



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

Ruth Litovsky, Ph.D.

*Professor & Chair, Communication Sciences & Disorders
& Surgery-Otolaryngology*

University of Wisconsin-Madison

litovsky@waisman.wisc.edu

<http://www.waisman.wisc.edu/bhl>

Waisman Center

Day with Experts – Down Syndrome

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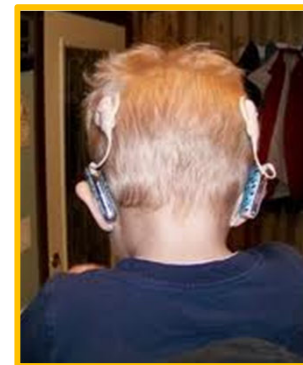
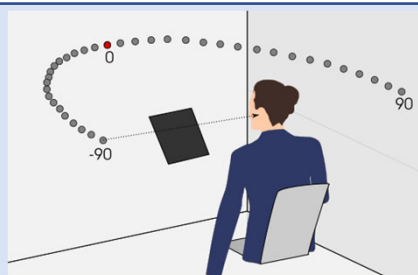
NIH-NICHD

P01 HD076892

U54 HD090256

Bilateral hearing provide benefits relative to unilateral hearing

Sound Localization



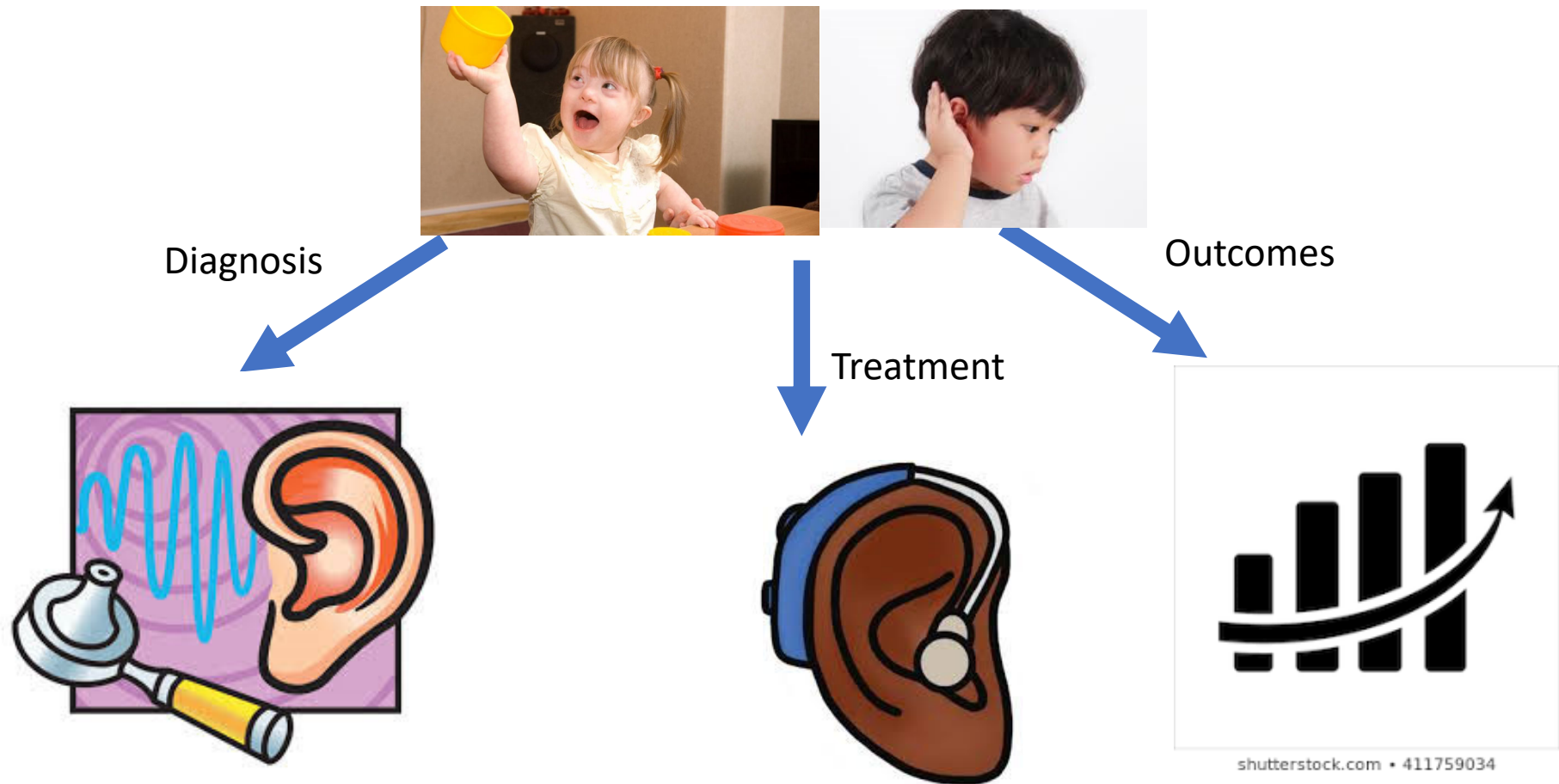
*Separating Speech from Noise;
“Cocktail Party” effect*



*Reduced Cognitive Load
(engagement, fatigue)*

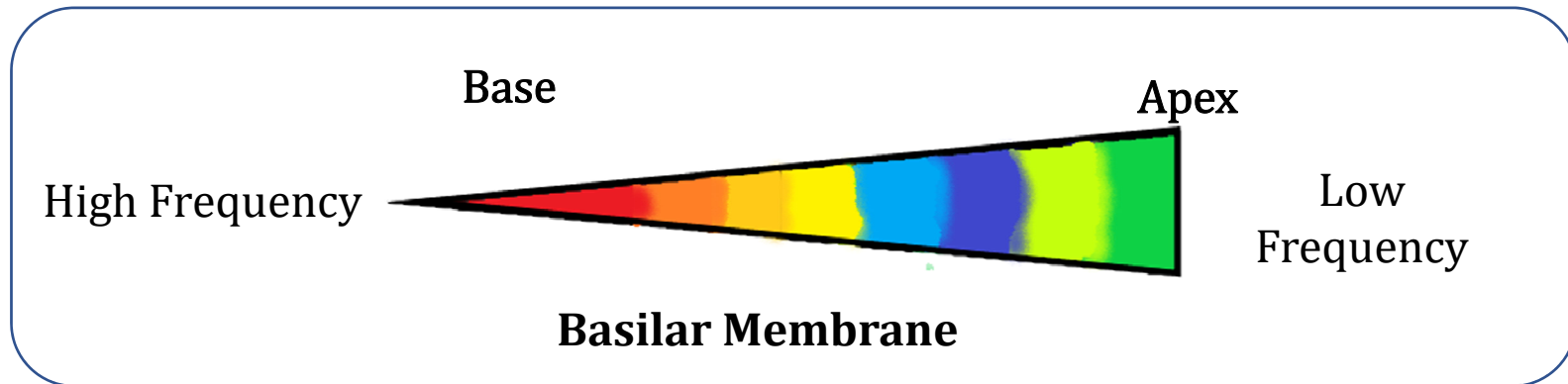


Down Syndrome: High proportion of hearing loss



**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

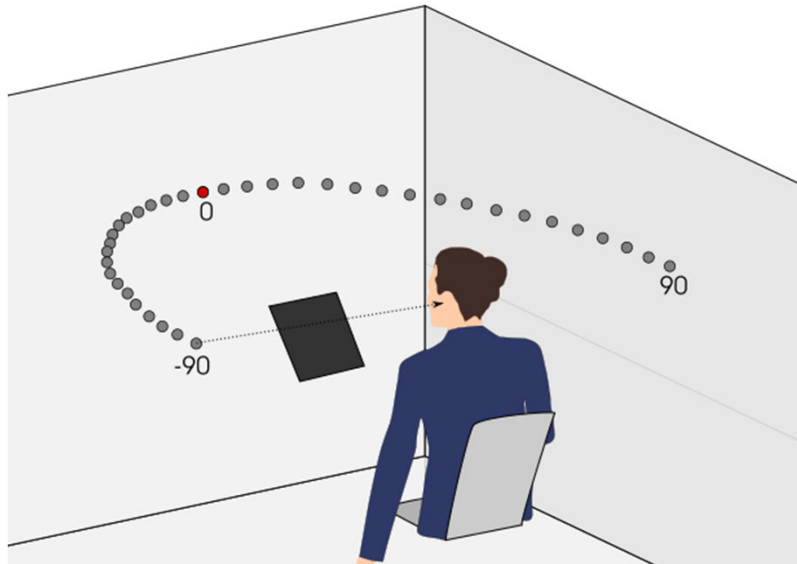
“use it or lose it”

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.

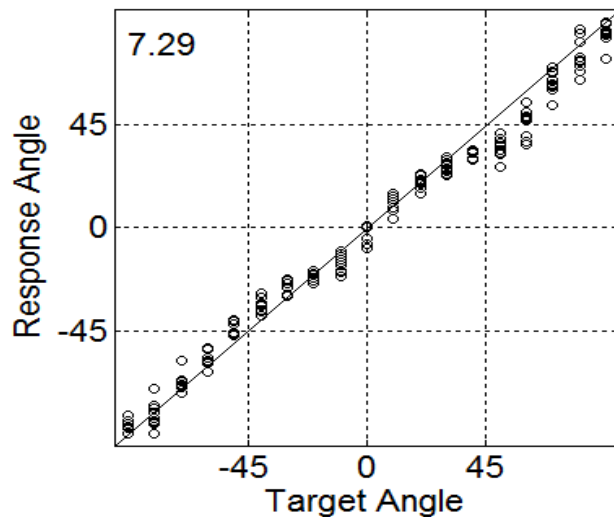


Need to assess hearing early
***Need to treat hearing and stay on top of changes
throughout lifetime***

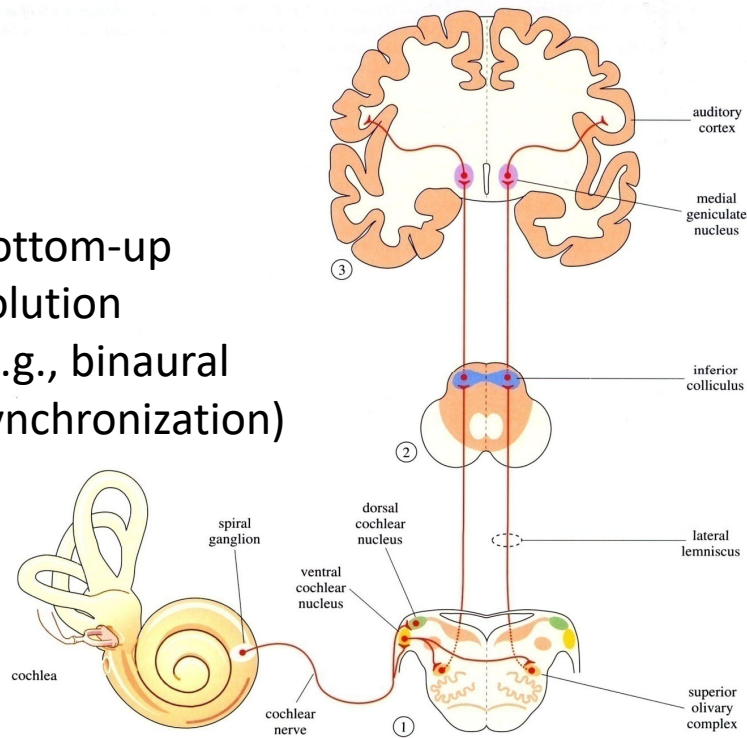
Sound Localization in control adults



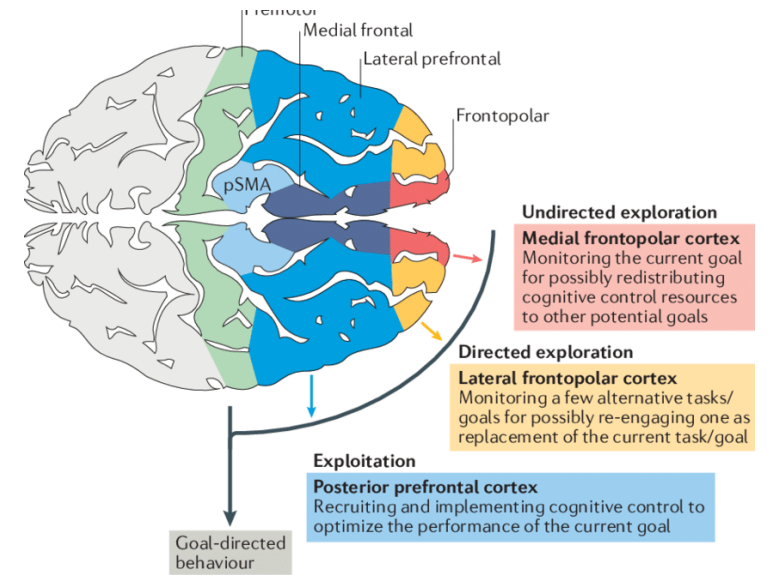
1. Young adults with DS, ages 18-24
2. Localization within 10-15 degrees
3. Excellent ability to tell if sounds on right vs. left
4. Unless there is diagnosis of hearing loss in either ear
 - Need good hearing in both ears to be able to localize sound
 - Need good hearing in both ears to separate speech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



Bottom-up Solution (e.g., binaural Synchronization)

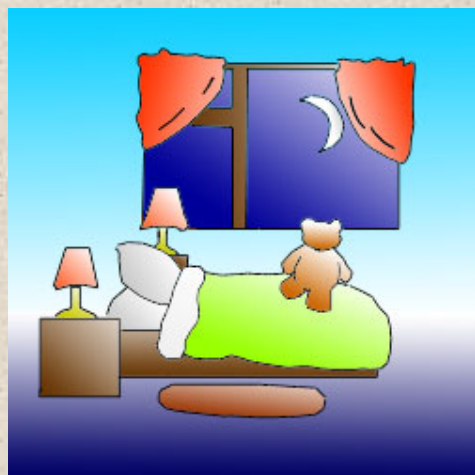
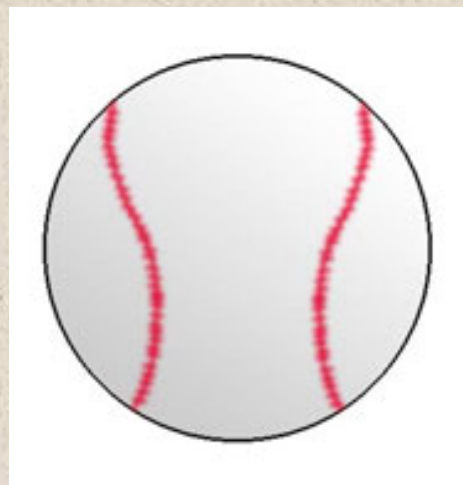
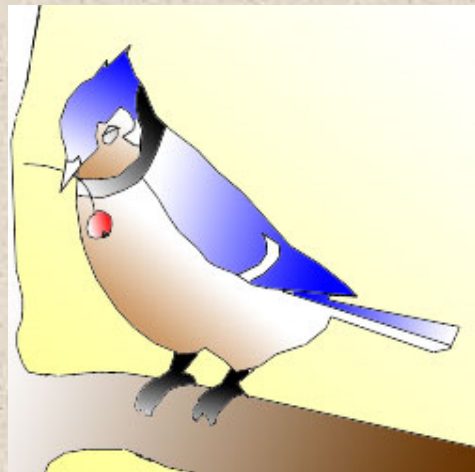


Top-down influences

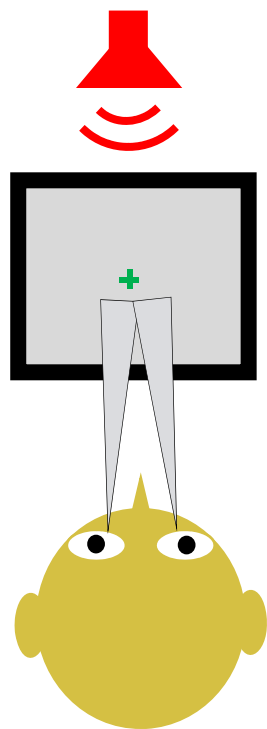


Top-down influences:
Cognition, attention, EF,
Memory, Effort

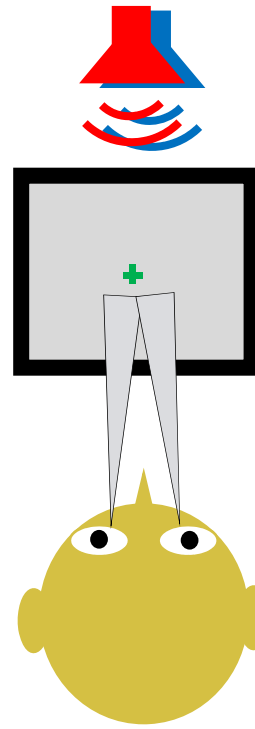
“Listening game” with spondees (within the vocabulary)



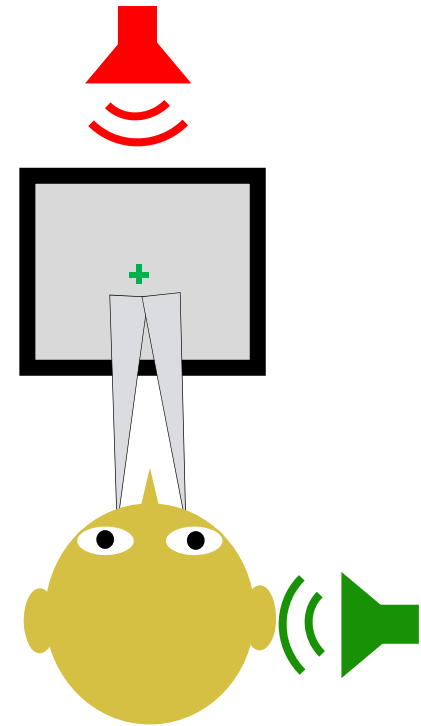
Speech Identification



Quiet

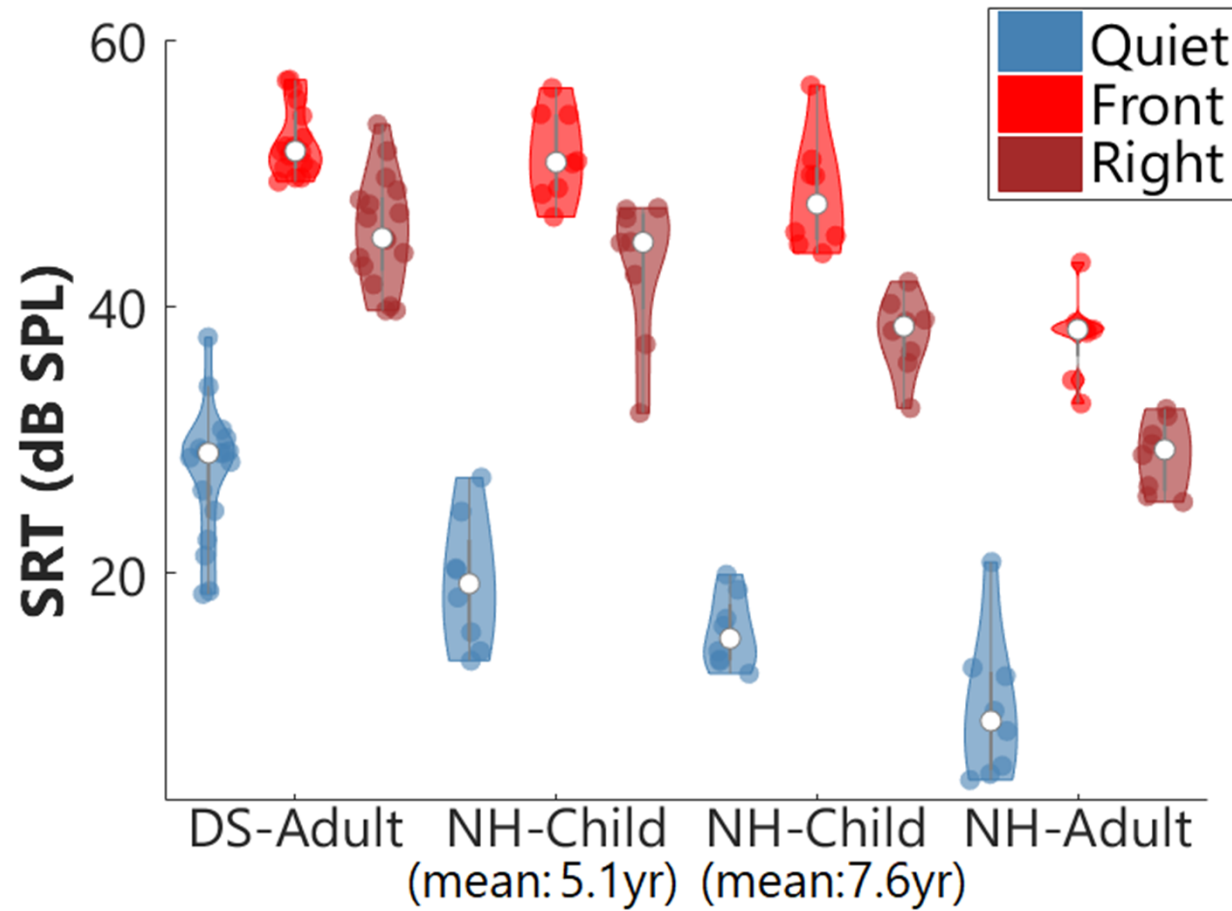


Co-located

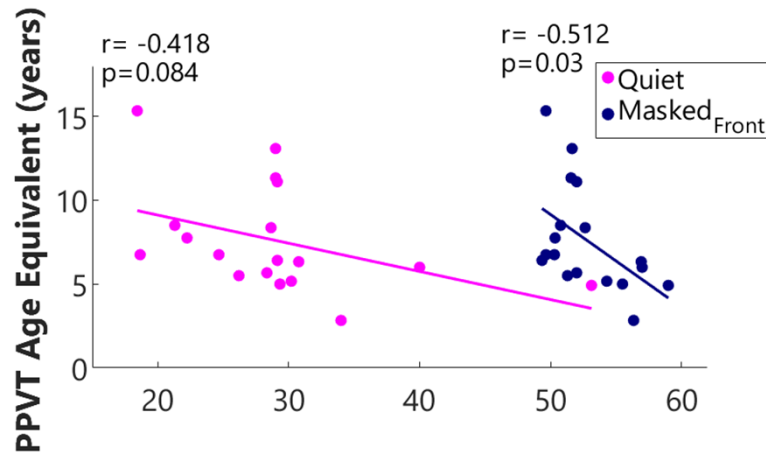


Location
Separated

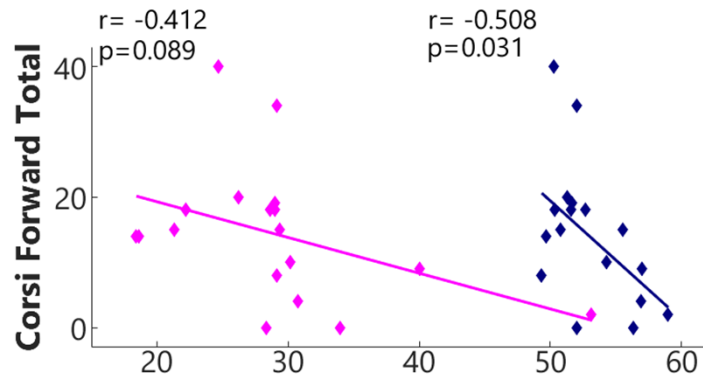
Speech identification Results



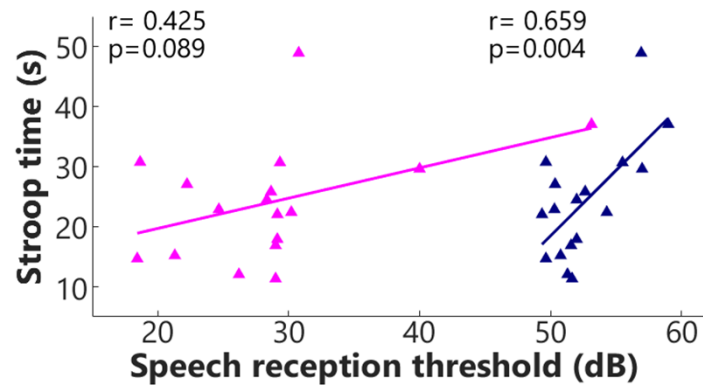
Speech identification predicts measures of cognition



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?



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Binaural Hearing and Speech Lab

‘WHAT’ AND ‘WHERE’



