrent sources](image)

Experiment 2

- **Movement direction and number of concurrent sources:**
  - On each trial, random number of sounds (1-5) from random positions (0°, 45°, 90°, 135°, 180°, 225°, 270° or 315°)
  - Two tasks administered using graphical user interfaces (see figures)
    - Task 1: Indicate number of concurrent sound sources
    - Task 2: Indicate movement direction of target sound

PARTICIPANTS

- OHI listeners with symmetric moderate sensorineural hearing losses
- Division into groups for experiment 1 (but not experiment 2)
  - Group 1+2 (tested with two masker sounds): mean age of 66.9 yr, mean PTA of 37 dB HL
  - Group 1+4 (tested with four masker sounds): mean age of 64 yr, mean PTA of 34.1 dB HL

SUMMARY

- In principle, the transition from a headphone-based setup with simulated hearing aid algorithms towards a loudspeaker-based setup with head-worn devices is possible
- So far, however, no effects of the different hearing aid conditions observable:
  - L-R and N-F movement detectability: For group 1+2 (tested with two masker sounds) no significant differences measured; for group 1+4, trend towards lower thresholds for DIR condition in the N-F-dimension (similar to the results in [5])
  - Significant effects of number of concurrent sound sources and starting position for the movement direction and number of concurrent sound sources tasks
- Outlook: Design of scenarios that can show effects of the small differences among hearing aid settings already at the acoustical level

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REFERENCES