SUBJECTIVE EVALUATION WITH UT-DALLAS RESEARCH INTERFACE FOR COCHLEAR IMPLANT USERS

Hussnain Ali, Sandeep Ammula, Juliana N. Saba, John H.L. Hansen

Center for Robust Speech Systems (CRSS): Cochlear Implant Lab
Erik Jonsson School of Engineering & Computer Science, University of Texas at Dallas, Richardson, Texas, U.S.A.
(hussnain.ali, sandeep.ammula@utdallas.edu, juliana.saba, john.hansen)@utdallas.edu

Cochlear Implant Laboratory

1. Introduction

- The CCi-MOBILE research interface is an **"open-source"**, software-flexible, and a highly re-configurable research interface suitable for acute and take-home chronic studies with CI devices manufactured by Cochlear Corporation.

2. Aim

- The aim of this study was to assess the efficacy of the platform and compare the speech recognition performance of CI users with CCi-MOBILE platform against the clinical processor.

3. Methods

- **SUBJECTS:** A total of 8 post-lingually deafened adult CI users participated in the listening study. All subjects were native speakers of American English and had a minimum of 3 years experience with their devices.
- **SPEECH MATERIAL:** The assessment of speech recognition was accomplished with:
  - AzBio sentences presented in quiet, 10dB SNR, and 5 dB SNR 4-talker babble noise,
  - IEEE sentences presented in quiet, 10dB SNR, and 5 dB SNR speech-shaped noise,
  - CNC words/phonemes, and
  - BKB-SIN sentences.
- **STUDY PROCEDURES:** All subjects were tested unilaterally. For bilateral CI subjects, best ear was used.
- Subjects were tested with their clinical processor as well as CCi-MOBILE Android processor for a 1-to-1 comparison.
- Both processors (clinical and CCi-MOBILE) were programmed with standard ACE sound coding strategy (without any add-on processing).
- Acoustic stimuli were presented in free-field at 60 dB SPL (A-weighting) inside a double-walled sound booth.

4. Results

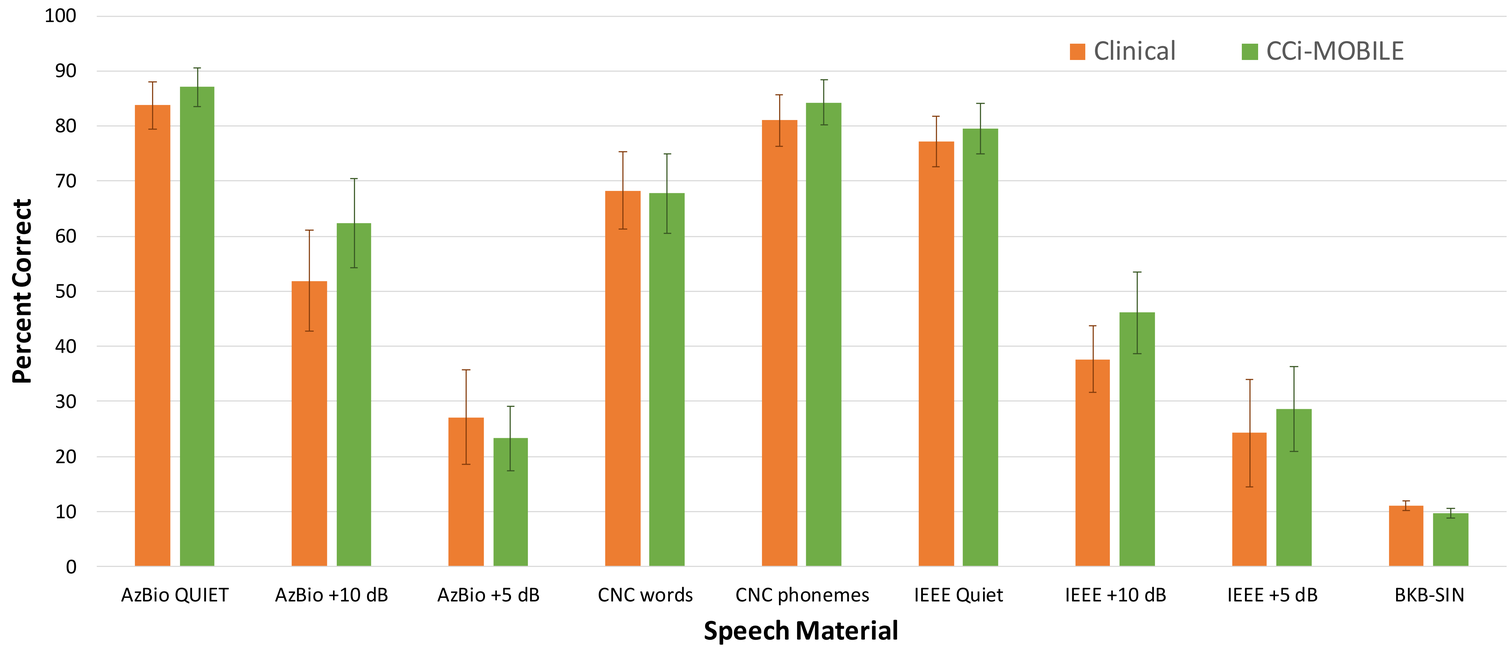

Fig. 1. Percentage correct mean speech recognitions scores with clinical processor and CCi-MOBILE research platform. Error bars represent SEM. N = 8.

- On all measures of test material, CCi-MOBILE produced ***statistically equivalent performance levels*** (μ=59.86±16.02) to each individual's clinical processors (μ=56.38±17.96).
- Repeated Measures Analysis of Variance:
  No statistically significant difference between the two processors. ($F_{1,7}$ = 4.882, p = 0.069).
  Effect of speech material was statistically significant. ($F_{7,49}$ = 47.882, p <0.000).
  Interactions between speech material and processor type were not significant. ($F_{7,49}$ = 1.143, p = 0.356).

5. Platform Description

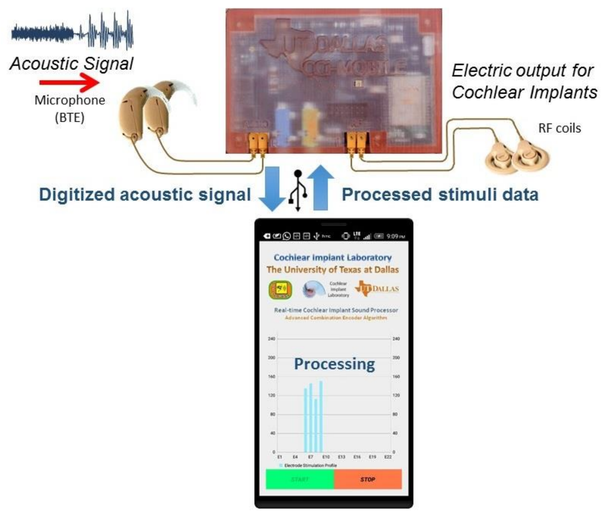

Fig. 2. The acoustic signal is first acquired from BTE unit and is sampled digitally by an on-board stereo codec. The sampled signal is transmitted to the computing platform (Android phone) via USB. The computing platform receives packets of stereo acoustic data, and processes them through a sound coding strategy on a frame-by-frame basis. The processing generates a set of stimulation sequence which is sent back to the interface board where it is encoded (using the transmission protocols of the CI device), and is finally streamed to the implant for stimulation. This process is repeated in real-time.

6. Conclusions

- The data from this study indicate that performance with the research platform is comparable to the clinical processor, and that it holds potential for conducting reliable speech assessments in future studies.
- The CCi-MOBILE research platform is intended as an open-source contribution to the cochlear implant field and will be freely distributed to the research community.
- The platform can be used for conducting scientific studies not only in laboratory settings but also in real world environments for extended periods of time.
- This is likely to facilitate true chronic assessment of novel sound processing strategies and help researchers to realize their scientific ideas that are not presently possible.

2017 Conference on Implantable Auditory Prostheses
Lake Tahoe, CA, July 16 – 21, 2017

This work was supported by the grant R01 DC010494-01A from the National Institute on Deafness and Other Communication Disorders, National Institutes of Health.