Music pre-processing assessment with CI users

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B-Audio session – Brussels – Friday 15 November 2013
Overview

• Introduction
• Music pre-processing scheme
• Assessment with cochlear implant users
• Conclusion
Introduction

- Top factors to enhance music enjoyment for CI users (a.o.) [1]
  - Simple musical structure
  - Clear rhythm/beat
  - Ability to follow musical score or words

- Effect of complexity on the appraisal of complex songs [2]
  - Strong negative correlation between complexity and appraisal for CI subjects
  - Positive correlation for normal hearing (NH) subjects

Introduction

• Music mixing preferences of cochlear implant recipients [3]
  o The original audio mix in real-world pop music might not be suitable for CI recipients.
  o Modifying the relative instrument level settings potentially improves music enjoyment.
  o Preference for clear vocals with bass/drum preservation

Music Pre-Processing

Complex Music Signal → Melody Extraction (W1) → Preprocessed Music

Complex Music Signal → Rhythm/Drum Extraction (W2) → Preprocessed Music

Complex Music Signal → Bass Extraction (W3) → Preprocessed Music

Complex Music Signal → ... (W4) → Preprocessed Music
Music Pre-Processing for CI

P: Vocals, Bass and Drums
H: Other instruments
S: Attenuation parameter
Demo

• Hey Jude
  o Unprocessed: second 0-10
  o Processed: second 10-20
  o Unprocessed: second 20-30
Subjective Evaluation: song selection

• Complexity rating 50 song excerpts (pop/rock) with scoring from 1 (simple) to 100 (complex) by 12 NH

• Define 3 groups of songs:
  o LOW: Group with 8 least complex songs
  o HIGH: Group with 8 most complex songs
  o MID: Group with 8 songs in between
Subjective Evaluation

Listen to song excerpt and select preferred setting (1-7)

- 24 song excerpts (8 low, 8 mid, 8 high complexity)
- 3 repetitions
- Attenuation parameter range from +6 dB to -30 dB (or reversed)
- 7 post-lingually deafened CI users (Cochlear®)
Subjective Evaluation with CI (N=7)

Each data point represents:
- 1 song
- 7 CI subjects (post-lingually deafened)
- 3 repetitions
- 95% confidence interval

Positive correlation between complexity and mean preferred attenuation

Pearson’s $r(24)=0.65$, $p=0.001$
Subjective Evaluation with CI (N=7)

- CI1 preferred low attenuation
- CI2, CI4 and CI6 preferred higher attenuation of harmonic components for songs with high complexity
- CI3 and CI5 preferred the harmonic components to be attenuated irrespective of the complexity of the songs
- AVG: higher attenuation for high complexity songs
Conclusions

• The Music Pre-Processing Scheme potentially improves music appreciation for CI subjects

• Mean preferred attenuation of harmonic components is significantly higher for high complexity songs as opposed to low and mid complexity songs

• Individual differences occur in preferred attenuation of harmonic components in music
Thanks