Title: Individualized estimation of spectral weighting during sentence recognition in noise among normal-hearing and hearing-impaired listeners

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One factor underlying the individual differences in understanding speech in background noise among listeners with age-related hearing loss is that some listeners benefit from amplification in extended high-frequency regions while others do not. Therefore, it is useful to obtain individualized estimation on how listeners utilize speech information in various spectral regions. For this purpose, an adaptive test procedure, namely the quick-band-importance-function or qBIF procedure, has been developed in our laboratory. The current study aims to evaluate the test-retest reliability of the qBIF procedure using both normal-hearing and hearing-impaired listeners.

Thirty normal-hearing listeners and ten hearing-impaired listeners were recruited. The relative contributions from five octave frequency bands (centered at 250, 500, 1000, 2000, and 4000 Hz), i.e. the band importance function (BIF), were estimated twice using the qBIF procedure from each listeners. All listeners were naïve to speech recognition tests before the first run of the qBIF procedure, and the first and second qBIF runs were separated by at least one week. During each qBIF run, listeners recognized keywords in IEEE sentences (i.e. the target) in 12-talker babble noises (i.e. the masker). The stimuli were processed so that the target and masker were only presented in a subset of the five octave-frequency bands. The presentation bands and the target-to-masker ratio (TMR) were optimized iteratively after each trial to maximize information gain. For hearing-impaired listeners, the stimuli at conversational speech level (65 dB SPL) were amplified and spectrally shaped to ensure speech audibility, validated using real-ear sound pressure measurements. For normal-hearing listeners, three speech levels (55, 65, and 75 dB SPL) were tested. Each estimate of the BIF was obtained using 100 test trials, approximately 20 minutes of testing time.

The BIFs for IEEE sentences estimated from normal-hearing listeners were relatively consistent across listeners and did not vary significantly across the three speech levels. The root-mean-square deviation between the test and retest in terms of the relative weight in each of the five bands was on average 4.78% (SD: 1.80%). Across the ten hearing-impaired listeners, the shape of the BIF varied greatly, which cannot be fully explained by the shape of their audiograms. The root-mean-square deviation between the test and retest in terms of the relative weight was on average 4.95% (SD: 2.74%). The test-retest reliability of the qBIF procedure is sufficient in capturing the individual differences in the BIF for sentence recognition in noise among listeners with age-related hearing loss.

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