Essential Components of the Pediatric Hearing Instrument Fitting Process

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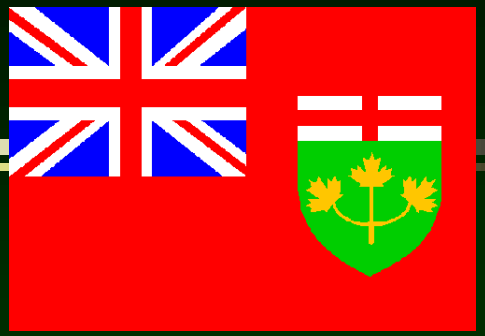
Outline

- On the use of ‘Best Practice’ Protocols
- Resources
- Essential Elements for Pediatric Fitting in 2011

Infant Hearing Programs

Some thoughts on the need for
'Best Practice' clinical protocols

Ideally . . .



- Same equipment
- Same audiologic assessment procedures
- Same prescriptive procedures
- Same electroacoustic verification procedures, and so on . . .

Example

Hearing Instrument Fittings of Pre-School Children: Do we Meet the Prescription Goals?

Susan Strauss & Catherine van Dijk

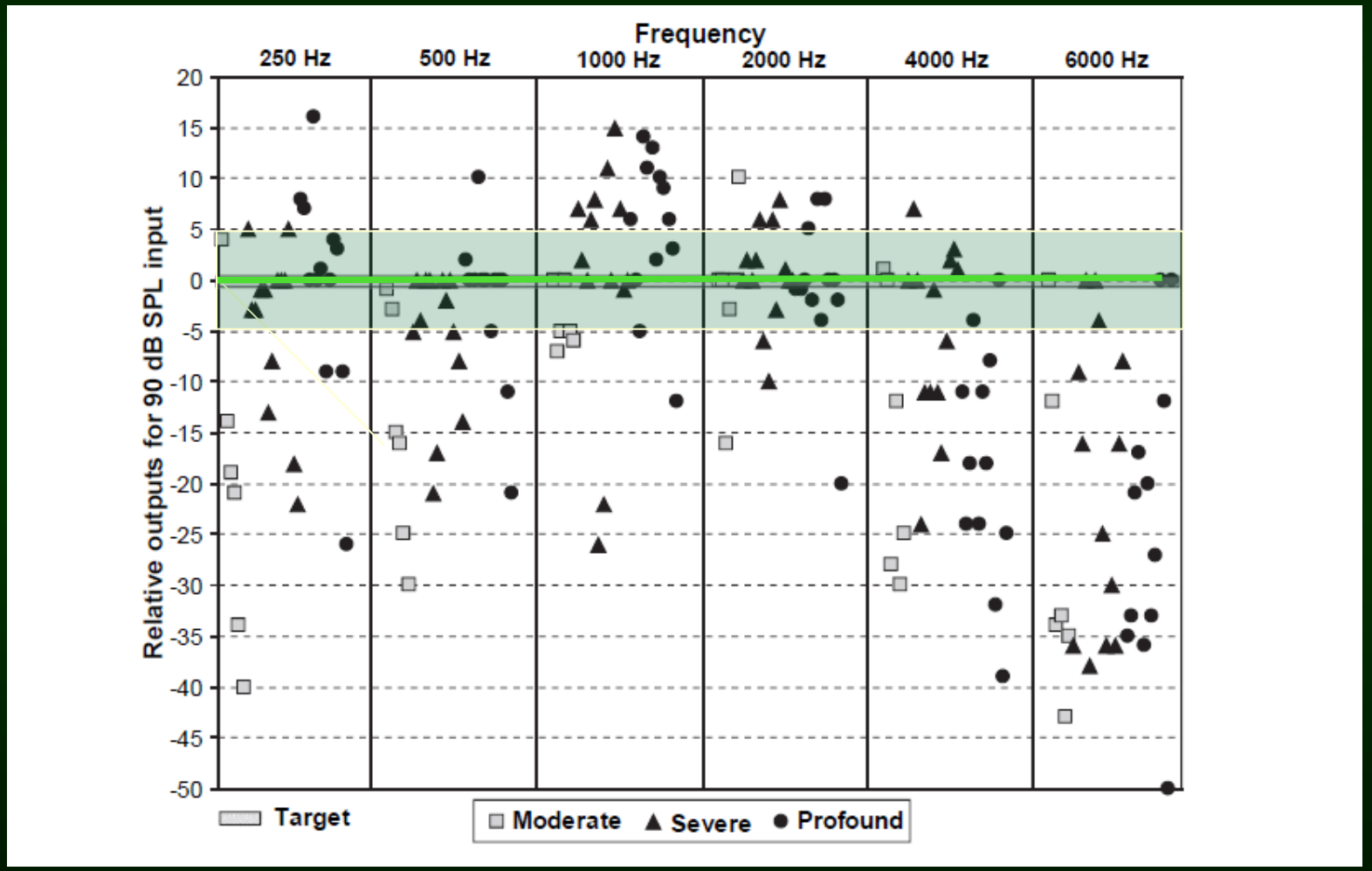
International Journal of Audiology

2008

Method

- Measured the output from 20 children's hearing instruments – total of 31 ears – moderate to profound hearing loss.
- Instruments fitted by a variety of clinicians.
- Compared the measured outputs to the DSLv5 prescribed levels for each child.

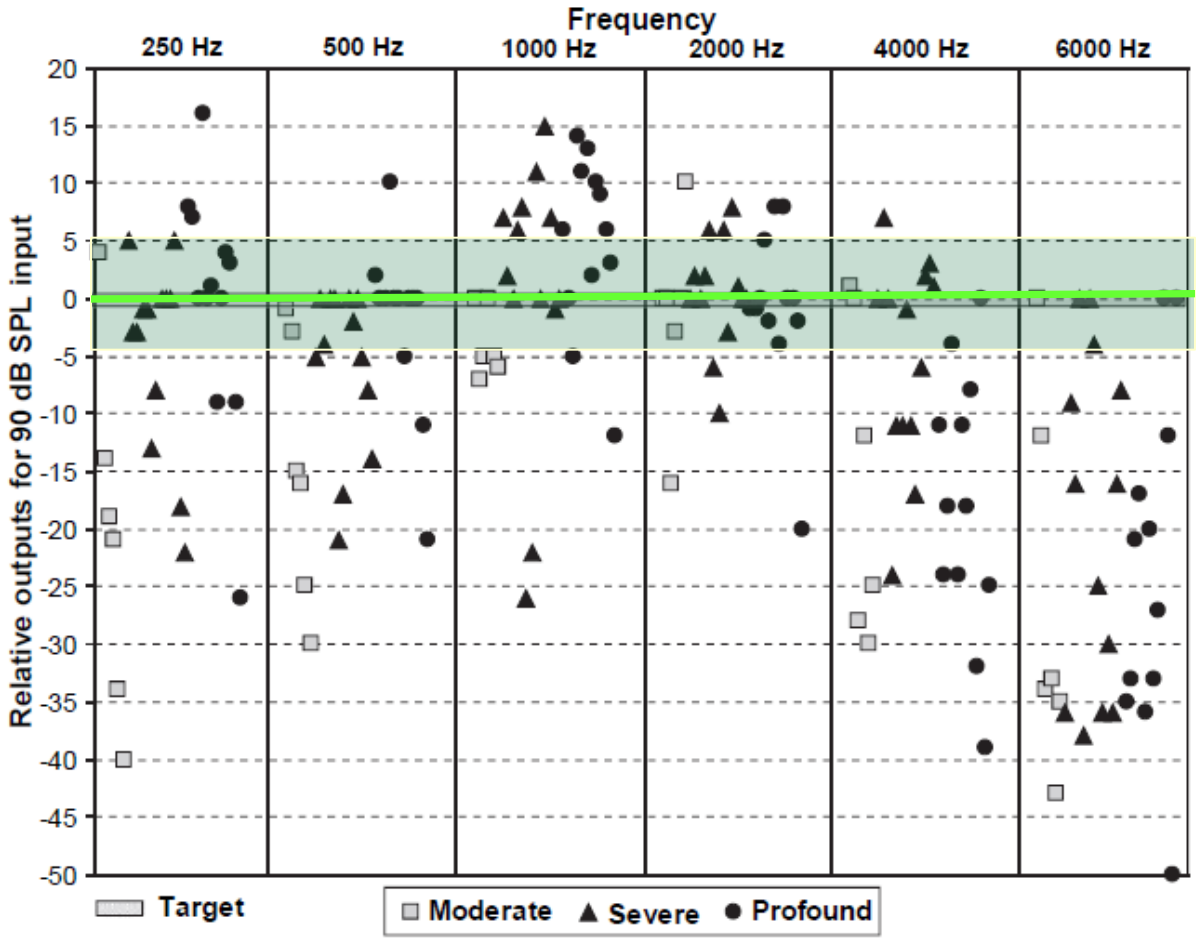
Results: 65 dB SPL speech input



Results: 65 dB SPL Input

- **Moderate Losses: 34%** had output values that were ±5 dB of the prescribed values.
- **Severe Losses: 47%** were within ±5 dB.
- **Profound Losses: 34%** were within ±5dB

Results: 90 dB SPL narrow band input



Results: 90 dB SPL Input

- **Moderate Losses: 34%** had output values that were ±5 dB of the prescribed values.
- **Severe Losses: 39%** were within ±5 dB.
- **Profound Losses: 92**% were 5 dB or more below the DSLv5 target values for output limiting.

Resources for Pediatric Amplification

‘Best Practice’ Clinical Protocols from Around the World

Australia

King, A. (2010). The national protocol for paediatric amplification in Australia. *International Journal of Audiology, 49*: S64-S69.

Ontario Canada

Bagatto, Scollie, Hyde and Seewald (2010). Protocol for the provision of amplification within the Ontario infant hearing program. *International Journal of Audiology, 49*: S70-79.

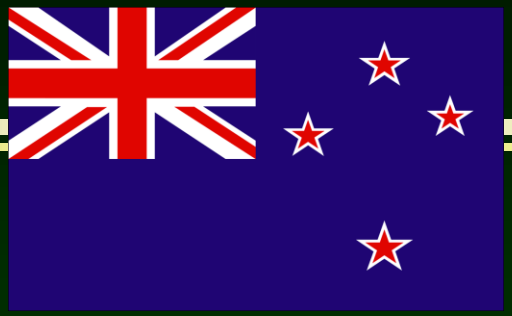
http://www.mountsinai.on.ca/care/infant-hearing-program/health-professionals

British Columbia Canada

http://www.phsa.ca/AgenciesAndServices/Services/BCEarlyHearing/ForProfessionals/Resources/Protocols-Standards.htm

http://www.phsa.ca/AgenciesAndServices/Services/BCEarlyHearing/ForProfessionals/Resources/Training-Materials.htm

NEW ZEALAND



http://www.nsu.govt.nz/Health-Professionals/3956.aspx

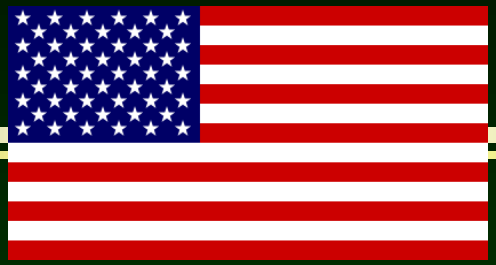
EUROPEAN NATIONS

http://www.biap.org

United Kingdom

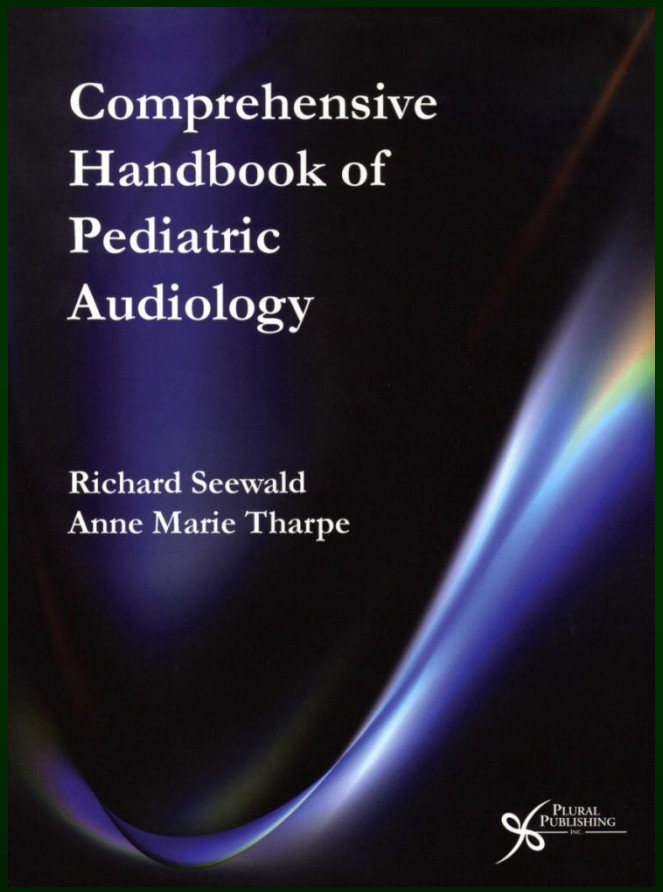
http://www.psych-sci.manchester.ac.uk/mchas/guidelines/fittingguidelines.doc

United States



http://www.audiology.org/resources/documentlibrary/Documents/pedamp.pdf

Additional Resources



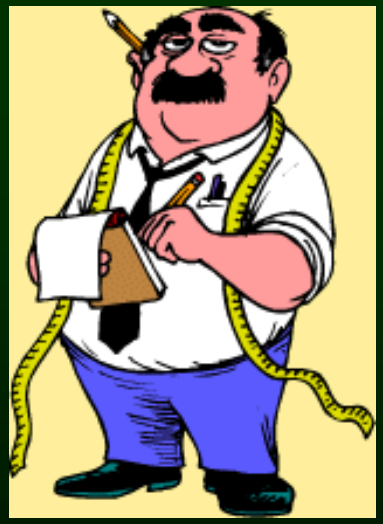
Pluralpublishing.com

Additional Resources

A Sound Foundation Through Early Amplification: Proceedings of the 5th International Conference August 2011 by Phonak AG

http://www.phonakpro.com/com/b2b/en/events/proceedings/soundfoundation_chicago2010.html

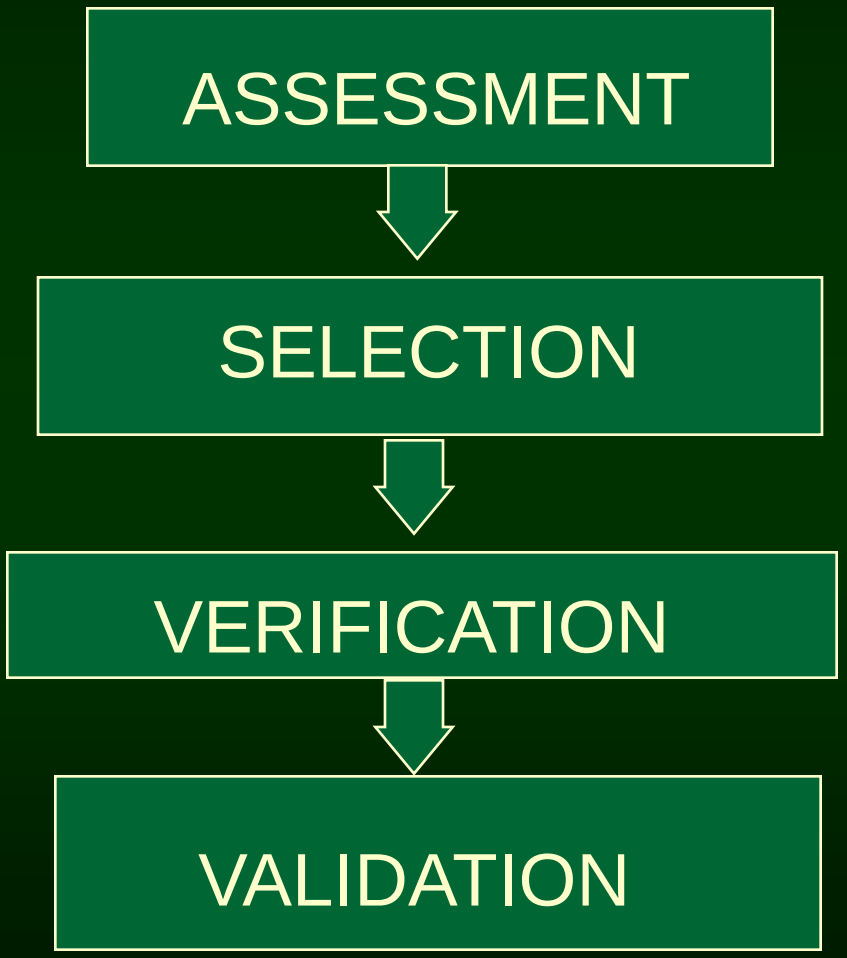
Essential Components of the Pediatric Hearing Aid Fitting Process



Modern Hearing Instrument Technologies

- **Directional Microphones**
- **Frequency-lowering Technologies**
- **Feedback Control Systems**
- **Digital Noise Reduction**
- **FM-systems**
- **etc.**

The Fitting Process



What we want to know . . .

That we have achieved a good match between the amplification characteristics of hearing instruments and the auditory characteristics of infants and children so that *the use of their residual auditory capacity can be maximized.*

Assessment Considerations for Fitting Infants and Young Children with Amplification

Component #1

We need ear-specific and frequency-specific threshold estimates for air and bone conduction before proceeding with the prescription and fitting of amplification for infants and young children.

Component #2

To fit hearing instruments accurately in the pediatric population (and to follow all current ‘best practice’ guidelines) we need to use a real-ear / hearing aid analyzer that implements the generic pediatric prescription procedures.

Why??

Component #3

We need to measure the external ear acoustics of the individual infant/child using the real-ear to coupler difference (RECD) procedure for the purposes of audiometry and hearing instrument fitting.

Why ????

Acoustic Transforms in Audiometry and Hearing Instrument Fitting

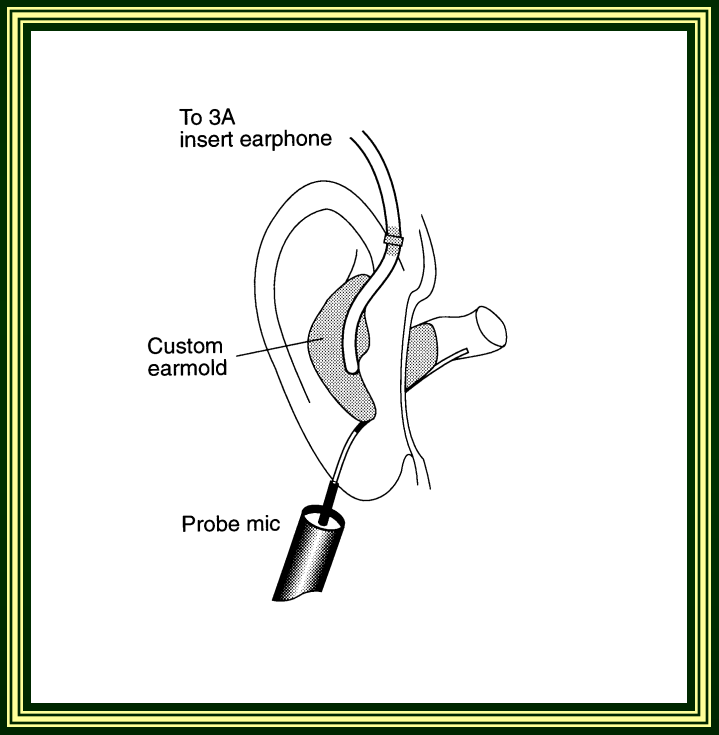
Assumption:

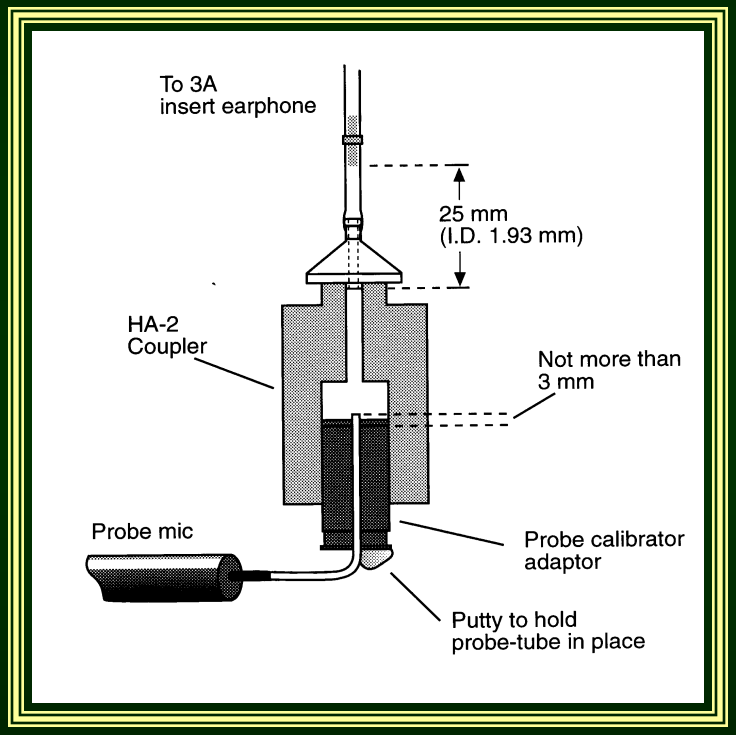
The real-ear to coupler difference (RECD) values across frequencies are equal to those measured for an average adult.

RECDs in Infants: Key Points

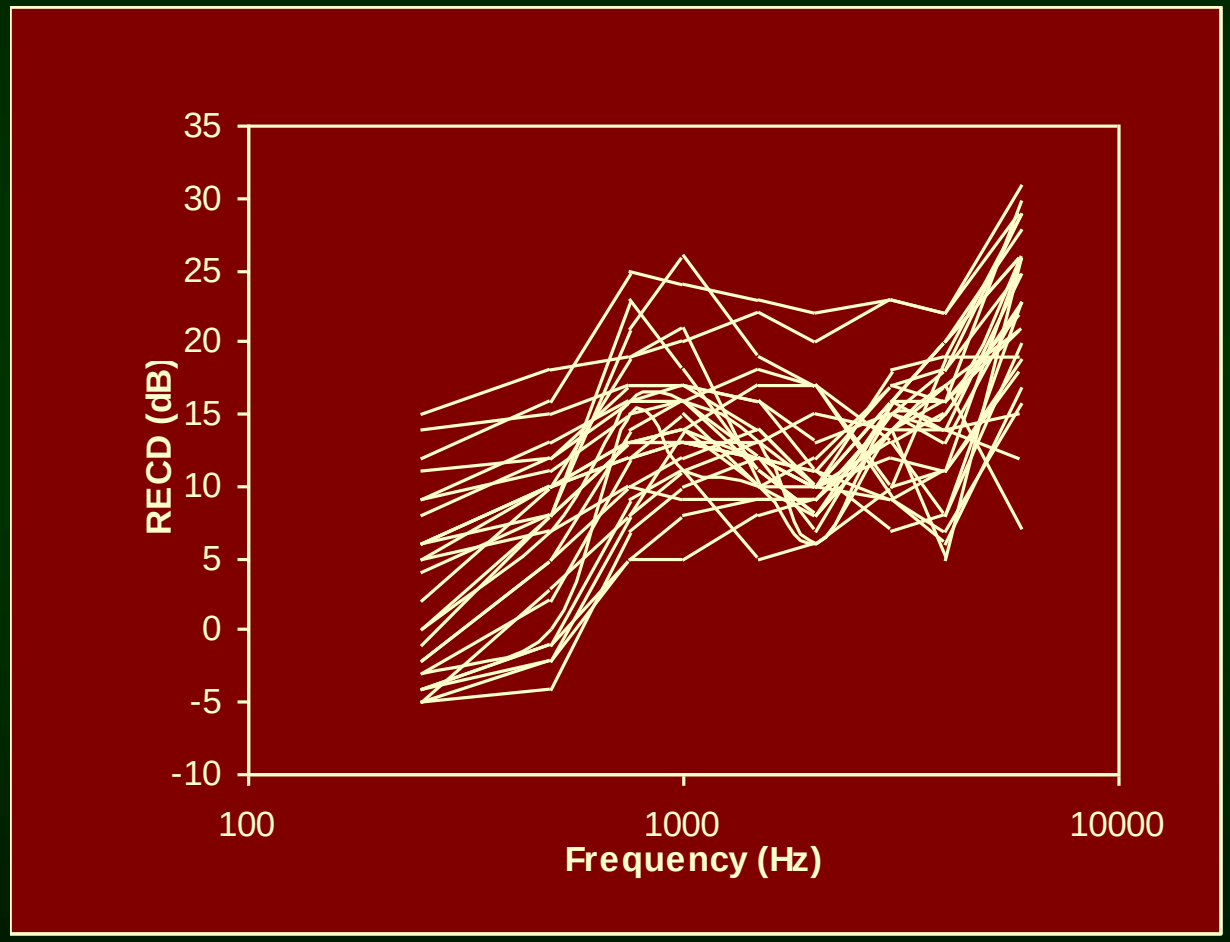
- RECDs in infants and toddlers differ significantly from average adult values.
- RECDs vary from infant to infant.
- RECDs will change for a given infant over time.

The Real-ear to Coupler Difference (RECD)





A sample of RECD values for infants



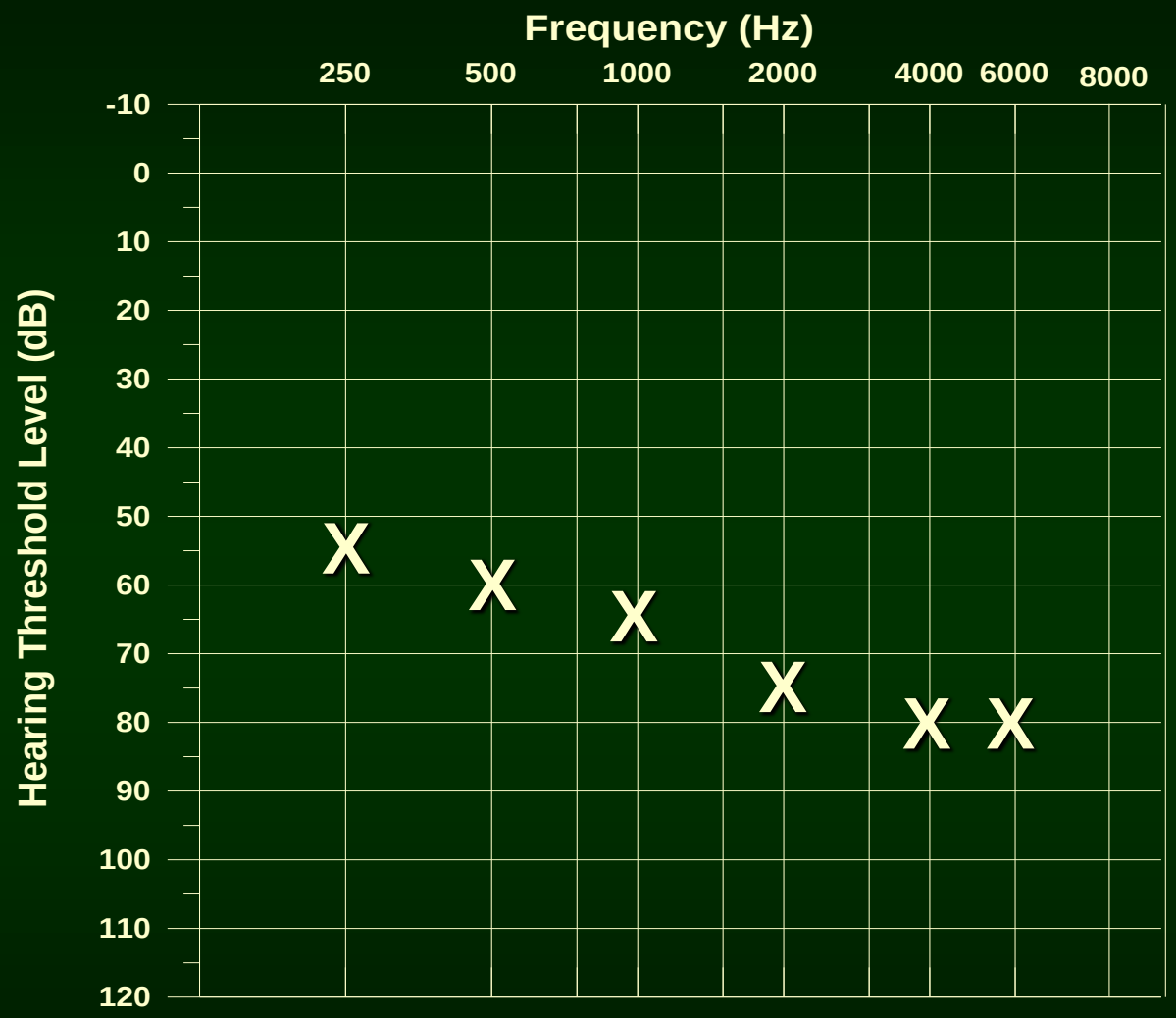
Component #4

Using the external ear acoustics, measured for the individual infant/child we are working with, we need to convert all audiometric data from dB HL to dB SPL in the ear canal.

Why ?

Component #4

To ensure that we have a good match between audiometric characteristics of the child and amplification characteristics of the hearing aid all variables we are working need to be defined using a common point of reference.


Frequency (Hz)
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Hearing Threshold Level (dB)
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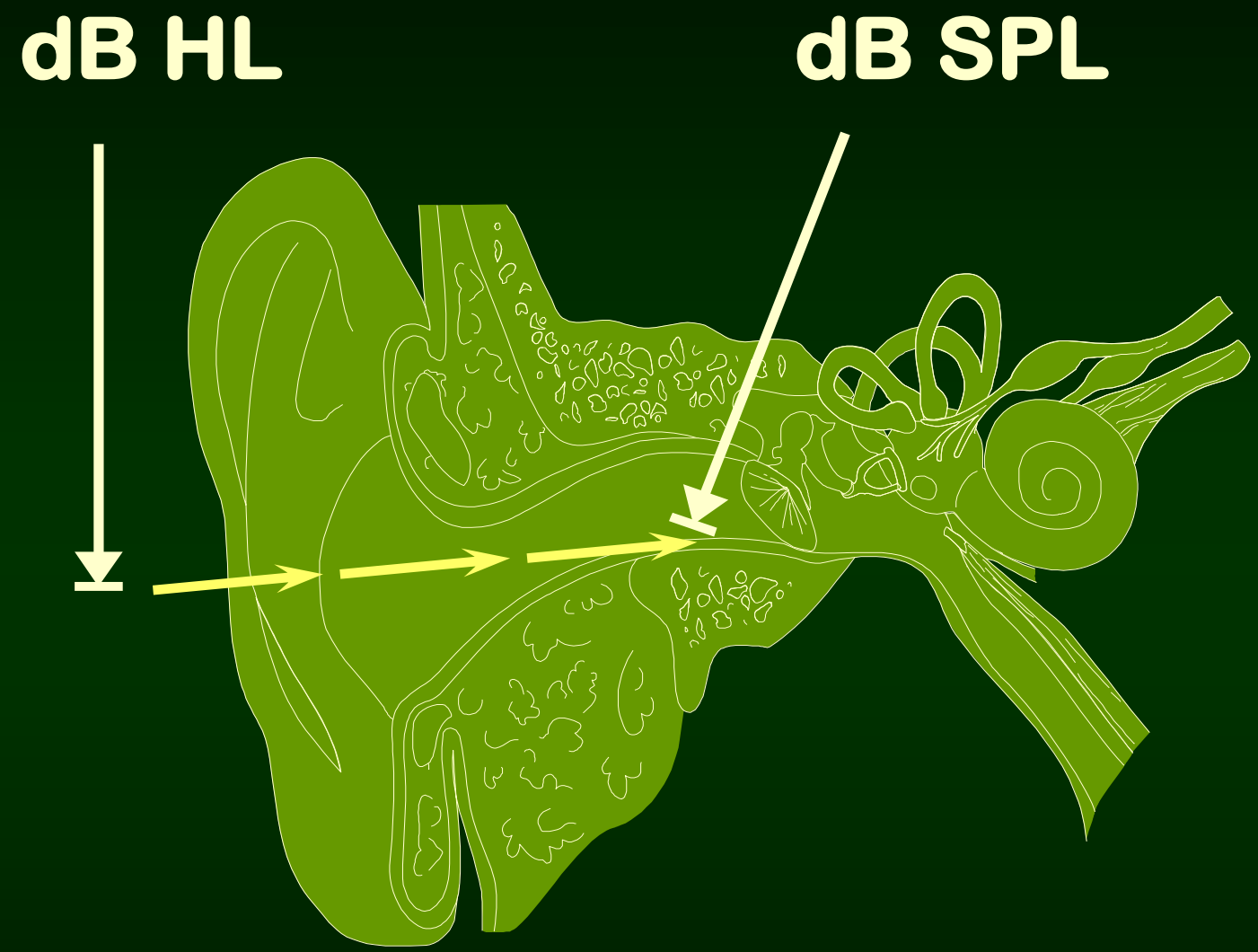
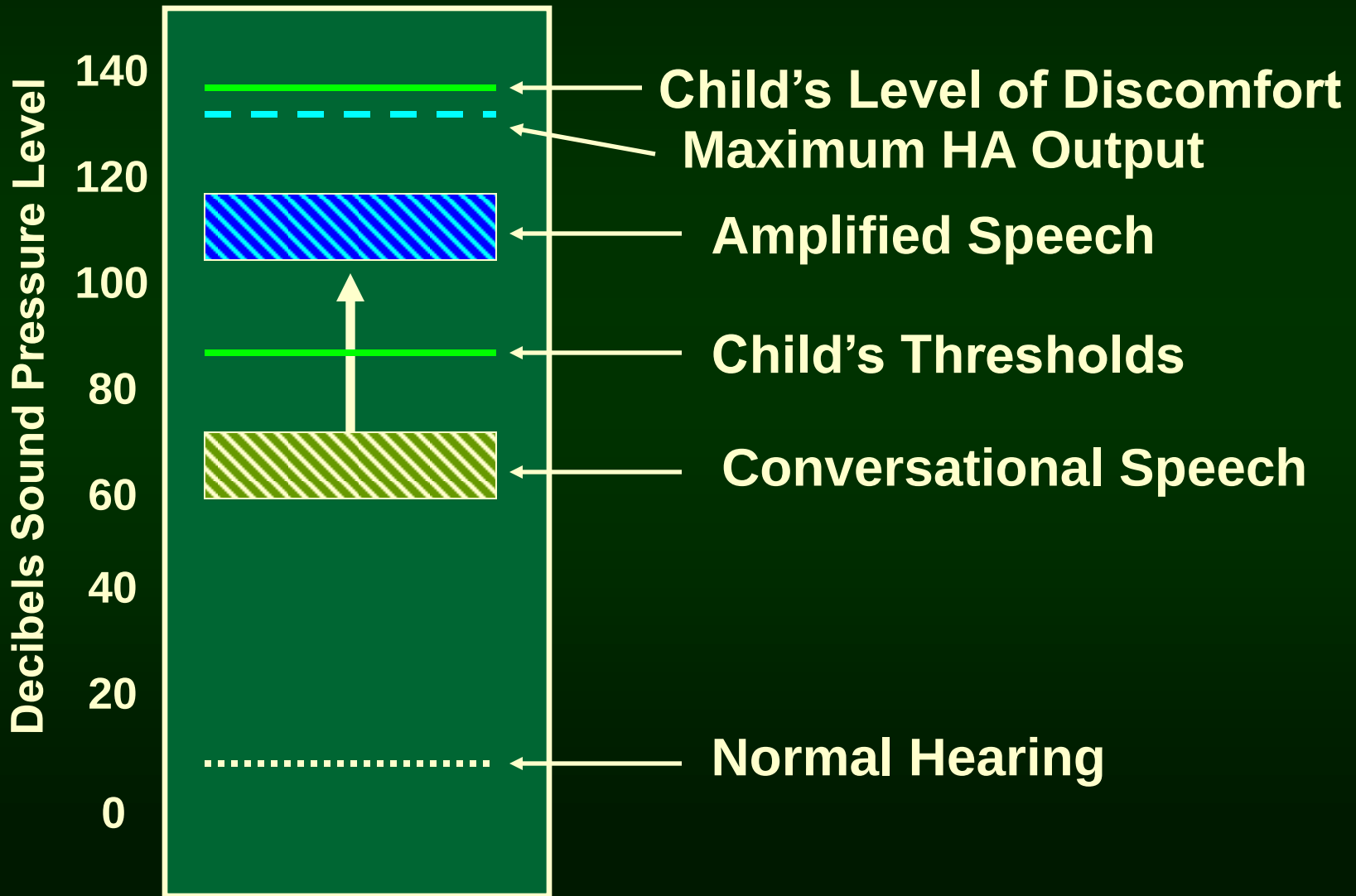
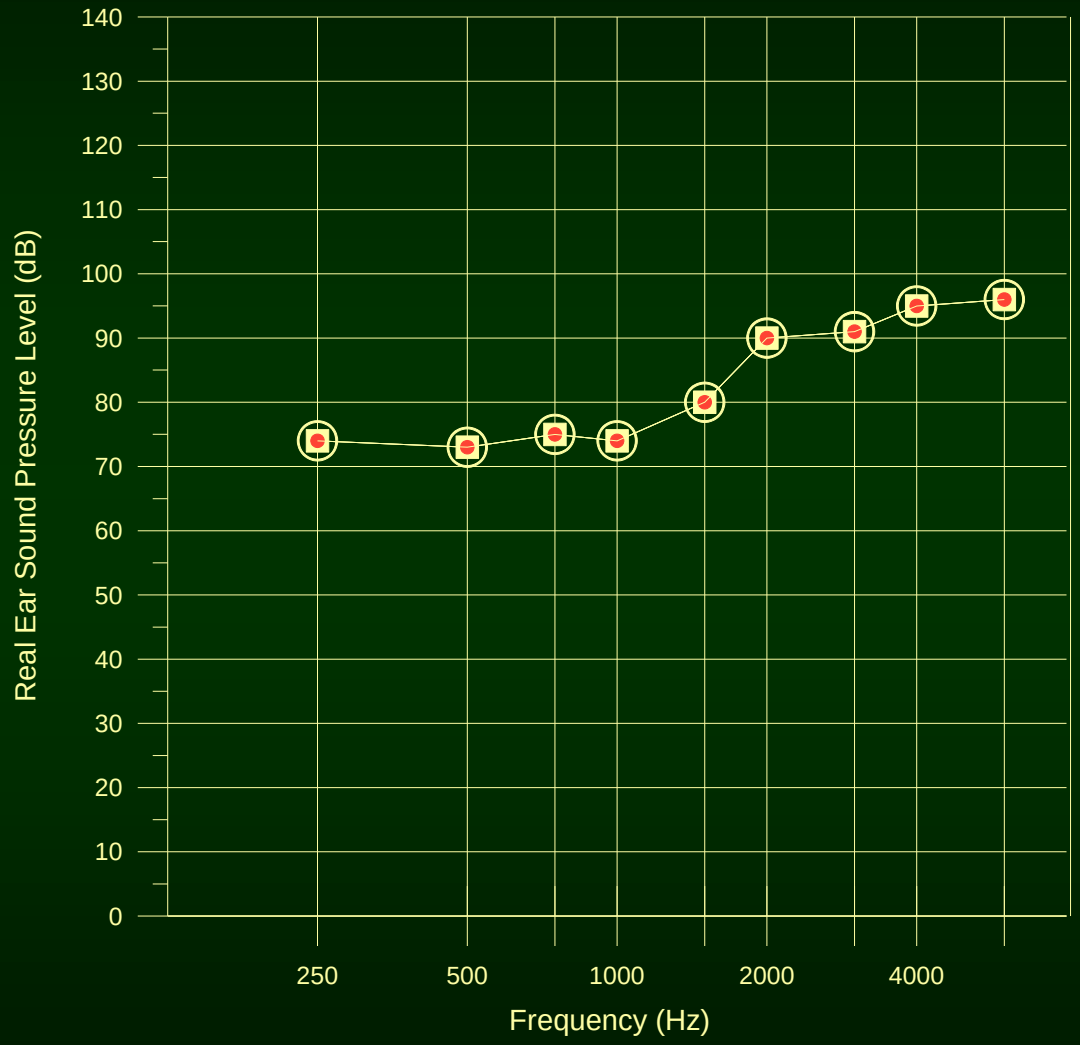

dB HL
dB SPL

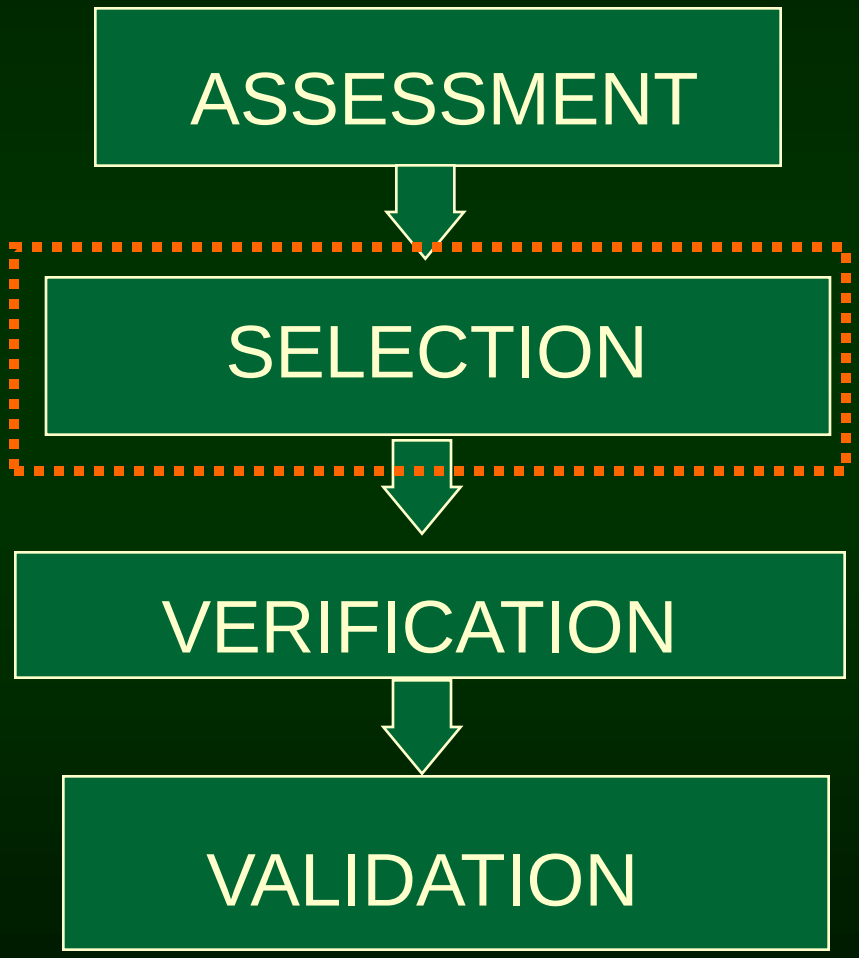
The SPLogram



The SPLogram: In ear canal SPL



The Fitting Process



What we want to do. . .

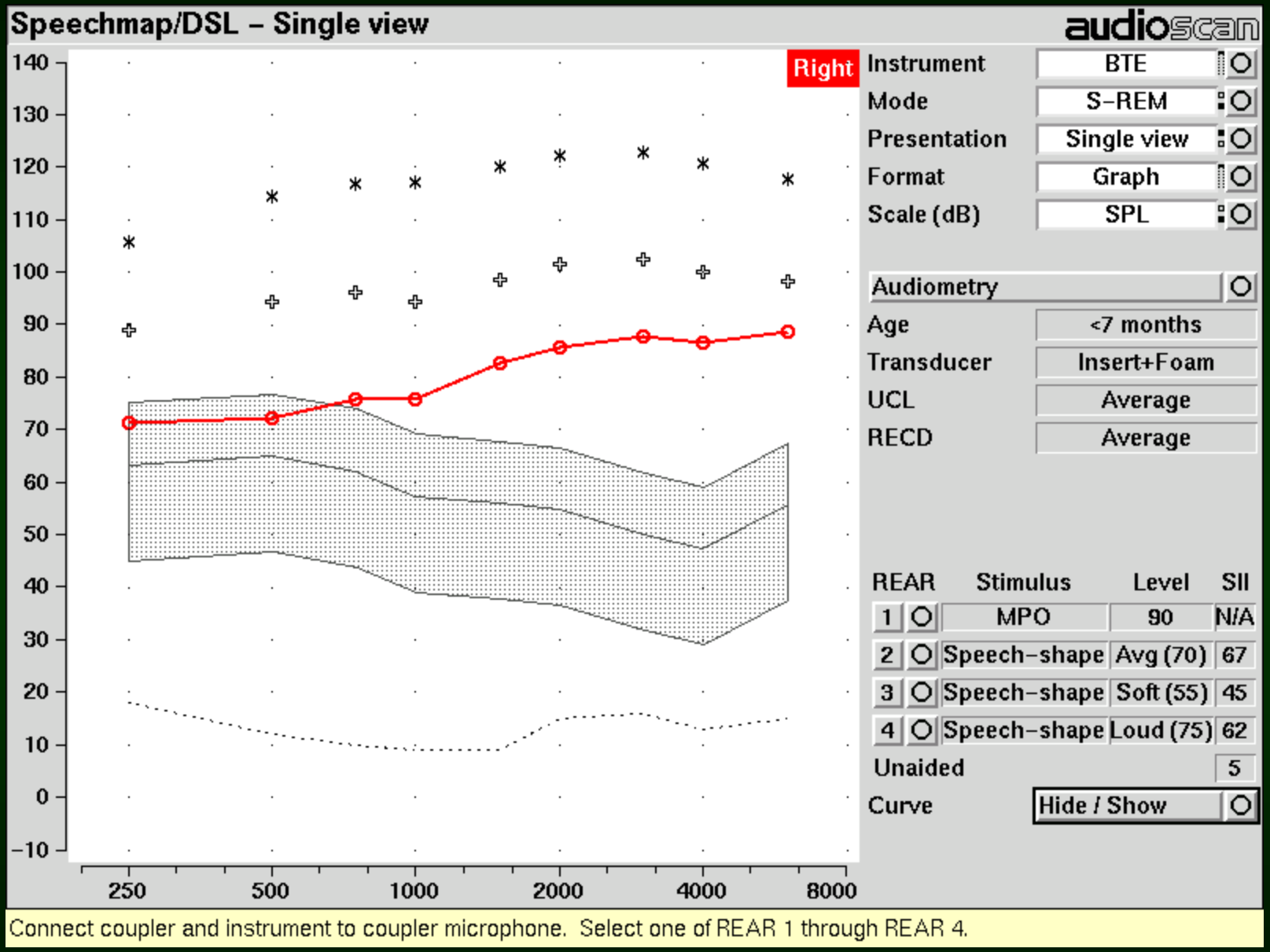
To match the amplification characteristics of hearing instruments to the auditory characteristics of infants and children so that *the use of their residual auditory capacity can be maximized.*

Component #5

We need to use an evidence-based generic prescription procedure that has been developed specifically for application with infants and children (i.e. the DSL v5.0 method or the NAL-NL2 prescription procedure).

Available in:

- **Manufacturer fitting software**
- **Real-ear / hearing aid analyzer system**


Speechmap/DSL – Single view
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Avg (70)
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Speech-shape
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Speech-shape
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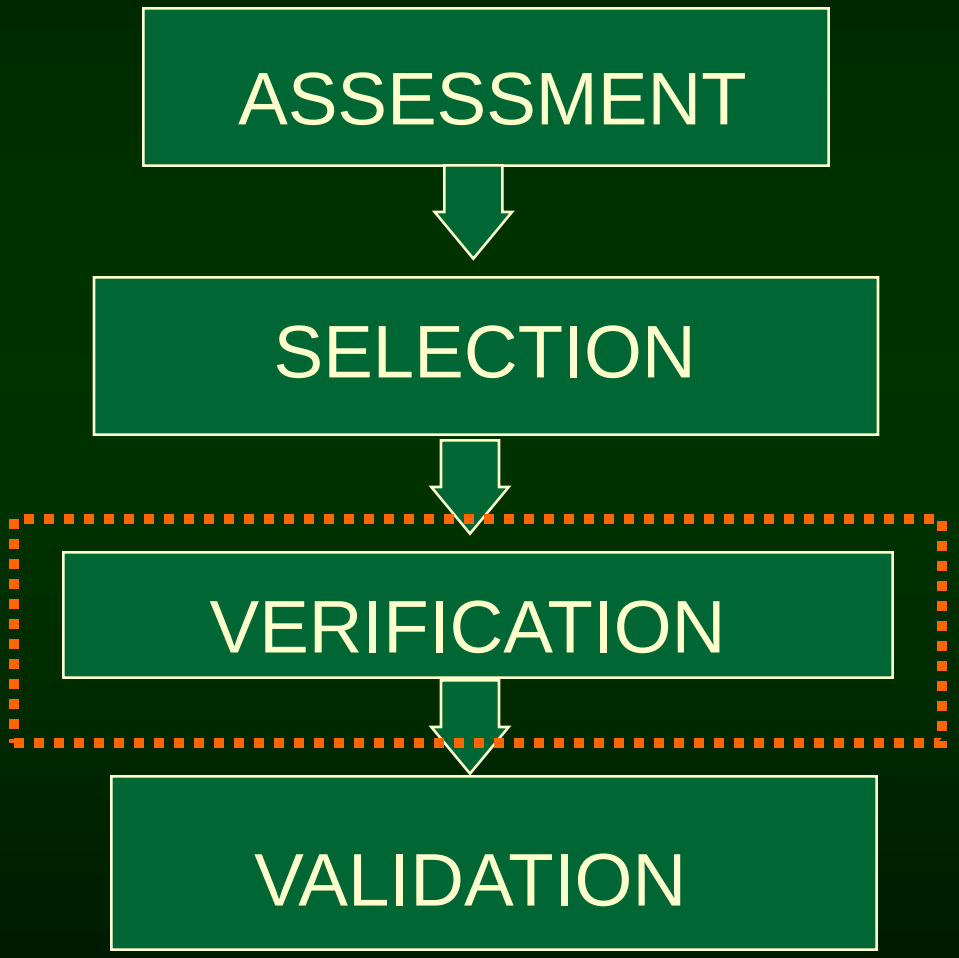
Curve
Hide / Show
Connect coupler and instrument to coupler microphone. Select one of REAR 1 through REAR 4.

The Fitting Process



Component #6

We need to verify that the desired real-ear performance of the hearing instrument has been provided to the infant or child before they leave the clinic.

Why ?????

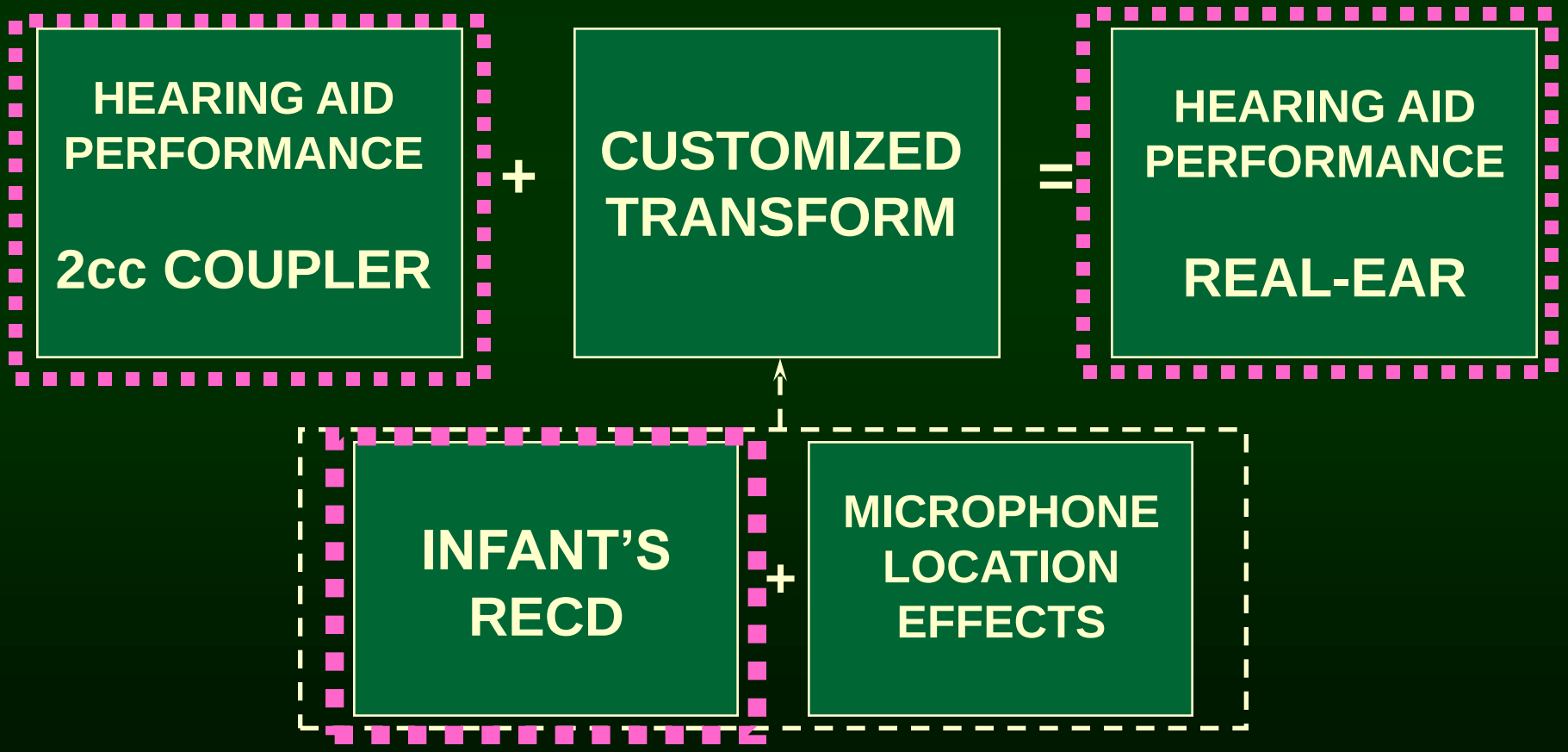
Electroacoustic Verification

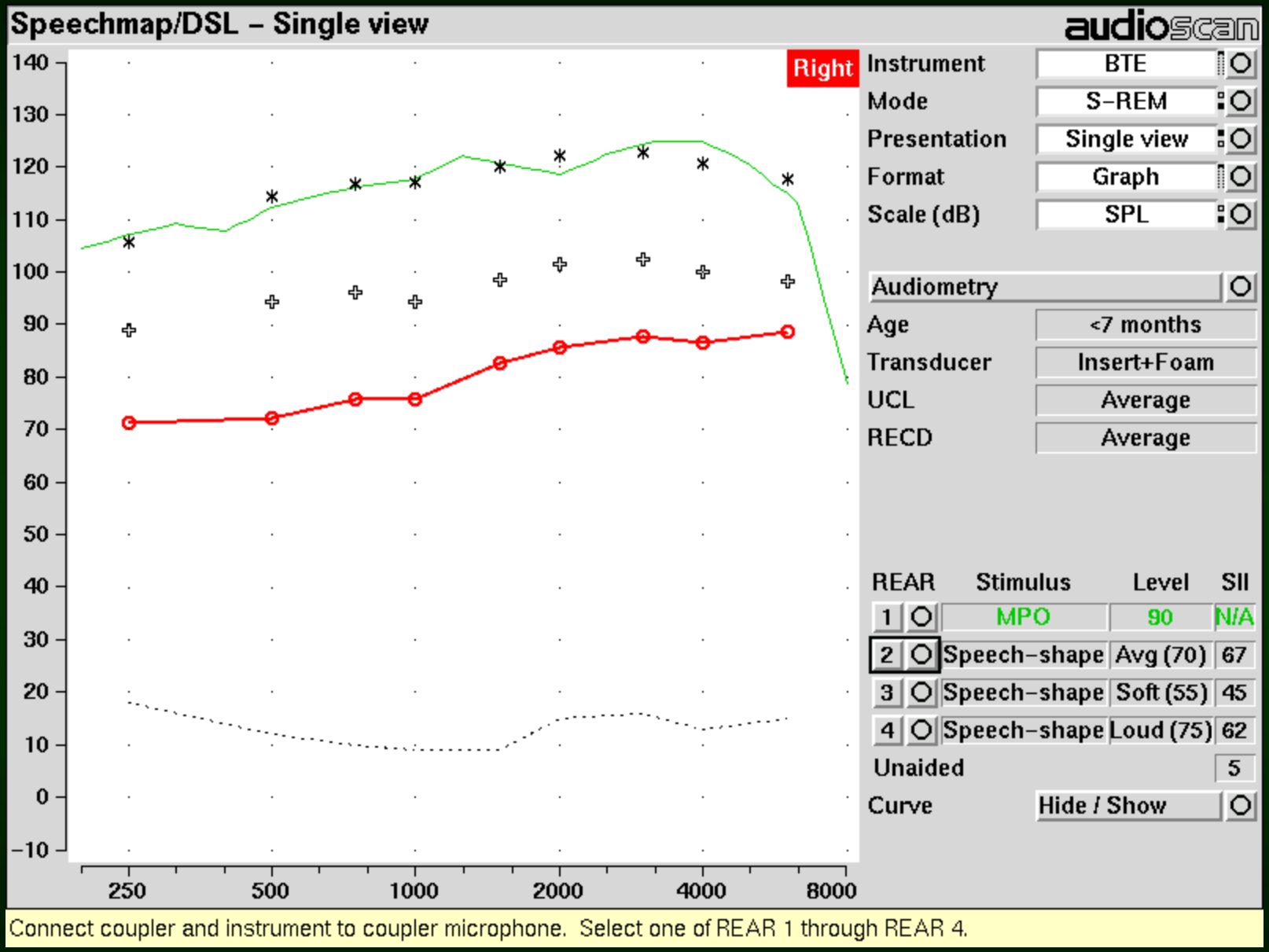
We need to know the levels of sound that a hearing instrument delivers into the ear of an infant or young child.

Consequently, comprehensive electroacoustic verification is an essential component in the pediatric hearing instrument fitting process.

How are RECDs used??
In Hearing Instrument Fitting

To predict real-ear hearing aid performance

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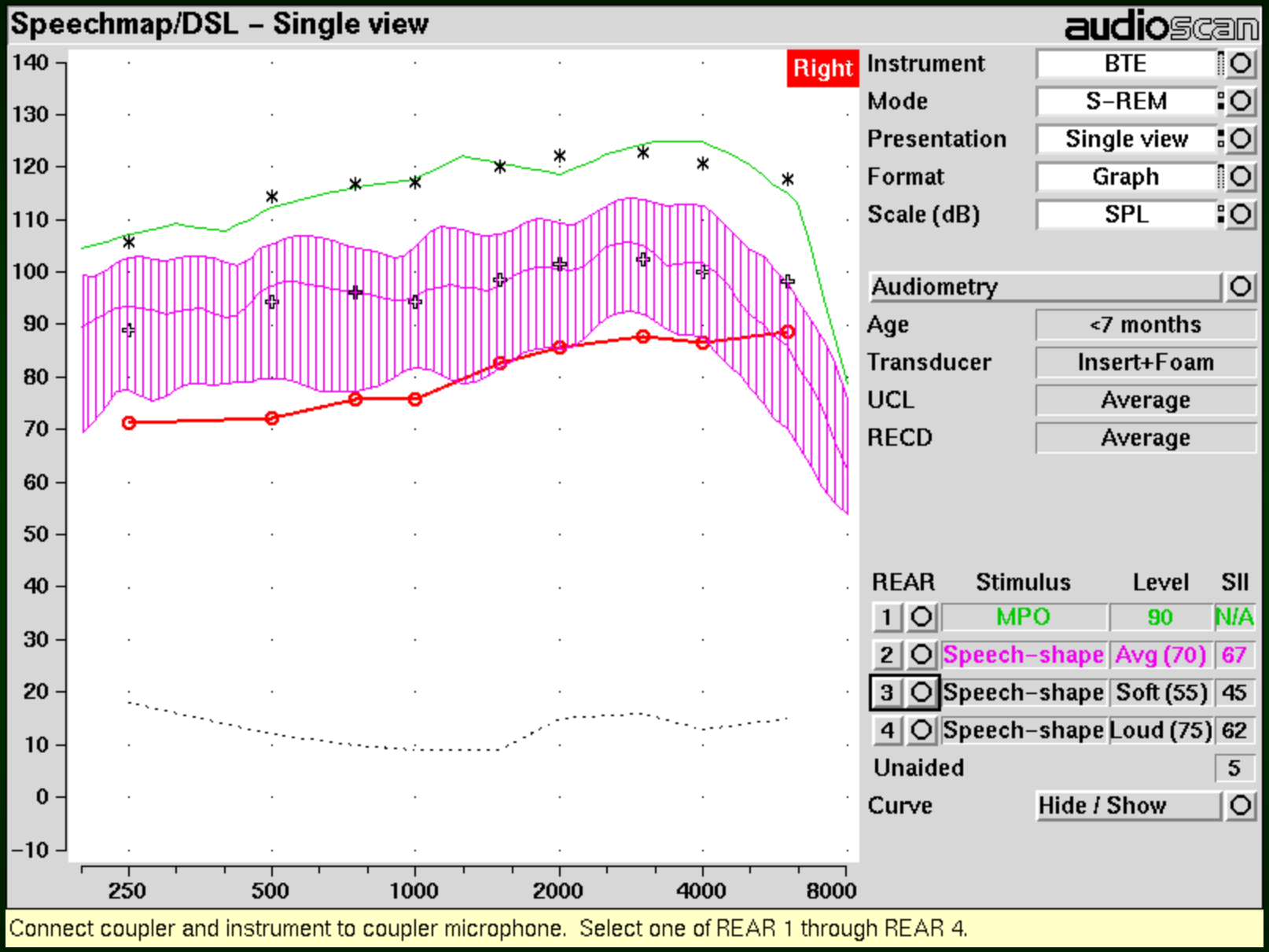
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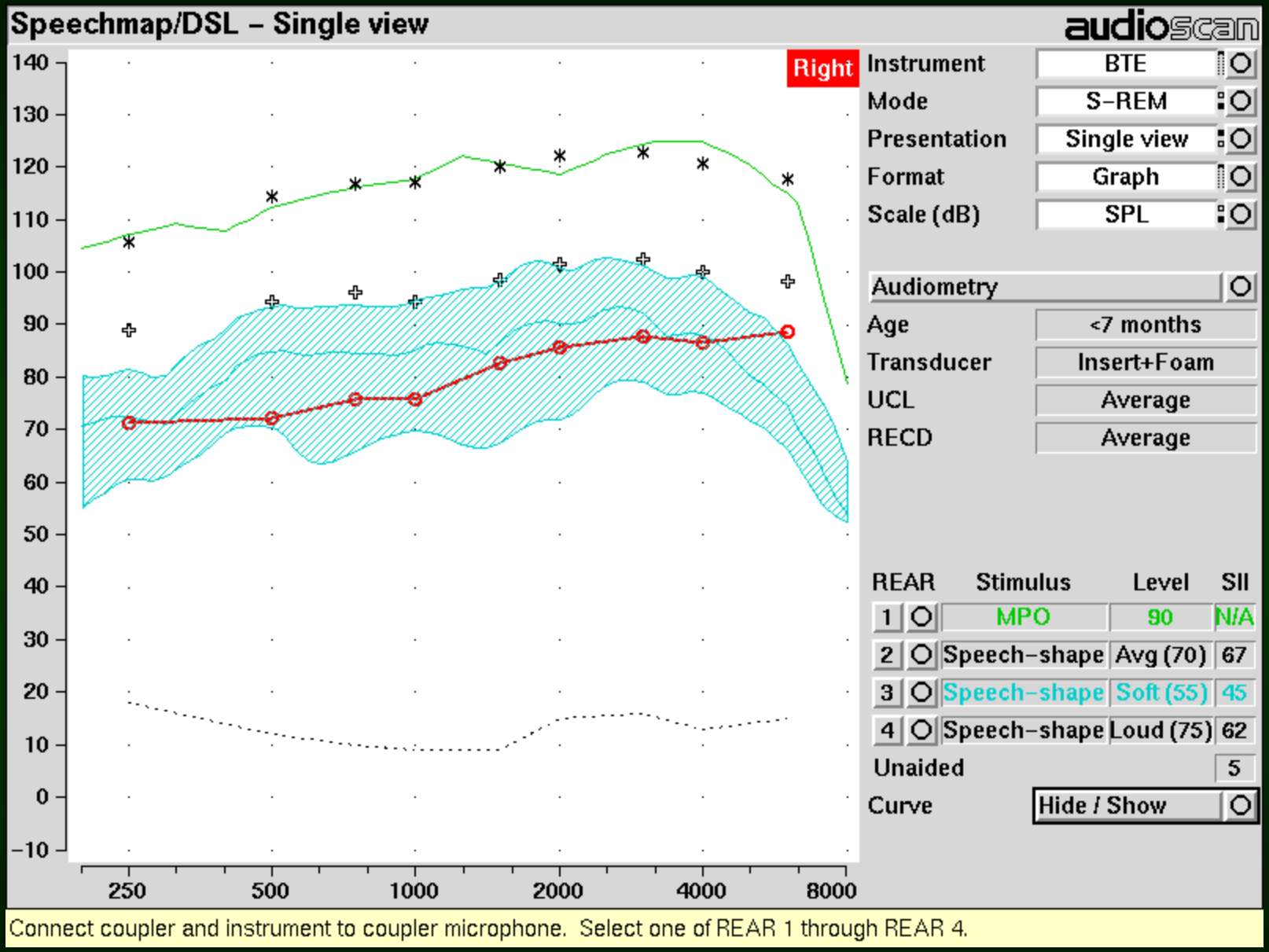
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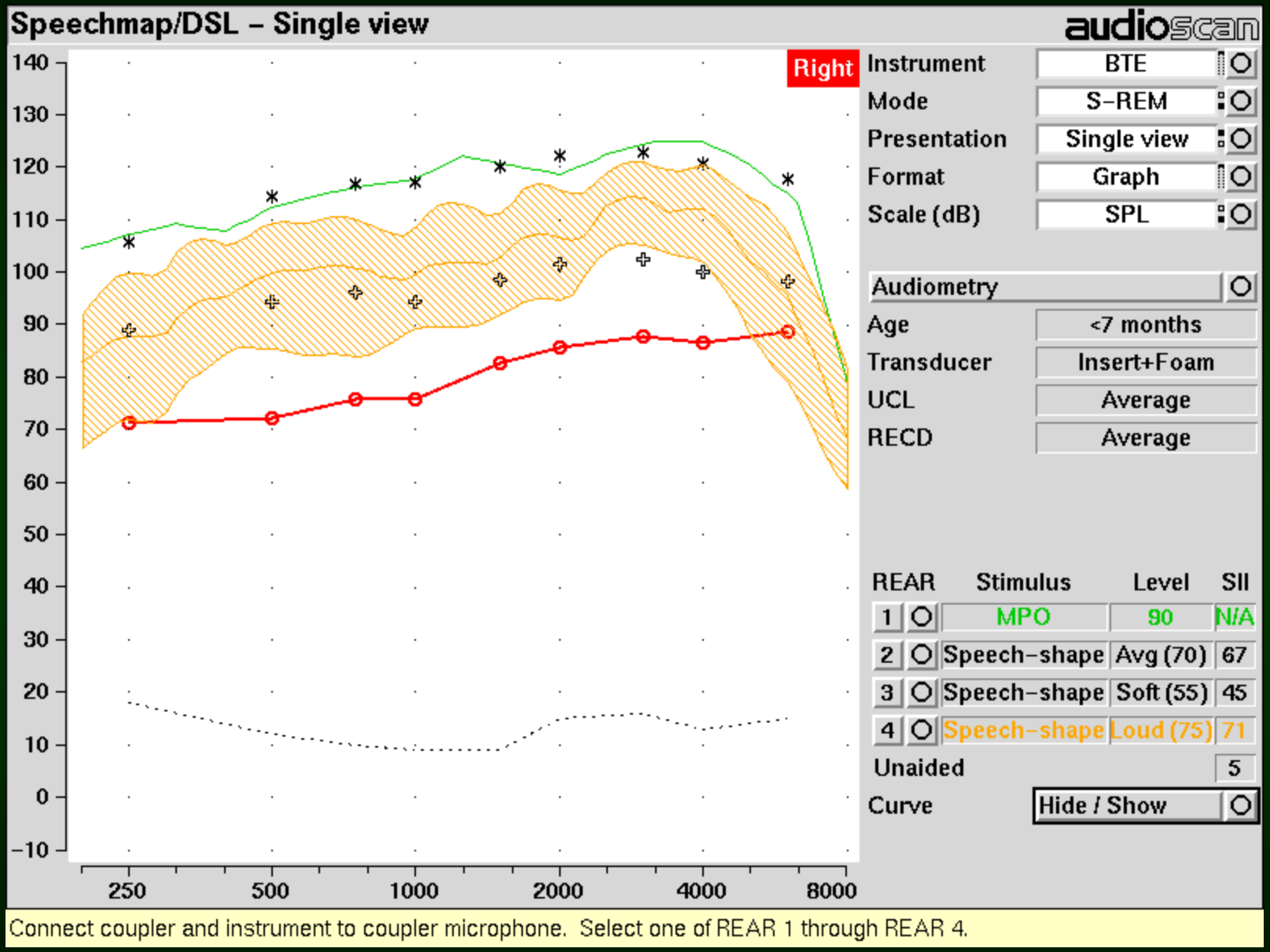
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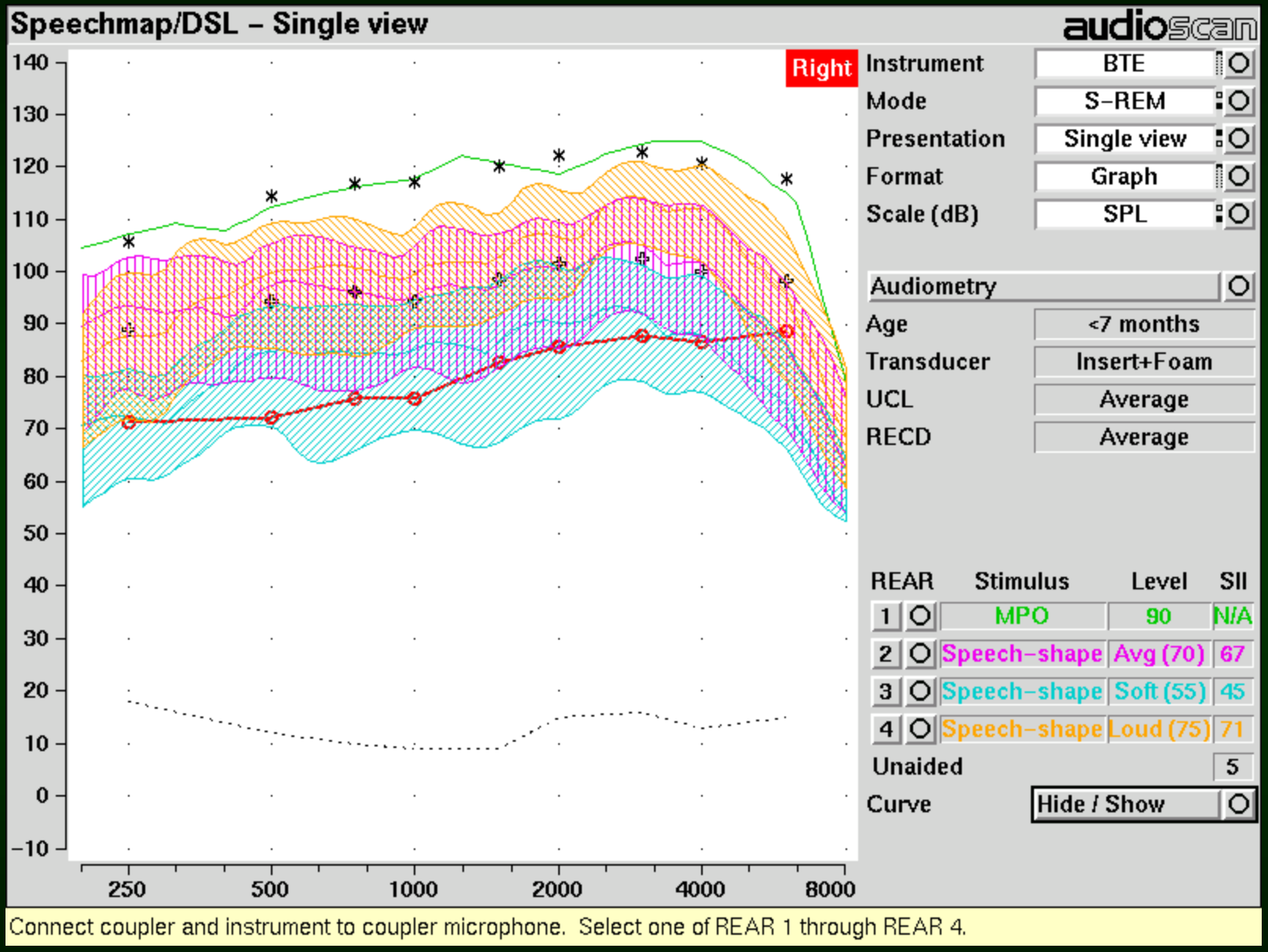
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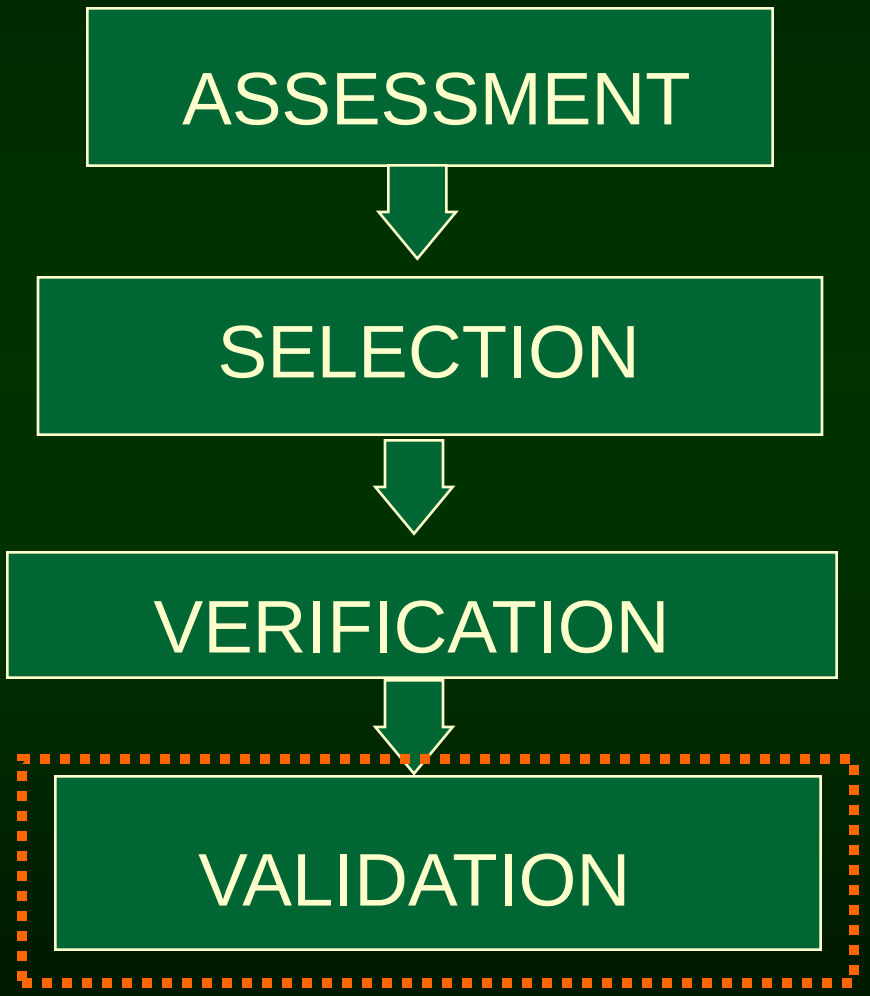

Component #7

We need to measure and monitor auditory performance and communication development with amplification over time.

- **objective measures**
- **subjective measures**