SpEAR: A speech database for the advancement of hearing protection devices equipped with in-ear microphones

Rachel E. Bouserhal and Jérémie Voix
ÉTS, Université du Québec à Montréal, Québec, H3C 1K3

1. Introduction

The use of in-ear microphones (IEM) with advanced hearing protection is becoming more popular, due to the relatively high SNR and their multi-purpose use. When trying to understand IEM speech there are a few things to consider:

1. IEM speech has a limited bandwidth
2. Speech production changes when wearing HPDs
3. The Lombard effect with occluded ears

Currently, no existing databases accommodate for these changes. SpEAR was developed to aid researchers and developers working with IEMs.

2. Methods and Materials

Condition 1: Occluded Noisy
Condition 2: Occluded Quiet
Condition 3: Occluded Noisy (regenerated in-ear noise)
Condition 4: Quiet open-ear

3. Results

Figure 1 - Occlusion effect measurements at 250 Hz and 500 Hz for the right and left ear, for all participants.

Figure 2 - SPL values of the residual noise (Res) measured inside the ear when ambient noise at 95 dBA is played in the room compared to the SPL values of the regenerated (ReGen) noise played directly inside the ear, for all participants in the right (R) and left (L) ear.

Figure 3 - Speech levels over all sentences in each condition for each participant in the open-ear quiet, occluded quiet and occluded noisy conditions.

4. Conclusions

- Bilingual database of French and English
- Occluded speech database
- Noisy and quiet conditions
- In-ear microphone

Users will have access to the following information as part of the database:
- Age
- Native Language
- Spoken Language
- Occlusion Effect
- Octave Band
- Audometry
- Measured residual noise
- Measured regenerated noise in the ear
- Speech sentences in four different conditions

Better understanding of speech production in adverse conditions
Accelerate the development of speech algorithms for consumer intra-aural technology and occupational safety and health

Relevant References: