Hearing and its relation to Cognitive Measures in Young Adults with Down Syndrome

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Bilateral hearing provide benefits relative to unilateral hearing

- **Sound Localization**

- **Separating Speech from Noise; “Cocktail Party” effect**

- **Reduced Cognitive Load (engagement, fatigue)**
Down Syndrome: High proportion of hearing loss

Diagnosis

Outcomes

Treatment

Tremendous progress in treating medical conditions. Hearing status not well understood.
How does hearing work?

Normal acoustic system has tens of thousands of frequency channels.
Plasticity of the auditory system and the brain

“use it or lose it”

If we don’t treat hearing loss early in life, the brain is not able to develop the pathways and connections needed for good hearing.

Need to assess hearing early

*Need to treat hearing and stay on top of changes throughout lifetime*
Sound Localization in control adults

1. Young adults with DS, ages 18-24
2. Localization within 10-15 degrees
3. Excellent ability to tell if sounds on right vs. left
4. Unless there is diagnosis of hearing loss in either ear
   → Need good hearing in both ears to be able to localize sound
   → Need good hearing in both ears to separate speech from noise
Top-down influences:
Cognition, attention, EF, Memory, Effort

Bottom-up Solution
(e.g., binaural Synchronization)
“Listening game” with spondees (within the vocabulary)
Speech Identification

- Quiet
- Co-located
- Location Separated
Speech identification Results

SRT (dB SPL)

DS-Adult  NH-Child  NH-Child  NH-Adult

(mean: 5.1yr)  (mean: 7.6yr)

Quiet  Front  Right

Legend:
Speech identification predicts measures of cognition

Vocabulary

Memory

Executive Function
Need to understand hearing loss!
- Consequences for everyday functioning
- Impact on cognition and language
- Brain maturation?
- Long-term relationships to other conditions such as dementia?
Binaural Hearing and Speech Lab

‘WHAT’ AND ‘WHERE’