The effects of training on music perception and appreciation in cochlear implant users

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Introduction

CI users experience poor perceptual accuracy for music and find music to be less enjoyable post-implant.

Recent findings indicate that music perception and enjoyment can be improved through targeted training (Gfeller et al., 2002; Galvin, Fu & Nogaki, 2007; Looi et al., 2012).

- Based on neuroplasticity

Focused music listening has also been suggested to help, but the effects have yet to be studied (Gfeller et al., 2002; Looi et al., 2012).
Aim of current study

To compare the effects of a computer-based music appreciation training program (MATP) to focused music listening on:
- Music perception
- Music appreciation
- Speech perception in noise

Hypothesis: Both approaches would improve music perception, music appreciation, and speech perception in noise; computer-based training would result in greater improvements.
Participants

10 CI recipients (≥13 years of age, at least 6 months of CI experience, fluent in English)

5 Cochlear, 3 MED-EL, 2 Advanced Bionics

Participants randomly divided into:
- MATP group (n=5, age range: 13-31 years, mean = 26 years)
- ML group (n=5, age range: 15-46 years, mean = 24 years)
Study design

MTB = Music test battery
MQRT = Music quality ratings test
BKB-SIN = Bamford-Kowal-Bench speech-in-noise test

MBQ = Music background questionnaire
MEQ = MATP/ML evaluation questionnaire
Materials: tests and questionnaires

Music test battery (MTB) - pitch ranking (half and quarter octave), instrument identification (ID), ensemble ID and style ID → perceptual accuracy
Which sound has the higher pitch?

FIRST

SECOND
Materials: tests and questionnaires

Music test battery (MTB) - pitch ranking (half and quarter octave), instrument identification (ID), ensemble ID and style ID → perceptual accuracy

Music quality ratings test (MQRT) → enjoyment
Please rate the sound quality of each musical piece on the scales provided. There are no right or wrong answers. This is solely your opinion about how each song sounds through your cochlear implant.

Pleasantness

Unpleasant

Naturalness

Unnatural

Richness

Tinny
Please rate the sound quality of each musical piece on the scales provided.
There are no right or wrong answers. This is solely your opinion about how each song sounds through your cochlear implant.

Fullness
- Emptier
- Just Right
- Fuller

Sharpness
- Duller
- Just Right
- Sharper

Roughness
- Rougher
- Just Right
- Smoother

Save ratings and move to next song
Materials: tests and questionnaires

**Music test battery (MTB)** - pitch ranking (half and quarter octave), instrument identification (ID), ensemble ID and style ID → *perceptual accuracy*

**Music quality ratings test (MQRT)** → *enjoyment*

**BKB-SIN** → *speech perception in noise*

**Music background questionnaire**

**MATP/ML Evaluation questionnaire**
Materials: training period

- Take home, computer-based auditory training program designed for long-term, ongoing use
- 3 modules – solo instruments, musical ensembles, musical styles
- 3 phases – teaching, training, self-testing

8 weeks, 4 sessions per week, 30 minutes per session

- Asked to listen to music of their choice
- Given a list of questions (e.g. “what was the mood?”, “how

Music Appreciation Training Program (MATP)

Music listening (ML)
Please select a module

**Teaching Modules**

Solo Instruments

Musical Ensembles

Musical Styles

**Administration**

View Logs
Please select a type

- Cello
- Clarinet
- Drum Kit
- Female Singer
- Flute
- Guitar
- Male Singer
- Piano
- Trombone
- Trumpet
- Violin
- Xylophone
What ensemble is this?

String Quartet

Brass Band

End Training

Repeat

Stop
What style is this?

- Eastern
- Classical - Large groups
- Classical - Small groups
- Country and Western
- Jazz
- Classical - Solo
- Modern Pop (1990's onwards)

Repeat  Stop
Results: training details

Training logs showed that the MATP group completed an average of 618 minutes (of 960) of computer-based training.
Results: training details

Music listening diaries showed that the ML group completed an average of 925 minutes (of 960) of focused music listening.
Results: effect of training period

Compared pre-training scores (average of 1st and 2nd visit scores) to post-training scores

MATP group:
- Significant improvement in instrument ID scores ($p = 0.043$)
- Improvement in music quality ratings for scales 1-3 ($p = 0.080$)

ML group:
- Improvement in ensemble ID scores ($p = 0.080$)

No improvement was seen in either group for
- Pitch ranking and style identification of the MTB
- scales 4-6 of the MQRT
- SNR-50 scores of the BKB-SIN
Results: effect of training period

**INSTRUMENT ID**
- MATP GROUP: 62.7
- ML GROUP: 64.8

**ENSEMBLE ID**
- MATP GROUP: 43.7
- ML GROUP: 41.4

**MQRT SCALES 1-3**
- MATP GROUP: 59.0
- ML GROUP: 59.7

*Pre-training
Post-training*
Results: MATP vs ML

Difference scores (post-training score - pre-training score) compared between the two groups

- No significant differences in degree of improvement between the two groups
- Greater improvement in the MATP group for scales 1-3 of the MQRT ($p = 0.070$)
Results: Perceived benefits

**MATP group**
- Average benefit reported = 3.3 out of 5
- Areas with most benefit reported:
  - ability to recognize instruments or ensembles
  - perceived pleasantness of music

**ML group**
- Average benefit reported = 3.3 out of 5
- Areas with most benefit reported:
  - ability to recognize instruments or ensembles
  - perceived naturalness of music
Conclusions and future directions

Computer-based music training significantly improved single instrument identification.

Both approaches brought about in improvements, although significance of results limited by small sample size.

Both groups perceived benefits from the 8-week training period.

Speech perception in noise may require more pitch-related training.

Combine both computer-based training and focused music listening? QOL measure?
Acknowledgements

Valerie and Jenny - for their supervision, guidance, assistance and advice
Advanced Bionics, Cochlear and MED-EL - for funding this project
Kah Yee and Edmund - for helping with the setting up of C07
Tze Ling - for helping with recruitment
Joe - for MATP program modifications
Johnny - for statistical advice
All faculty and staff of the MSc Audiology program - for the support and encouragement
MSc Audiology Class of 2015 - for the friendship over the last two years
Participants - for their time and effort
References


Thank you!

Q&A

It always seems impossible until it's done.

NELSON MANDELA