Impact of stimulus-related factors and hearing impairment on listening effort as indicated by pupil dilation

Previous research has reported effects of masker type and signal-to-noise ratio (SNR) on listening effort, as indicated by the peak pupil dilation (PPD) relative to baseline during speech recognition. At about 50% correct sentence recognition performance, increasing SNRs generally results in declining PPDs, indicating reduced effort. However, the decline in PPD over SNRs has been observed to be less pronounced for hearing-impaired (HI) compared to normal-hearing (NH) listeners. The presence of a competing talker during speech recognition generally resulted in larger PPDs as compared to the presence of a fluctuating or stationary background noise. The aim of the present study was to examine the interplay between hearing-status, a broad range of SNRs corresponding to sentence recognition performance varying from 0 to 100% correct, and different masker types (stationary noise and single-talker masker) on the PPD during speech perception. Twenty-five HI and 32 age-matched NH participants listened to sentences across a broad range of SNRs, masked with speech from a single talker (-25 dB to +15 dB SNR) or with stationary noise (-12 dB to +16 dB). Correct sentence recognition scores and pupil responses were recorded during stimulus presentation. With a stationary masker, NH listeners show maximum PPD across a relatively narrow range of low SNRs, while HI listeners show relatively large PPD across a wide range of ecological SNRs. With the single-talker masker, maximum PPD was observed in the mid-range of SNRs around 50% correct sentence recognition performance, while smaller PPDs were observed at lower and higher SNRs. Mixed-model ANOVAs revealed significant interactions between hearing-status and SNR on the PPD for both masker types. Our data show a different pattern of PPDs across SNRs between groups, which indicates that listening and the allocation of effort during listening in daily life environments may be different for NH and HI listeners.