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Pitch Ranking of Complex Tones using a Model of the Virtual Channels in the Nucleus Freedom System

Omran, S.A. (1, 2), Büchler, M. (1), Lai, W. (1), Dillier, N. (1)

(1) University Hospital Zurich, ENT Dept, CH-8091 Zurich, Switzerland

(2) Institute of Neuroinformatics, CH-8057 Zurich, Switzerland

Introduction

Nucleus Cochlear Implant (CI) devices provide 22 intracochlear stimulation electrodes which can be used as 22 stimulation channels. There are physical limitations preventing a substantial increase in the number of stimulation electrodes although theoretically a higher number of stimulation channels are expected to improve music notes discrimination. One way to do this in spite of the physical constraints of currently available electrode arrays would be to use Virtual Channels (VC). These are channels formed by stimulating two adjacent electrodes simultaneously. It was shown in [1] that VC stimulation can result in the perception of an intermediate frequency between adjacent electrodes.

Methods

VCs increase the number of available stimulation channels from 22 to 43. In this study, frequency discrimination for 43 and 22 channels using an Acoustic Model (AM) was measured. The degree of adjacent music notes discrimination is measured through a pitch ranking test using complex tones. The test involves a set of music notes separated by 6, 4 or 2 semitones respectively. Adjacent pairs of notes are presented to the subject who then has to indicate which note sounded higher in pitch. This test compares the subjects' ability to discriminate notes on a musical scale using 43 and 22 channels. The sounds were presented to Normal Hearing (NH) subjects after pre-processing them with an AM.

Discussion

Testing is currently in progress and the final results will be presented at the conference. It is expected that if the ability to discriminate music notes increases using 43 channels, this would be due to an increase in frequency representation that is beneficial for music appreciation. These tests with NH subjects are carried out to obtain an estimate of potential improvements in complex tone discrimination using VC instead of standard stimulation channels. The same tests will be applied to CI users subsequently.

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Literatur:

[1] Busby, P. A., and Plant, K. L. (2005) "Dual electrode stimulation using the nucleus CI24RE cochlear implant: electrode impedance and pitch ranking studies," *Ear and Hearing* 26(5), 504-511

