ADDRESSING EMOTIONAL COMMUNICATION THROUGH PROSODY IN COCHLEAR IMPLANT USERS

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Emotional Prosody and CIs

➢ Spoken emotion communication is dominated by *how we say it* (prosody) over *what we say* (lexical-semantic cues). Ben David et al., JSLHR 59 (1), 72-89, 2016; Richter & Chatterjee, Ear & Hearing, In Review 2021


➢ CI patients appear to have similar facial emotion sensitivity compared to hearing peers or even a deficit. So there remains an overall deficit in emotion communication. Stevenson et al., Ear & Hear 38(5),521-, 2017; Fengler et al., PLoS One, 12(10), e0185821, 2017.

➢ Demonstrated links between CI patients’ quality of life and their sensitivity to emotional prosody (both child and adult CI recipients) → implications for both development and aging Schorr et al., J.S.L.H.R. 52(1), 141-152, 2009; Luo et al., J.Acoust.Soc.Am. 144(5), EL429.
EMOTION: STIMULI

- 12 sentences, 5 emotion each: happy, angry, sad, neutral, scared (child-directed speech)
- 1 female and 1 male talker (selected from pilot with 4 talkers)

Happy | Angry | Neutral | Sad | Scared
PERCEPTION OF EMOTIONAL PROSODY WITH THE CI: AN OVERALL DEFICIT, WITH HIGH INDIVIDUAL VARIABILITY

How we say it > what we say (Emotional prosody)

Voice pitch is a primary cue to emotional prosody but not well represented via CIs

Links between QoL and emotion recognition by children and adults with CIs
Sensitivity to static and dynamic changes in F0
Age, duration of experience with device
Speaking style: exaggerated prosody, regular prosody
Nonverbal cognition
Age at implantation
Socio-economic status

[Barrett et al., 2020, Ear & Hearing; Chatterjee et al., 2022 In Review]
INTERACTIONS BETWEEN HEARING AGE (DEVICE EXPERIENCE), COGNITIVE STATUS, TALKER, EMOTION

N=47

Nonverbal Cognition Score

d'
HOW WELL CAN AN INDIVIDUAL PATIENT UTILIZE A SPECIFIC CUE TO DISTINGUISH EMOTIONS?

5 Manipulated contours

- **1 (Happy)**
- **0.75**
- **0.5**
- **0.25**
- **0 (Sad)**

5 Manipulated durations

- **0.50s**
- **0.789s [natural happy]**
- **1.00s**
- **1.16s [natural sad]**
- **1.25s**

5 Manipulated intensities

- **75 dB SPL**
- **70 dB SPL**
- **65 dB SPL**
- **60 dB SPL**
- **55 dB SPL**

= 125 stimuli

How well can an individual patient utilize a specific cue to distinguish emotions?
INDIVIDUAL ACCESS TO ACOUSTIC CUES

Normally hearing listeners

Bilateral CI listener
EMOTIONAL PRODUCTIONS: HEARING AT BIRTH MATTERS

Happy (red) and sad (blue) F0 contours

NHCH03
NH child (11 yrs)

A41
NH adult

N5
Post-lingually deaf CI adult

CICH04
18-year old CI child with early hearing implanted at age 6

CICH03
11-year old congenitally deaf CI child implanted at age 1.5

Sara Damm  Jenni Sis  Rizwan Siddiqui  Aditya M Kulkarni  Julie Christensen
CHILDREN WITH COCHLEAR IMPLANTS SHOW SMALLER ACOUSTIC CONTRASTS THAN PEERS WITH NH

Chatterjee et al., Front. Neurosc. 2019
The Child CI Talker’s Age at Implantation Matters

The NH Child Listener’s Age Matters

Damm et al., JSLHR 2019
New Directions
Conversations with SLPs
NEW METHODS TO ELICIT EMOTIONAL SPEECH

-- An attempt to develop a more naturalistic way of eliciting emotional speech in children
[Sophie Ambrose, Kayla Skaggs, Sarah Al-Salim, Aditya Kulkarni, Ava Feller, John J Galvin]
ADULTS SHOW AGE-RELATED DECLINE IN EMOTION PERCEPTION

Cannon & Chatterjee, 2022, Ear & Hearing

[Graph showing age-related decline in emotion perception for NH and CI groups]
Collaboration with Dr. Shuman He (OSU) and Dr. Zilong Xie (Florida State University)
Audiovisual Integration of Emotional Speech

Dr. Kaylah Lalonde, PI
Grace Dwyer, RA

Audiovisual Speech Processing Lab
Boys Town National Research Hospital
### COLLABORATORS AND FUNDING SOURCES

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<th>BTNRH</th>
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THANK YOU!!