Links between audio features, aspects of music and happy/sad emotions elicited by music in CI users and NH adults

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MED\textsuperscript{e}L
Emotions elicited by music in CI users

- Some evidence that CI users experience different emotional states when listening to music (e.g. Brockmeier et al., 2011; Rosslau et al., 2012)

- Perception of the “emotional space” evoked by music is selectively impaired in CI users (Ambert-Dahan et al., 2015. *Frontiers in Psychology*)
• To further explore the “psychological space” of happy/sad emotions elicited by music in CI users

• The happy/sad continuum is central in modelling emotions in music
Perception of Music with the Fine Structure Processing (FSP) Strategy in Adult Cochlear Implant Users: A Multi-center Study

(Papadelis et al., Under review, *Int J Audiol*)

- 53 postlingually deafened CI users wearing a MEDEL implant with an OPUS 2 processor
- 44 NH listeners
Stimuli & procedure

- 15 instrumental pieces composed by Oliver Searle
- Various instrument combinations
- Mode: major/minor
- Tempo: 46 – 180 bpm
• How these 15 musical pieces are related perceptually with respect to the happy/sad rating they received?

• What dimensions listeners use to perform happy/sad judgements?
Happy/sad ratings

(Dis)Similarities between musical pieces

Distances between musical pieces

Use PROXSCAL to assign all musical pieces to specific locations in a low-dimensional space

(IBM SPSS Statistics v. 22 - Commandeur & Heiser, 1993)
Common Space - NH listeners (N = 44)
Common Space - NH listeners (N = 44)
Perceptual mapping

Dimension 1 (Mean happy/sad rating)

Dimension 2 (Variability of rating)

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Perceptual mapping

Common Space - CI users (N = 53)

Dimension 2

Sad
Neutral
Happy

Dimension 1
Common Space - CI users (N = 53)

Dimension 2

Dimension 1

Sad
Neutral
Happy

Perceptual mapping
Dimension 1 (Mean happy/sad rating)

Dimension 2 (Variability of rating)
Research questions

• Which particular acoustic/musical features mostly affected mean happy/sad rating (Dimension 1)?

• ... and which mostly affected the variability of ratings (Dimension 2)?
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<thead>
<tr>
<th>Audio/musical features</th>
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<th>Rhythm</th>
<th>Harmony</th>
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Both groups - Dimension 1 (Mean happy/sad rating)
Audio/musical features

Dynamics
- RMS energy
- Low-energy rate
- Attack time

Timbre
- Spectral flux
- Roll-off frequency
- Zero-crossing rate
- Roughness

Rhythm
- Tempo
- Event density
- Pulse clarity
- Pulse clarity

Harmony
- Mode
- Harmonic change-rate

CI users - Dimension 2 (variability of rating)
Audio/musical features

- Dynamics
  - RMS energy
  - Low-energy rate
- Timbre
  - Spectral flux
  - Roll-off frequency
  - Zero-crossing rate
  - Roughness
- Rhythm
  - Tempo
  - Event density
  - Pulse clarity
- Harmony
  - Mode
  - Harmonic change-rate

NH listeners - Dimension 2 (variability of rating)
... to take home

- Qualitative differences in happy/sad rating of music between CI users and NH listeners
- In both groups, mean rating primary relies on rhythmic features, along with the harmonic change-rate
- Variability of rating is influenced by cues related to timbre and the dynamics, but only in the CI group
Thanks for your attention!