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On the dynamics of the preference-performance relation for hearing aid noise reduction

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Motivation

- Speech understanding in noise (SiN) is an important but demanding daily-life situation, especially for hearing impaired people
- Noise reduction (NR) algorithms are supposed to be helpful in such situations
- However, there are indications that some hearing impaired like NR – the stronger the better – while other people dislike this kind of signal processing
- Furthermore, the relation between preference for and performance with NR algorithms is not clear (e.g., Neher 2014; Gorman et al. 2016)

Results

- Main effect of NR condition (F(1,35) = 39.073, p < .001): In general, P2 is preferred over P1
- Interaction NR condition & Preference group (F(1,35) = 21.178, p < .001): “Indifferent” people have a stronger preference for P1 than NR-losers, for P2 vice versa (post-hoc t-tests with Bonferroni correction; p < .01)

Performance results (ANOVA with covariates Age and PTA4)

Conclusions

- Although NR-losers clearly prefer a setting with single-channel noise reduction and directional microphone, they show same performance in an omni-directional setting as the group with no preference for either hearing aid setting
- New and experienced hearing aid users do not differ in their performance and preference relation
- In general, people perform worse the higher their hearing threshold is and the older they are
- Future focus: evaluation of long-term stability of preference & performance

Subjects

Tab: Means and ranges for age, PTA and hearing aid experience data used in the statistical analyses.

<table>
<thead>
<tr>
<th>Preference group</th>
<th>Indifferent</th>
<th>NR-losers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(N=19; 10.9)</td>
<td>(N=20; 8.9)</td>
</tr>
<tr>
<td>M</td>
<td>Min</td>
<td>Max</td>
</tr>
<tr>
<td>Age [years]</td>
<td>68</td>
<td>53</td>
</tr>
<tr>
<td>PTA4 [dB HL]</td>
<td>45</td>
<td>27</td>
</tr>
<tr>
<td>HA experience [years]</td>
<td>7</td>
<td>0</td>
</tr>
</tbody>
</table>

Predictor variables

- Experimental group (novice vs. experienced HA users)
- Preference group (initially measured preference with spatial dynamic SiN task: Indifferent vs. NR-losers)
- Age, PTA

Hearing Aid conditions

- KEMAR recordings with Signia Pure 7px devices in experimental setups (detailed description below)
  - P1: Omni-directional
  - P2: Combination of single-channel noise reduction and directional microphone (speech-weighted SNR improvement of 7.7dB with respect to P1)
  - Post processing of recordings: individual amplification to provide insertion gain target of NAL-NL1-3dB
  - Playback via headphones

Preference measure: Spatially dynamic SiN task (after Getzmann et al., 2015)

- Three-loudspeaker-setup: -45, 0, +45° in spatially diffuse cafeteria noise (65dB)
- Oldenburg sentence material (Wagener et al. 1999; Hochmuth et al. 2015)
- Target: female German speaker (71dB)
- Distractors: male Russian and Spanish speakers (71dB)
- Target and distractors switched their spatial positions from trial to trial
- Subjects are instructed to follow the German speaker while ignoring the distractors

Performance measures

- Listening span test (LST): N correct final word recognition and recall
- Spatially dynamic SiN task: N correct repeated numbers (1 per sentence)
- Speech intelligibility (OLSA): SRT in dB

References:


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