Supplemental Material S1. Additional information on study design and sound data.

Study design

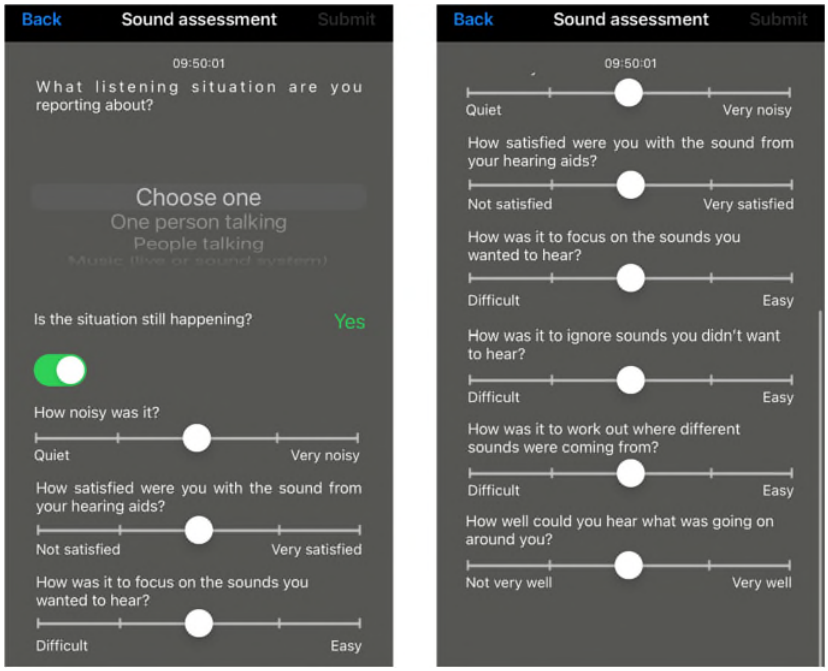

Figure S1. Smartphone app for Ecological Momentary Assessments used in the study. The left screenshot shows the app when starting an assessment. The right screenshot shows the app when scrolling down to reveal the last three EMA questions. An assessment can be submitted only if all questions have been answered. The questions with sliders are referred to as Q1 to Q6 in order of appearance.

Sound data

Variation across time

Sound data were collected continuously via the hearing aids when they were connected via Bluetooth to a smartphone. As discussed by Christensen et al. (2021) this form of data logging underestimates actual hearing aid wear time since smartphone connectivity is not constant, due to for example the smartphone being out of range of connectivity or connected to another Bluetooth device. However, as also noted in that article, connectivity appears to be active 85% of time, and more importantly here, there was no association between connectivity and patterns of daily hearing aid wear or sound exposure. Thus, despite differences in hearing aid connectivity time, we expect the logged sound environment to have varied in a similar fashion across the day among participants.

Figure S2 shows the median and the 25th and 75th percentiles of the sound data across all participants separated by HA and time of day. There are clear temporal fluctuations, with SPL being high early noon and again early evening, while SNR is predominantly above average in later hours of the day. Again, these temporal patterns are comparable for the two hearing aid models. We statistically evaluated this by

modeling SPL and SNR in separate mixed-effects models with time (hour), hearing aid model (HA1 vs. HA2), and their interaction as fixed effects. Analysis of variance of the resulting model coefficients demonstrated main effects of time (SPL: $F(23, 1301.7) = 17.12$, $p < .001$; SNR: $F(23, 1302.0) = 21.54$, $p < .001$) and hearing aid model (SPL: $F(1, 1312.0) = 33.43$, $p < .001$; SNR: $F(1, 1313.8) = 392.41$, $p < .001$), but no interaction effects between time and hearing aid model (SPL: $F(23, 1300.5) = 0.80$, $p = .741$; SNR: $F(23, 1300.6) = 0.90$, $p = .602$). These results demonstrate that the temporal patterns of change in SPL and SNR are comparable among hearing aid models, which suggest similar lifestyles (in terms of sound exposure) when testing them.

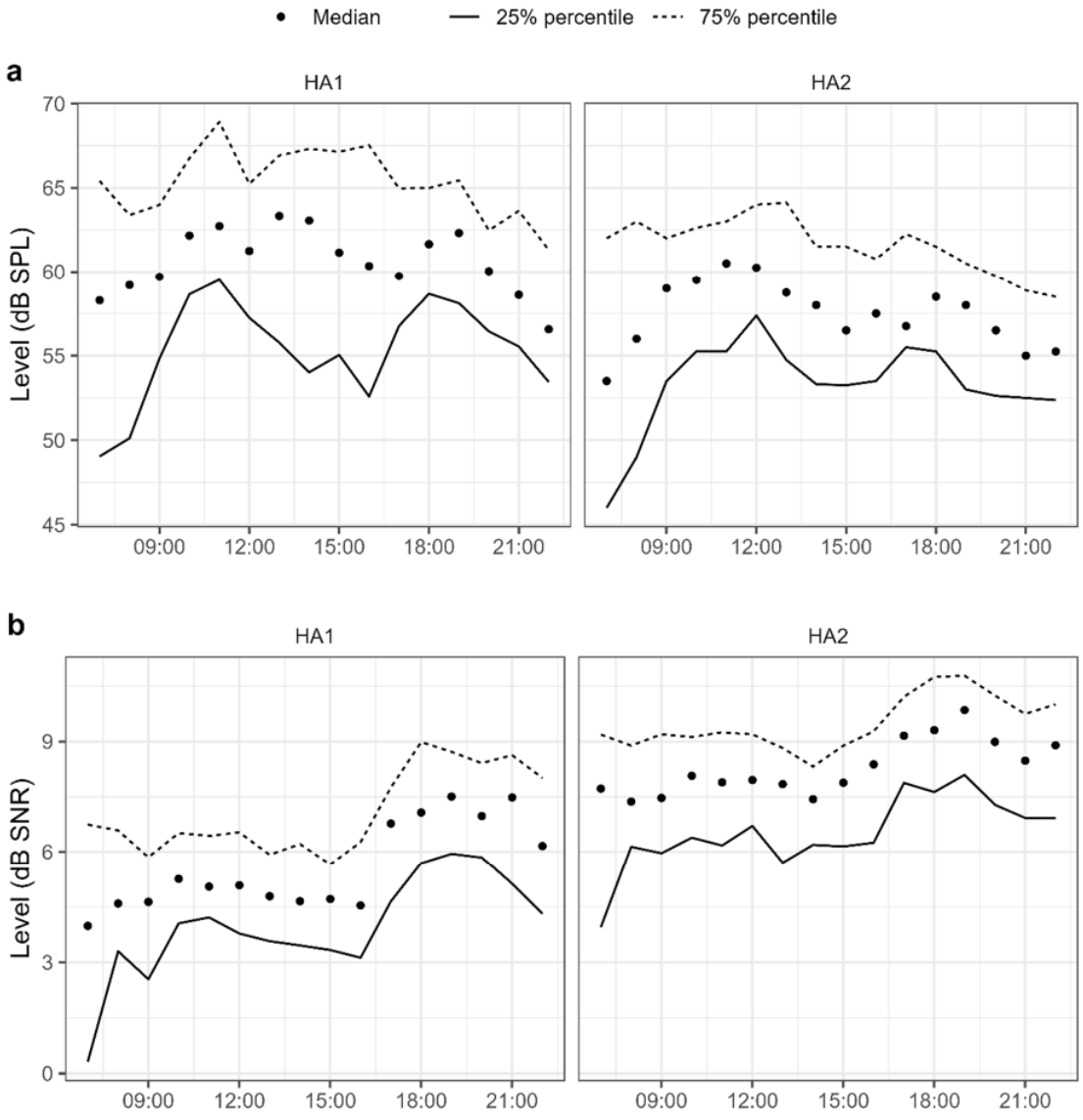

Figure S2. Temporal patterns of the logged acoustic features (in a, sound pressure levels; in b, signal-to-noise levels) across participants and separated by hearing aid model. Points represent the median across participants and the lines represent the 25th and the 75th percentiles.

Differences in sound estimation from hearing aid models

As described in the Methods section of the manuscript, there are differences in the frequency weighting of the SPL estimation from the two hearing aid models. Thus, the absolute levels differ since A-weighting in HA2 effectively suppress contributions from lower frequency ranges compared to the unweighted estimation in HA1. To document this, we here present results from a laboratory-conducted test aiming at validating the estimation of SPL and SNR from HA1 and HA2. We were interested in how the SPL estimations scale going from low to high SPL levels clean speech, and how pink noise and pink noise + clean speech are represented by both hearing aid models.

The test was conducted in a sound-proofed laboratory with HA1 and HA2 placed on a HATS (Type 5128-C, Hottinger Brüel & Kjær, Denmark) and 5-min sound clips. The sound clips were either clean speech (news speak) from one frontal speaker, pink noise (20–20000 Hz) from speakers placed to the left and right of the frontal speaker (equidistance), or both. For reference, the A-weighted loudness levels (SPL LAq) was recorded using a B&K 2250 Light sound level meter (Hottinger Brüel & Kjær, Denmark) with the microphone placed right in front of the HATS. See the setup in Figure S3.

Figure S3. Test setup for measuring SPL and SNR from HA1 and HA2.

The results are presented in Figure S4, and they document that the estimation of SNR from the two hearing aid models are comparable besides a constant offset. Moreover, when the sound is pure pink noise, the SPL estimation is almost identical between HA1 and HA2 due to the frequency-shaping of pink noise.

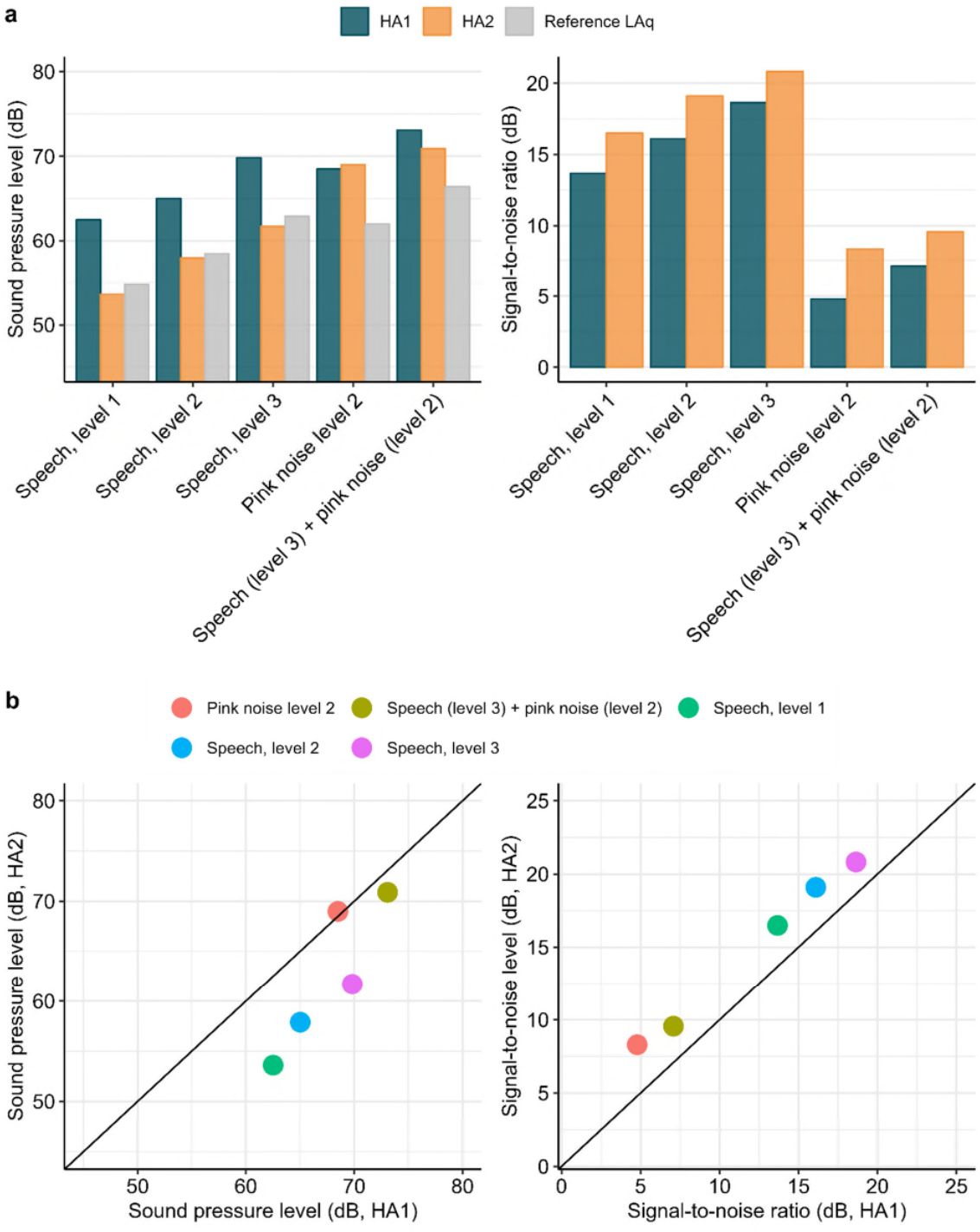

Figure S4. Results of acoustic measurements with HA1 and HA2 on a HATS.