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THEME:

Word recognition in sentence context in background noise: Speech Spectrum Noise and Multi Talker Babble Noise. A comparative study

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Abstract

Speech perception tests are assessment tools for evaluating a subject's speech perception and recognition. Speech testing in quiet does not provide sufficient information about an individual's actual ability to understand speech in natural environments characterized for being adverse listening contexts. On the contrary, evaluating speech perception in noise allows us to estimate a listener's speech intelligibility in the presence of background noise. As for noise types, different authors suggest using Multi-Talker Babble Noise (MTB) for being considered the most representative option as it aims to simulate natural listening contexts such as social gatherings. When this is not available, Speech Spectrum Noise (SSN) is commonly used, which is stationary and therefore not representative of natural environments. The RPS QuickSIN test is a word-in-sentence recognition test with a RPS MTB corresponding to the Rio de la Plata variant of Spanish used to calculate the signal-to-noise ratio necessary to achieve 50% word recognition (SNR-50) and signal-to-noise ratio loss (SNR-L).

Objectives

The purpose of the present study was to compare the results obtained in word recognition in sentence context using RPS MTB and SSN, in normal-hearing adults and adults with hearing loss, in the city of Córdoba (Argentina), in 2023.

Methods

This study has a non-experimental cross-sectional design with a comparative quantitative approach. The conventional RPS QuickSIN test (with RPS MTB) and its adaptation (with SSN) were administered using recorded materials. The SNR-50 was calculated for both normal-hearing subjects and subjects with hearing loss, as well as the SNR-L.

Results

In normal-hearing participants, the median SNR-50 obtained with SSN was -4.50 dB, while the media with RPS MTB was -5 dB. In participants with hearing loss, the median SNR-50 and SNR-L with SSN were 0.50 dB and 5 dB, respectively, while with RPS MTB, they were 1.50 and 6.50. The p-values obtained from Wilcoxon Test were 0.09, 0.32, and 0.10 for the results of SNR-50 in normal-hearing participants, SNR-50 in participants with hearing loss, and SNR-L, respectively.

Discussion

Multi-talker noise is considered representative of everyday conditions since it aims to simulate a natural multi-speaker noise situation. In addition, several authors assert that this noise has greater validity than stationary noises since the latter are not very competitive and have the advantage of reducing noise level variability. In similar studies, it is mentioned that MTBN has a greater masking effect than speech-shaped noise and even more so in people with hearing loss

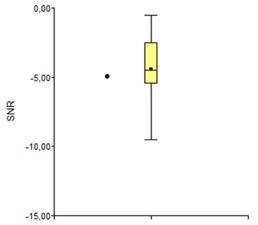

Figure1. SNR-50 obtained with SSN in normal-hearing listeners

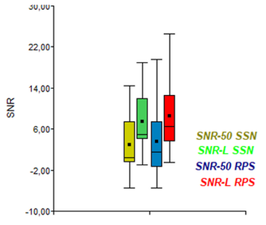

Figure 2. SNR-50 obtained with SSN and RPS MTB in participants with hearing loss

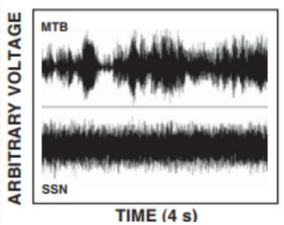

Figure 3. Multi-Talker Babble Noise (MTB) and Speech Spectrum Noise (SSN) presented at equal effective value through a TDH-50P earphone and measured with a 6 cm3 coupler. Extracted from Wilson et al. (2007).

In this work, it is possible to observe clinical differences in individual results: normal-hearing subjects perform better with RPS MTBN than with SSN, whereas in the case of subjects with hearing loss, the opposite occurs. This is because MTBN is random and is made up of the superposition of conversations from multiple speakers, which present small temporal valleys with a decrease in the signal amplitude. These temporal spaces can correspond to the time between the end and beginning of vocal emissions or pauses in speech. Therefore, it is considered that listeners could take advantage of these spaces that generate an improved signal-to-noise ratio in word recognition in background noise. The RPS Quick-SIN test is the only one that is adapted to the Spanish variant from the Rio de la Plata region, and it is free access at no cost to professionals. In addition, it allows the SNR-L value to be calculated, that is, how many dB are required above the average performance of normal-hearing people to obtain 50% word recognition.

Conclusion

No statistically significant differences were found between the results obtained using one type of noise or the other. However, differences can be observed in individual samples: in normal-hearing participants, better results were obtained with RPS MTB, whereas in participants with hearing loss, as they were unable to benefit from the temporal valleys provided by this noise, performance was better when using SSN.

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