

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

WONG YUHAN (A0046683X)

SUPERVISORS: DR VALRIE LOOI & DR JENNY LOO

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

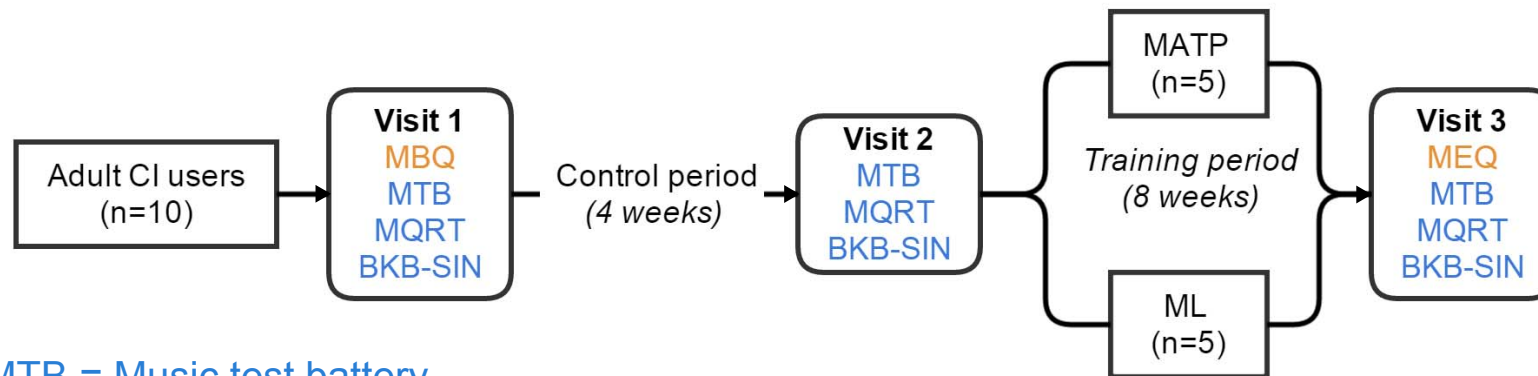
10 CI recipients (≥ 13 years of age, at least 6 months of CI experience, fluent in English)

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*

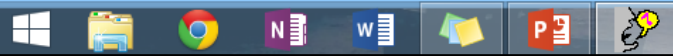
Trial 1 of 32

Cancel

Which sound has the higher pitch?

FIRST

SECOND



Trial 1 of 48

Cancel

Trumpet

Piano

Flute

Guitar

Female-Singer

Cello

Violin

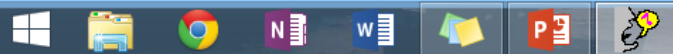
Clarinet

Xylophone

Male-Singer

Drum-Kit

Bass-Drum



Trial 1 of 48

Cancel

Male+Piano

Jazz-Band

Percussion

Country-Western

String-Quartet

Rock-Band

Cello+Piano

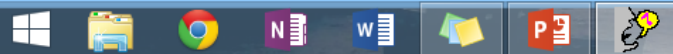
Choir

Orchestra

Male+Fem+Piano

Female+Piano

Violin+Piano



MACarena: Genre 1_modified

Trial 1 of 24 Cancel

Classical-Solo	Classical-Group	Jazz-Instrmntl
1990s-on	Country/Western	Eastern

Windows taskbar: File Explorer, Chrome, Notepad, Word, PowerPoint, and a custom icon. System tray: Keyboard, mouse, network, signal, volume, ENG, 9:58 PM, 03/11/2014

Materials: tests and questionnaires

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

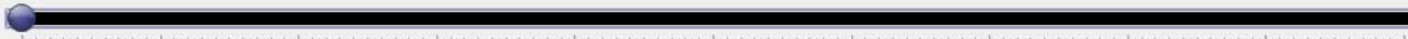
Music quality ratings test (MQRT) → *enjoyment*

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.

1 of 8



Pleasantness



Unpleasant

Pleasant

Naturalness



Unnatural

Natural

Richness



Tinny

Rich

Cancel

Next 3 Scales

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.

1 of 8

Fullness



Emptier

Just Right

Fuller



Sharpness



Duller

Just Right

Sharper



Roughness



Rougher

Just Right

Smoother

Cancel

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

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

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

ensembles, musical styles

- 3 phases - teaching, training, self-testing

Music Appreciation
Training Program
(MATP)



listened

Music listening
(ML)



Music Appreciation Training Program

MATP

Module Selection

Main Menu

Please select a module

Teaching Modules

Solo Instruments

Musical Ensembles

Musical Styles

Administration




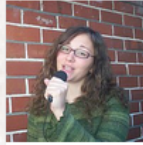
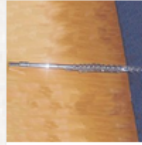







View Logs

Windows taskbar: File Explorer, Chrome, Notepad, Word, PowerPoint, Task View, Outlook, Edge, System tray (Keyboard, Mouse, Network, Signal, Volume, ENG, 9:13 PM, 03/11/2014)

Music Appreciation Training Program

MATP Teaching (Solo Instruments) [Main Menu](#) [Back to Solo Instruments](#)

Please select a type

 Cello	 Clarinet	 Drum Kit	 Female Singer	 Flute	 Guitar
 Male Singer	 Piano	 Trombone	 Trumpet	 Violin	 Xylophone


Windows taskbar: File Explorer, Chrome, Notepad, Word, PowerPoint, Task View, Edge, System tray (Keyboard, Network, Signal, Speaker, ENG, 9:12 PM, 03/11/2014)

Music Appreciation Training Program


MATP Training (Musical Ensembles) Main Menu Back to Musical Ensembles

0:12

What ensemble is this?



String Quartet



Brass Band

End Training Repeat Stop 00 : 13


Windows taskbar: File Explorer, Chrome, Notepad, Word, PowerPoint, Edge, System tray: Keyboard, Network, Signal, Speaker, ENG, 9:14 PM, 03/11/2014


Music Appreciation Training Program


MATP Self Testing (Musical Styles) Main Menu Back to Musical Styles


0:05


What style is this?


- 


Eastern
- 

Classical- Large groups
- 

Classical- Small groups
- 

Country and Western
- 

Jazz
- 

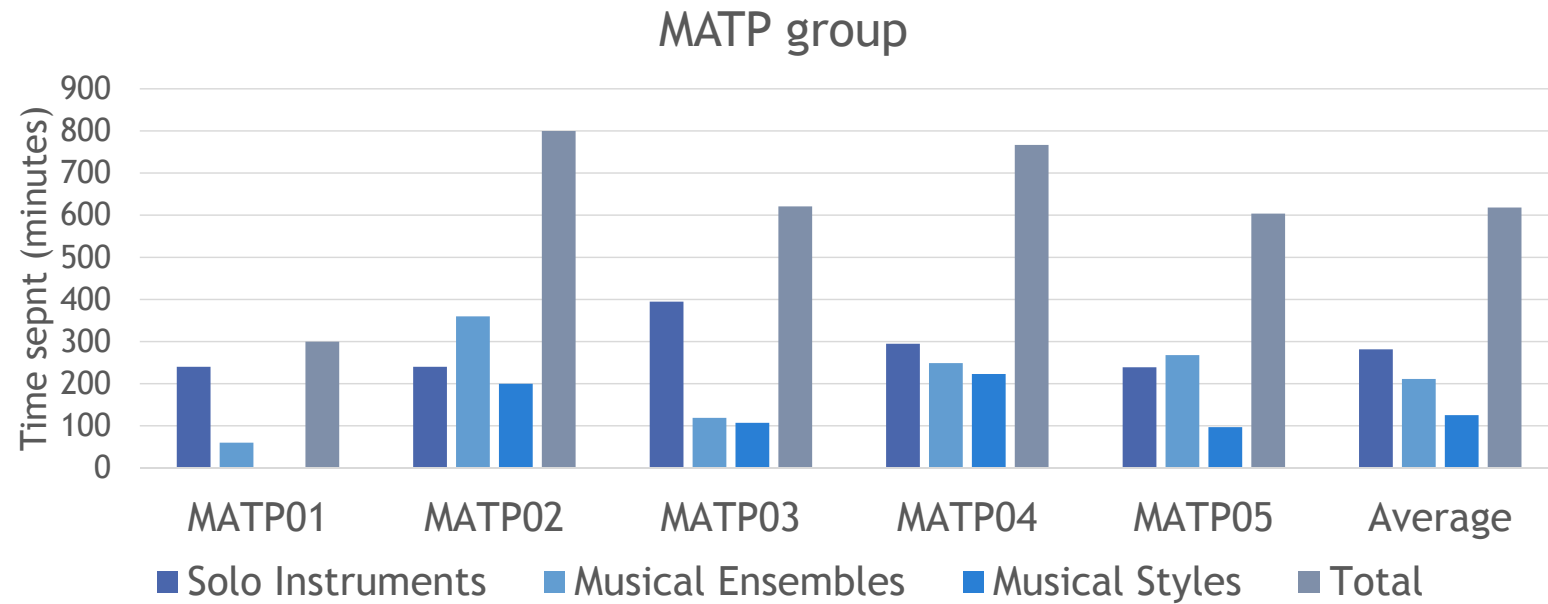
Classical- Solo
- 

Modern Pop (1990's onwards)

Repeat Stop

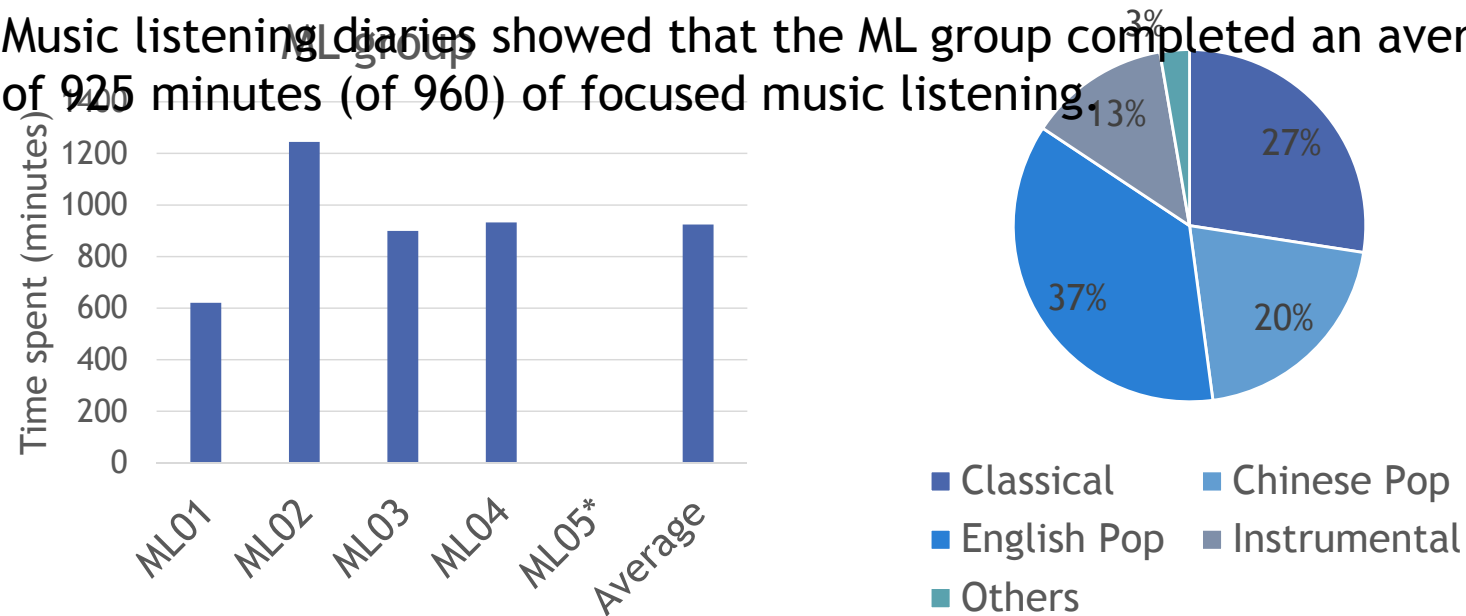
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Results: training details



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 ($p = 0.080$)

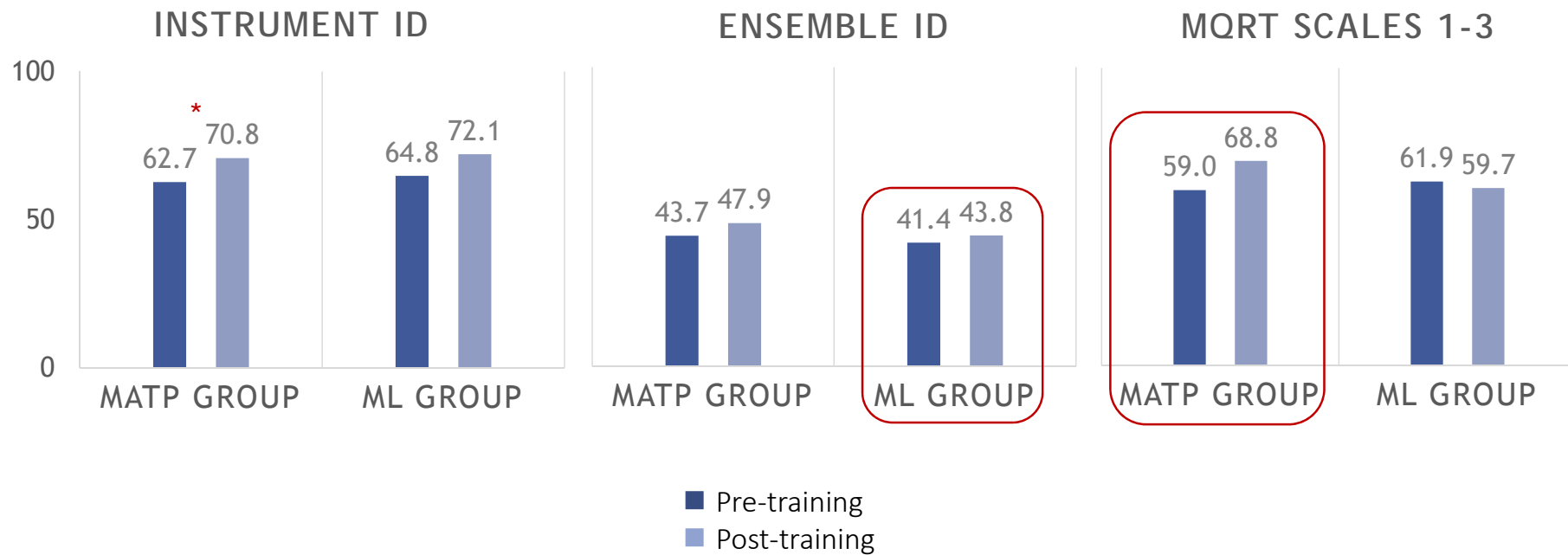
ML group:

- 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



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?

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References

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Thank you!

Q&A

IT ALWAYS
SEEMS
IMPOSSIBLE
UNTIL
IT'S DONE.



NELSON MANDELA