P293

HEARING AIDS

Real-life preferences of hearing-aid users for adjustment of advanced features

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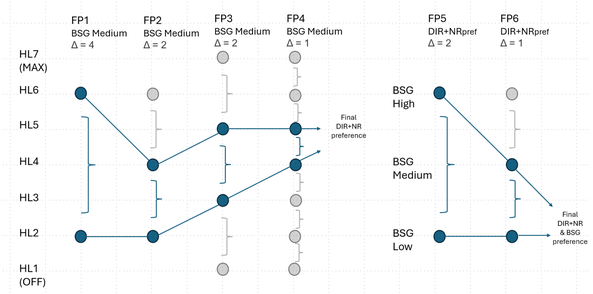
Aim

- Preferences for advanced hearing-aid settings, such as directionality and noise reduction (DIR+NR), vary considerably across users.
- No clinical best-practice is established for advanced features, and clinicians often rely on the patient preference to adjust their strength.

Main Q: Which DIR+NR settings do users prefer in hearing aids with adaptive DIR+NR processing?
Follow-up Q: How sensitive are users to changes in DIR+NR settings relative to minor gain changes?

Materials and Methods

- 123 experienced hearing-aid users (52 f, 71 m), mean age 65.2 years, native speakers of German (82) or Japanese (41).
- Mild to severe bilateral hearing loss.
- Users fitted with hearing aids (Oticon More 1). Hearing-aid amplification: REM-adjusted NAL-NL2 (Keidser et al., 2011) for the German population; Utsunomiya method (Shinden et al., 2021; Suzuki et al., 2023) for the Japanese population.
- Audiological measures including aided speech-reception thresholds (SRTs) and Audible Contrast Threshold (ACT) score as described in Zaar et al. (2024).
- A/B comparisons in the field (Figure 2) where subjects were instructed to provide at least 1 report per day (Figure1 (a)). Each field period (FP) ended with a structured interview (Figure 1 (b)).



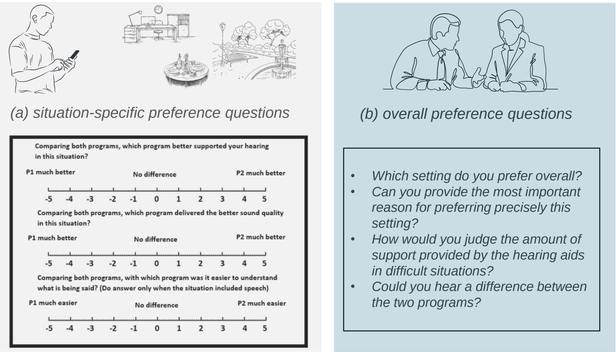


Figure 1 (up): Excerpt of questionnaires used in each field period during (a) the everyday situations and (b) the structured interviews at the end of each field period.

Figure 2 (left): Experimental design comprising 6 field periods (FP) lasting ~4 weeks; 2 listening programs (P1 & P2) in each FP with decreasing program differences. Programs differed in: DIR+NR strength in FP 1-4, High-frequency gain (brightness) and soft-sound gain (B+SG) in FP 5-6. Help levels (HL) 2 to 6 were adaptive DIR+NR settings. HL 1 indicates the omni and HL7 the full DIR with max NR. The circles and brackets show the available programs and program comparisons respectively for each FP. The blue lines show an example of a trajectory of choices for a user. Δ indicates the number of steps separating the two programs.

Results (Main Q): Overall preference in DIR+NR settings at the end of the field trial

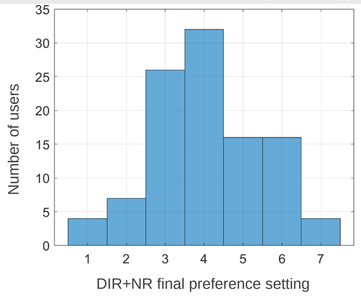


Figure 3. Distribution of overall preference for DIR+NR settings at the end of the field trial based on structured interviews (Figure 1(b)).

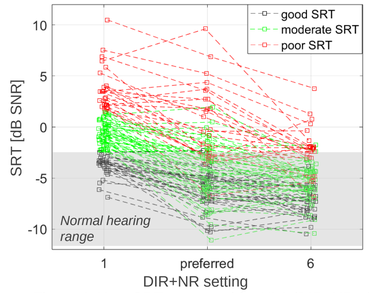


Figure 4. User SRT measured for HL1 (DIR+NR off), the preferred HL and HL6. The colors indicate the aided SRT performance for HL1 (DIR+NR off).

- Variable preference for DIR+NR with higher preference for adaptive DIR+NR (92% of the users) than for the omnidirectional (DIR+NR off) and fully directional (DIR+NR max) settings.
- Preferred DIR+NR settings did not always lead to maximum speech-in-noise benefit, especially for the poor aided SRT performers for DIR+NR off (see Figure 4, where good SRT< -2.5, -2.5 ≤ moderate SRT < 1.5, poor SRT≥1.5 dB SNR).
- No correlation of final DIR+NR preferences with audiological predictors (aided SRT for DIR+NR off, ACT score, audiogram, closedness of acoustic coupling and age).

Results (Follow-up Q): User sensitivity to changes in DIR+NR vs B+SG in everyday situations

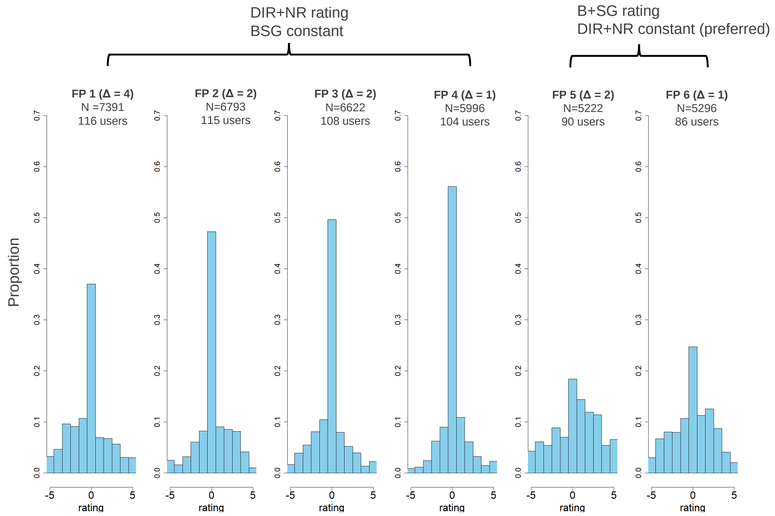


Figure 5. Histograms of the pooled situation-specific preference ratings (see Figure 1(a)) for each field period. Negative values indicate low program strength. For FP 2, 3, 4 and 6, users experienced different program comparisons defined by their individual choice trajectory (see Figure 2).

- Situation-specific preference ratings were clearer when the difference between the two programs was large and became less clear for smaller contrasts.
- Variance comparisons were made against a F(90,90) distribution, under the assumption that in each variance estimate about 90 independent users contributed data, while data contributed from each user was assumed to be highly correlated (Table 1).
- Users showed low sensitivity to DIR+NR (although changes can be up to ~6 dB SNR in FP1), while they showed higher sensitivity to minimal gain changes (~1-2 dB between B+SG settings).

	fp1	fp2	fp3	fp4	fp5	fp6
fp1		NS	NS	***	NS	NS
fp2			NS	NS	**	*
fp3				NS	***	*
fp4					***	***
fp5						NS
fp6						

Table1: Variance comparisons against a F(90,90) distribution. Non-significant results (NS) are indicated for p-values > 0.05.

Conclusions

- Adaptive DIR+NR (mild to very strong) is much more often preferred (92% of users) than omni without DIR+NR or full DIR with max NR.
- Overall preference did not lead to optimal speech benefit especially for the poor SRT performers.
- We found no correlation of overall preferences at the end of the field period with audiological predictors. For further exploration on environmental and audiological factors driving the everyday preferences see Vatti et al. (2024).
- Situation-specific DIR+NR preferences were much weaker compared to gain preferences, suggesting that clinicians can confidently guide patients towards DIR+NR settings that maximize speech-in-noise benefit. However, when fine-tuning gain, even minimally, clinicians should be mindful of the importance of individual preferences.

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