DISCUSSION

Lower frequency pairs

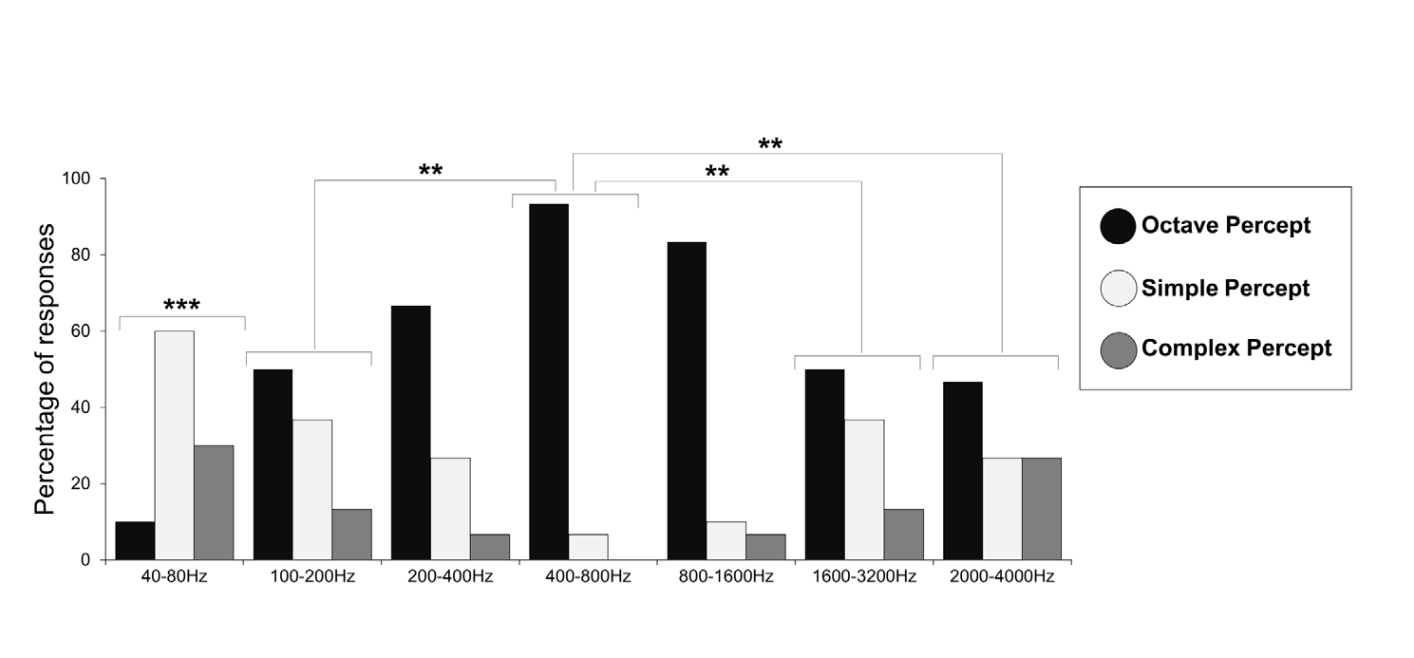
- Drop in recognition of melodic interval below 150Hz (Houstmas & Goldstein, 1972)
- Non-musicians fail to recognize minor and major triads when below 120Hz (Biasutti, 1997)

Higher frequency pairs

- Musical pitch and the ability to make octave matches largely disappears above 5000Hz (Moore, 1977)
- Pitch discrimination became very difficult at very high frequency (Henning, 1966; Shower & Biddulph, 1931; Wever & Wedell, 1941)

DISCUSSION

For these new frequency pairs that approach the upper and lower bounds of the musical scale, our results showed significant and interesting differences.



(Whittom et al., 2022 - Submitted)

FUTURE RESEARCH

- Neurophysiological correlates ?
- Musicians ?
  - (Brennan et Stevens, 2002)
- **Hearing impairment ?**
- **Can auditory illusion be useful evaluation tool for clinicians ?**

PERCEPTION OF THE MISSING FUNDAMENTAL IN HUMANS : A NEW PARADIGM ALLOWING TO MEASURE THRESHOLDS

Whittom, A., Couture, F, Chauvette, L. et Sharp A. (In writing)

RESEARCH AXES

Axis 1

- Investigation of fundamental mecanisms of auditory perception in complex auditory environments
  - Auditory scene analysis in humans (normal hearing, non-musicians)
  - Impact of musical training on auditory perception

Axis 2

- Impact of hearing loss on fundamental mecanisms of auditory perception in complex auditory environments
  - Evaluation of performances
  - Improvement of auditory skills - Rehabilitation

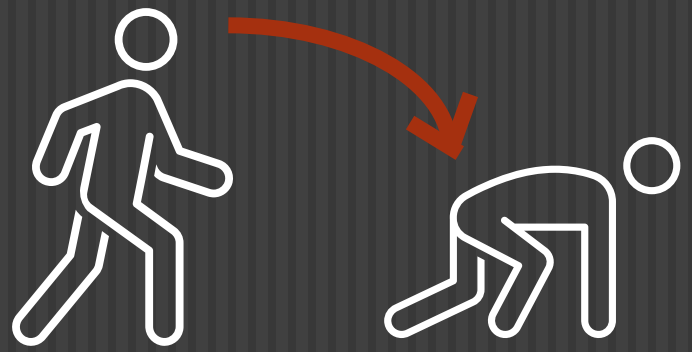
USE OF MUSIC THERAPY AS AN AUDIOLOGICAL REHABILITATION TOOL IN THE ELDERLY POPULATION

Grenier A.S., Lafontaine L. & Sharp A. (2022), *Front. in Neurosci.*

Reduced social participation

Isolation

Reduced quality of life



More and more studies suggest a link between age-related hearing loss, cognitive decline and even dementia when no hearing aid is used

(Lin et al. 2011; Deal et al., 2017; Linvingston et al., 2017; Thomson et al., 2017).

MUSIC THERAPY

Useful audiological rehabilitation tool ?

USE OF MUSIC THERAPY AS AN AUDIOLOGICAL REHABILITATION TOOL IN THE ELDERLY POPULATION

Communication

Cognitive abilities

Posture and balance

Social participation

IMPACT ON COMMUNICATION

Authors	Participants with hearing loss	Type of training	Type of measure	Results
Dubinsky et al. (2019)	Yes (measured)	Choir lessons (10 weeks)	Behavioral and FFR	↑ Speech-in-noise and Pitch discrimination ↑ Neural representation of pitch
Zendel et al. (2019)	No (measured)	Piano lessons (6 months)	Behavioral and EEG	↑ Accuracy to repeat words in the loud condition ↑ Positive cerebral electrical activity for fronto-left electrodes (motor speech system)
Fleming et al. (2019)			Behavioral and fMRI	No improvement HINT fMRI-adapted version ↑ increase in activation of cortical areas associated with speech encoding
Worschech et al. (2021)	No (not measured)	Piano lessons (6 months)	Behavioral only	↑ International Matrix Test

IMPACT ON POSTURE AND BALANCE

Authors	Participants with hearing loss	Type of training	Type of measure	Results
Hamburgh & Clair (2003)	Not measured	1-h-per-week movement sequence set to music to reflect the dynamics, rhythm, timing, and phrasing of music (14 weeks)	Balance Gait speed Functional reach	↑ One foot balance ↑ Walking speed ↑ Functional reach
Maclean et al. (2014)	Not measured	During a walk task, 1) Pratice + Background music 2) Background music only 3) No music	Single task Dual task	↑ no dual task deficit in speed for group 1) ↑ gait stability for single and dual task for group 1) No improvement for cognitive performance

IMPACT ON COGNITIVE ABILITIES

Authors	Participants with hearing loss	Type of training	Type of measure	Results
Hirokawa et al. (2004)	Not measured	During the task, listening to favourite music vs Directed relaxation vs Silence	AD ACL (arousal) Reading span	↑ Arousal
Thompson et al. (2005)	Not measured	During the task, listening to music (Vivaldi) vs Silence	Category fluency	Small facilitating effect found for music condition
Mammarella et al. (2007)	Not measured	During the task, listening to music (Vivaldi) vs White noise vs Silence	Digit span Phonemic fluency	Significant advantage of music over white noise and no music
J.A Bugos et al. (2007)	Not measured	Piano lessons (6 months)	Digit symbol* Digit span Block design Letter number sequencing Trail Making Tests*	↑ Execution speed of Trail Making tests and Digit symbol.

IMPACT ON SOCIAL PARTICIPATION

Large-scale qualitative investigation in the population to understand how music was improving or decreasing social aspects of older adults' life (n = 2)

- Cohen et al. (2002) - Canadian Study of Health and Aging
  - Most seniors evaluated the importance of music as high
- Hays & Minichiello (2005)
  - Connection between the elders and their memories in a way that it brings a sense of spirituality to life

It is well known that patient's motivation can greatly influence the outcome of a rehabilitation process (Maclean et al., 2000).

IMPACT ON SOCIAL PARTICIPATION

Social participation in groups of older adults participated weekly to musical activities such as choirs and bands (n = 3)

- Wise et al. (1992) - Choir
  - Musical skills and social benefits reported
- Hillman (2002) – Choir
  - Musical skills, social benefits and emotional wellbeing
- Coffman & Adamek (1999) – Band
  - Musical skills and social benefits

IMPACT ON SOCIAL PARTICIPATION

Authors	Participants with hearing loss	Type of training	Type of measure	Results
Vanderark et al. (1983)	Not measured	5-week program of music therapy (singing and percussion)	Questionnaire : self-concept, life satisfaction, quality of life, self-concept in music and attitudes toward music	↑ Life satisfaction ↑ Attitudes toward music
Solé et al. (2010)	Not measured	Once a week for 8 months 1) Choir 2) Music appreciation class, 3) Preventive music therapy session	Quality of life questionnaire	For all programs : Improved some components of quality of life (social relations and personal development)
Chan et al. (2012)	Not measured	Music listening session	Geriatric Depression Scale (GDS-15)	↓ Depressive symptoms
Ahessy (2016)	Not measured	Choir (12 weeks)	Cornell Scale for Depression in Dementia (CSDD) Cornell Brown Scale (CBS) Mini Mental State Examination (MMSE) Choir evaluation questionnaire (CEQ)	↓ Depressive symptoms ↑ Quality of life ↑ Cognitive functioning Musical skills Social benefits

IMPACT ON SOCIAL PARTICIPATION

- A limited number of studies suggest quality of life benefits (perceived and objective) from implementing musical therapy in the life of the elders.
- In fact, maintaining social relationships has often been perceived as an advantage gained from participating in several music programs.
- Another benefit perceived from music therapy is that it helps to reduce depression symptoms in seniors.
- None of these studies have considered if their participants had a hearing loss, which normally accompanies aging.

DISCUSSION

- Lack of quantification of hearing loss and vestibular function
- Measures of outcomes variability
- Therapy variability
- Duration of training variability
- Neural correlates

THANK YOU FOR YOUR ATTENTION

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UNIVERSITÉ LAVAL

CENTRE DE RECHERCHE CERVO BRAIN RESEARCH CENTRE

CRBLM Centre de recherche sur le cerveau, le langage et la musique

RBIQ RÉSEAU DE BIO-IMAGERIE DU QUÉBEC

MAPLab

Questions?

Contact - Contact@CanadianAudiology.ca

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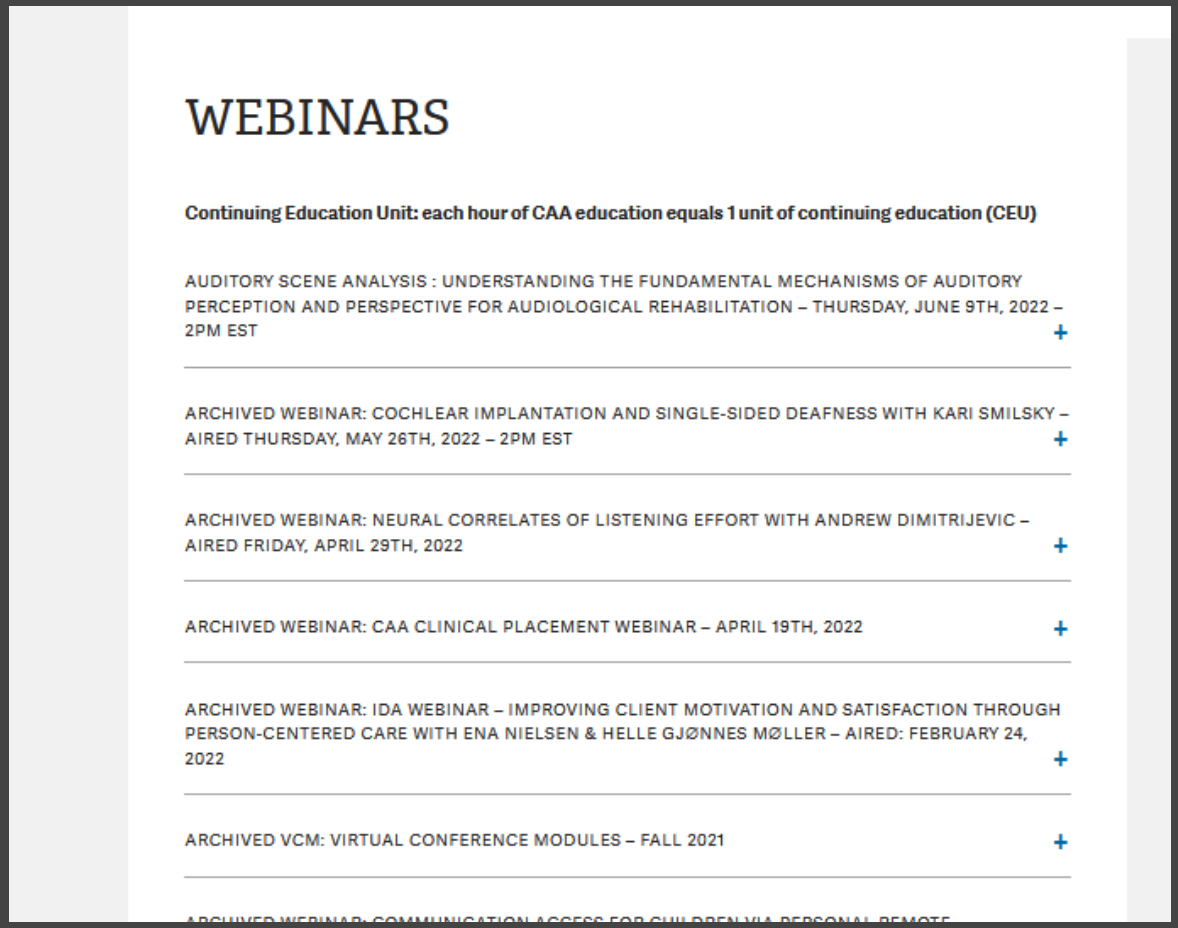

WEBINARS

Continuing Education Unit: each hour of CAA education equals 1 unit of continuing education (CEU)

AUDITORY SCENE ANALYSIS : UNDERSTANDING THE FUNDAMENTAL MECHANISMS OF AUDITORY PERCEPTION AND PERSPECTIVE FOR AUDIOLOGICAL REHABILITATION – THURSDAY, JUNE 9TH, 2022 – 2PM EST +

ARCHIVED WEBINAR: COCHLEAR IMPLANTATION AND SINGLE-SIDED DEAFNESS WITH KARI SMILSKY – AIRED THURSDAY, MAY 26TH, 2022 – 2PM EST +

ARCHIVED WEBINAR: NEURAL CORRELATES OF LISTENING EFFORT WITH ANDREW DIMITRIJEVIC – AIRED FRIDAY, APRIL 29TH, 2022 +

ARCHIVED WEBINAR: CAA CLINICAL PLACEMENT WEBINAR – APRIL 19TH, 2022 +

ARCHIVED WEBINAR: IDA WEBINAR – IMPROVING CLIENT MOTIVATION AND SATISFACTION THROUGH PERSON-CENTERED CARE WITH ENA NIELSEN & HELLE GJØNNES MØLLER – AIRED: FEBRUARY 24, 2022 +

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Thank You