

Trust but Verify: Building upon Hearing Aid Verification Basics

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Dr. Jorgensen's Disclosures

- ▶ Completed presentations/research with many verification systems and several HA companies.
- ▶ The views and opinions expressed here are that of the authors and not the Department of Veterans Affairs or the United States Government
- ▶ The views and opinions expressed here are that of the authors and not that of the University of South Dakota or the South Dakota Board of Regents.

Why should you verify?

If there is a REASON you are ordering a device...

VERIFY THAT FEATURE!

How much does a feature "cost" you?
Time, battery life, etc?



Introduction

- ▶ Professional Ethics vs. Ethical Practice
- ▶ Best Practices in Audiology

Upfront..

- ▶ You have all been fitting hearing aids
- ▶ What have you been doing??
 - ▶ You are part of the 40% ☹

The Big Problem:

TIME
REAL WORLD

Why do you...

- ▶ Choose a certain manufacturer?
- ▶ Choose a certain product line?
- ▶ Choose a certain product level?

Question:

- ▶ Verification is:
 - ▶ The same as validation
 - ▶ Ensuring the patient is satisfied
 - ▶ Ensuring the device(s) are functional
 - ▶ Ensuring the device(s) are providing appropriate access to acoustic information

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Verification



Validation



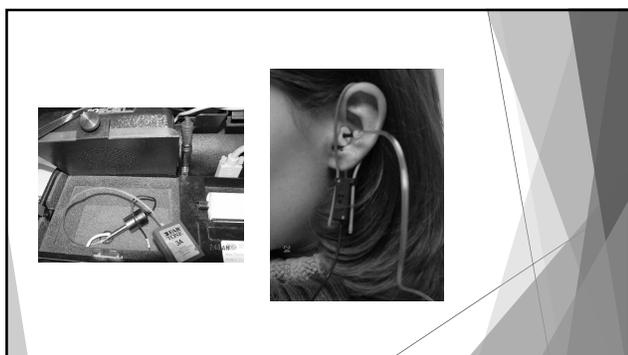
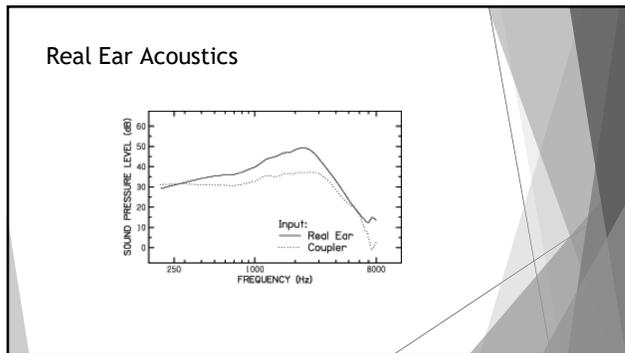
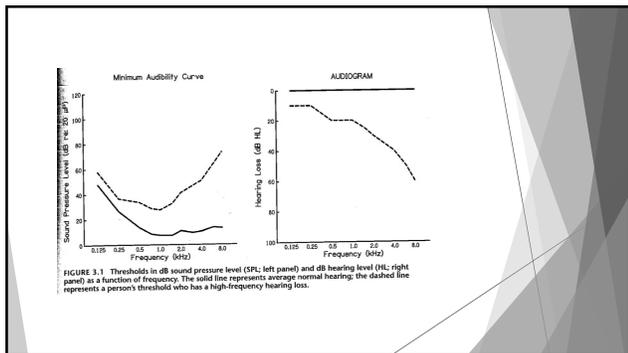
Steps to Verify

- ▶ **Audiogram**
 - ▶ Enter thresholds
- ▶ **Real-ear-to-coupler difference (RECDs)**
 - ▶ Conversation from dB HL to dB SPL for hearing aid
 - ▶ Critical, especially for pediatric patients
- ▶ **Programming on NOAH**
 - ▶ First fit vs. modification
- ▶ **Real Ear System**
 - ▶ Probe microphone measures
- ▶ **Test Box**
 - ▶ Hearing aid analyser

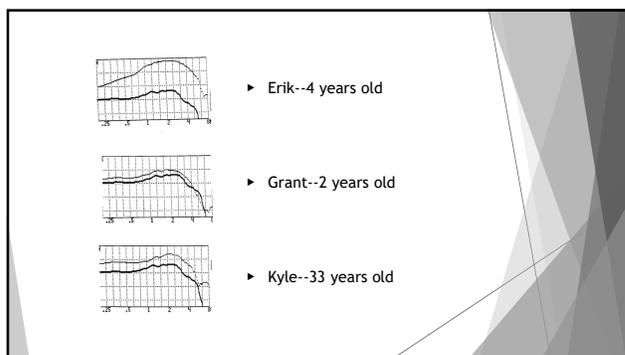
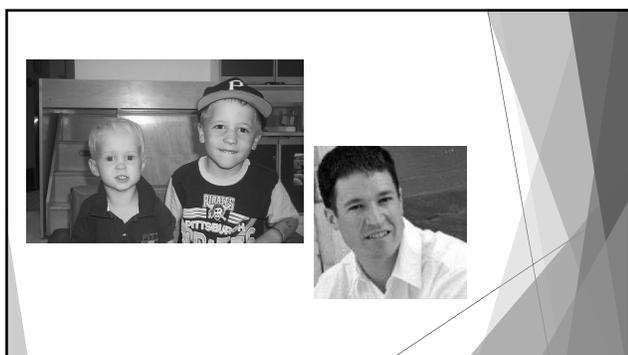
RECD

- ▶ What is RECD?
 - ▶ It has NOTHING to do with hearing aids!
 - ▶ RECD vs. wRECD
 - ▶ 2 cc Coupler vs. 0.4 cc Coupler
 - ▶ Not just for S-REM
- ▶ When is it important?





- ### Ideally you would account for:
- ▶ Residual volume
 - ▶ Earmold effects
 - ▶ Microphone placements
 - ▶ Eardrum impedance
 - ▶ Loss of natural ear canal resonance



Probe Microphone measures allow you to account for RECD and/or REUR

- ▶ RECD makes sense whenever you are dealing with couplers and want to be exact and/or know that your patient is very different from a coupler
- ▶ REUR makes sense when you are dealing with insertion gain or when all you have is sound field thresholds

A few comments about probe microphone measures:

- ▶ Equipment
 - ▶ How will it “fit” on a baby
 - ▶ Signal available
 - ▶ Upgrades you may need
- ▶ Placement

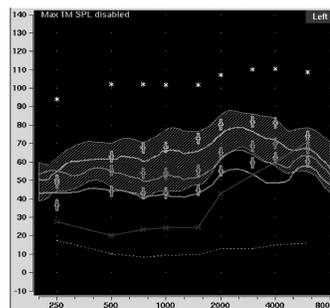
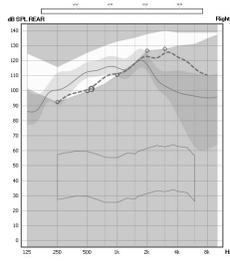
What are we going to do?

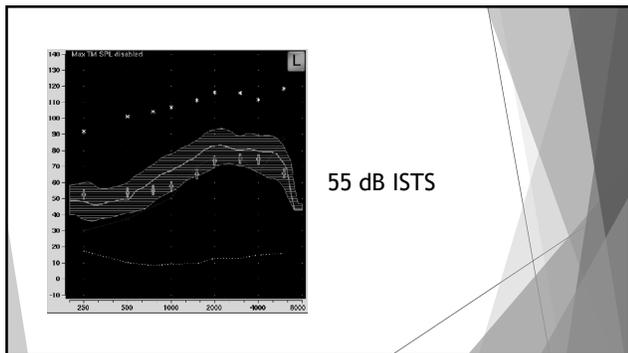
- ▶ Discuss advanced features
- ▶ Become familiar with equipment to verify advanced features
- ▶ Discuss what we can and cannot do

UGH—TARGETS!

Targets

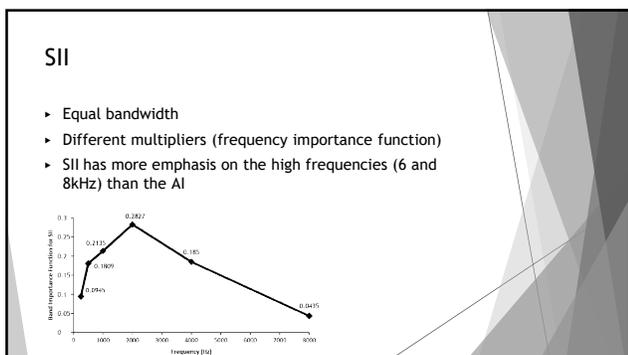
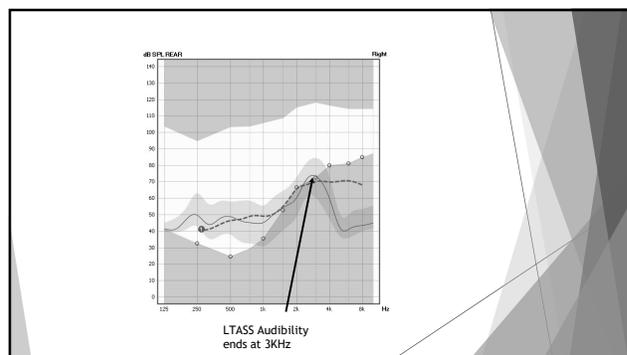
- ▶ How does this work with targets??? (DSL, NAL, etc.)
- ▶ Don't be a slave to the target—know what it means



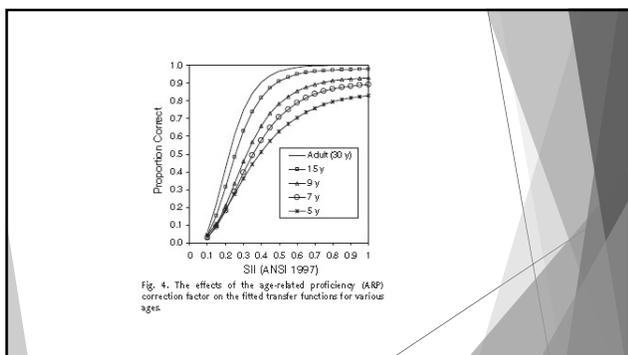
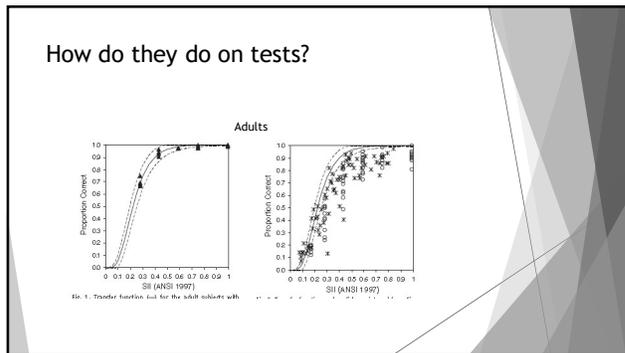
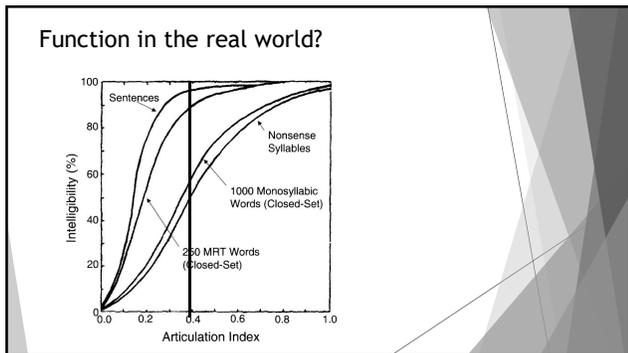


Speech Intelligibility Index

- ### Things that decrease speech
- ▶ SNR
 - ▶ Rate
 - ▶ Read speech
 - ▶ Conversational speech
 - ▶ 2-3 times faster
 - ▶ Co-articulation
 - ▶ Reverberation
 - ▶ Visual Cues
 - ▶ Audibility

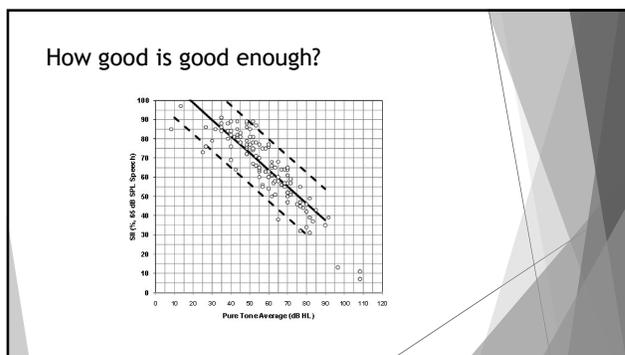
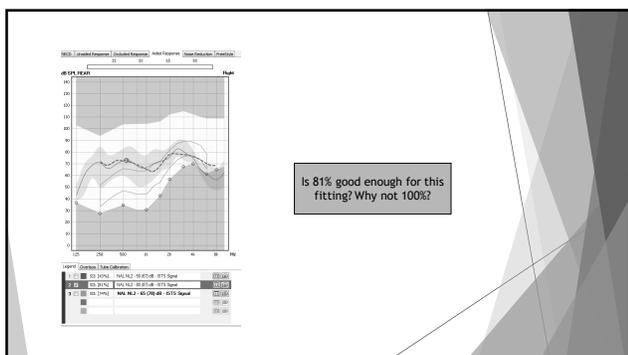


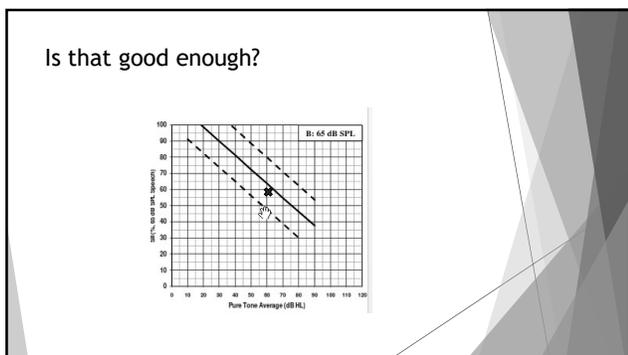
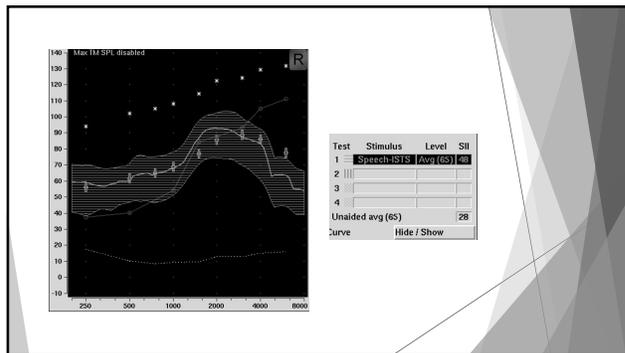
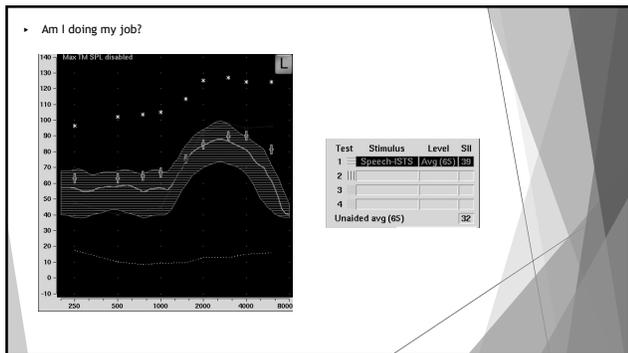
- ### Wow, that is great but!!!
- ▶ That is really complicated!!
 - ▶ How do we measure?
 - ▶ Verification system
 - ▶ "Count the dots"



So what does this all tell us...

- ▶ SII = amount of audible signal
- ▶ Context helps - particularly for adults
- ▶ Ensuring audibility is the **ONLY** current method of confirming appropriately fit aids



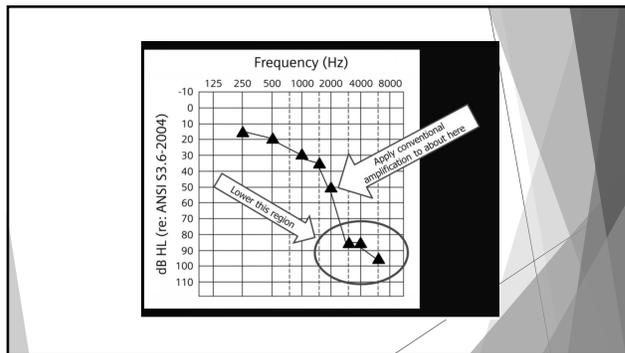


- How to use SII???
- ▶ Describing hearing loss
 - ▶ Third party payers
 - ▶ Fitting of aids
 - ▶ Are you helping?
 - ▶ Where can you do more?
 - ▶ Can you do more?

- Other
- ▶ Compression
 - ▶ Channels
 - ▶ How are your channels linked?
 - ▶ Frequency Lowering??

Why would I do this?

Frequency Lowering

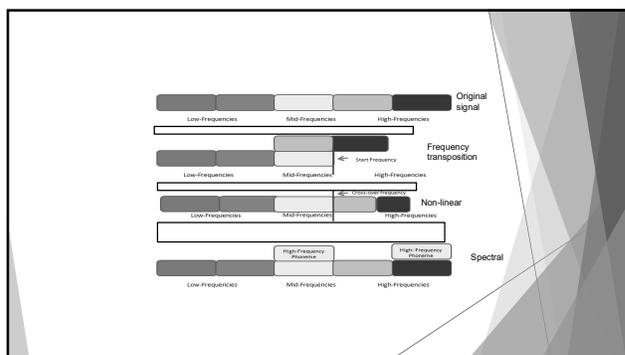
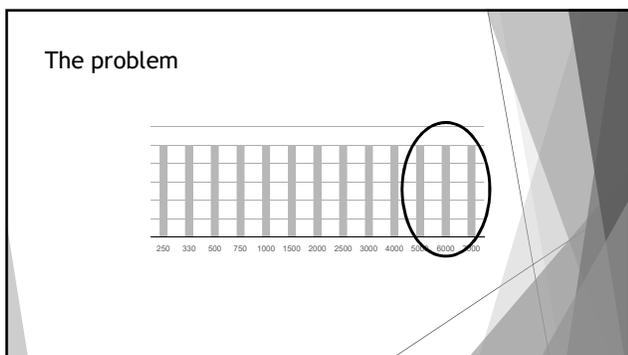


- ### Primary types....
- Transposition
 - Linear compression
 - Non-linear frequency compression
 - Spectral envelope warping

www.tinyURL.com/FLassist

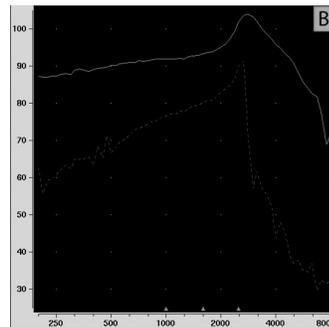
• Dr. Alexander - Purdue

Manufacturer	Feature Name	Frequency Lowering Method
Widex	Audibility Extender	Transposition (static)
	Enhanced Audibility Extender	Transposition (adaptive)
Phonak	SoundRecover ^a	Compression (static)
	SoundRecover2	Compression (adaptive)
Starkey	Spectral IQ ^b	Spectral Envelope Warping
Signia	Frequency Compression ^c	Compression
ReSound	Sound Shaper ^d	Proportional Compression
Oticon	Speech Rescue ^e	Multilayered Transposition

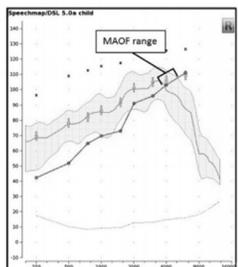


Is it beneficial?

- Problem - 90% of research is on 1 manufacturer
- People do better with it off
- But if they can't hear it - it doesn't hurt them

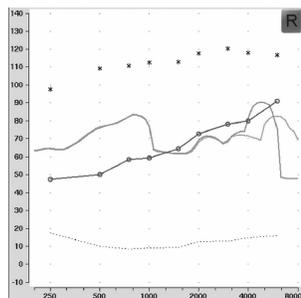


Maximum Audible Output Frequency (MAOF)



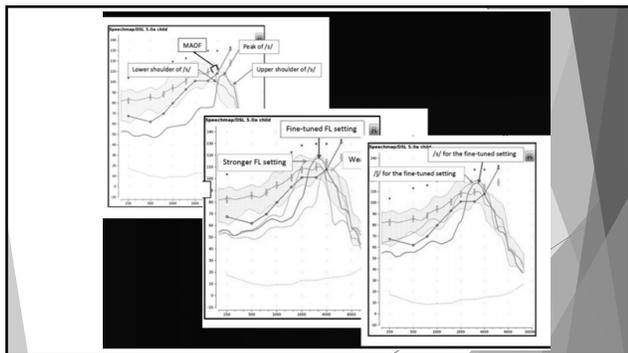
How do you fit it?

- Signal to verify that you've made high frequencies audible
 - Live /s/ and /sh/
 - Non-calibrated, non-repeatable
 - Filtered speech signals in 1/3 octave bands (3150, 4000, 5000, 6300 Hz)
 - Conservative, a real /s/ and /sh/ would be more intense because of the bandwidth/frequency spectrum
 - Female /s/ is higher than 6300 Hz
 - Pre-recorded, calibrated /s/ and /sh/
 - www.dslio.com



Newer method

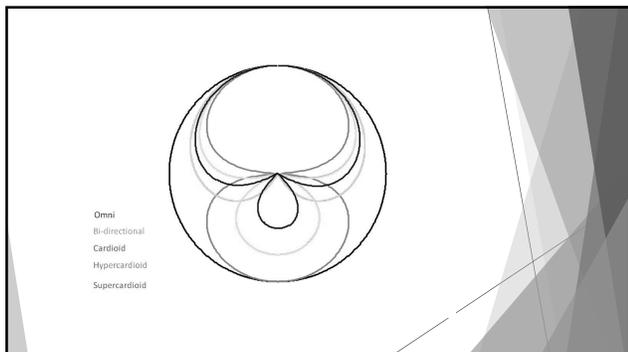
- S vs SH - more important with adaptive frequency lowering techniques

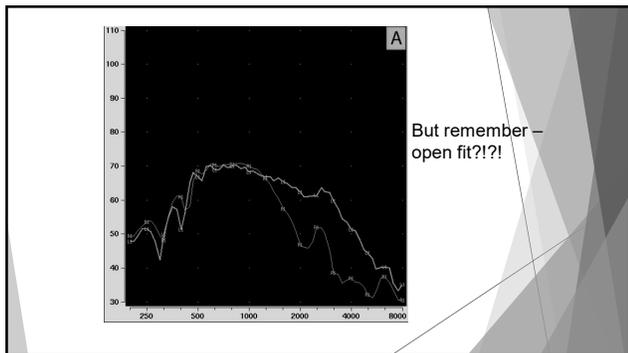


Directional Microphones

- ## Directional Microphones
- ▶ Problem:
 - ▶ Different manufacturers use different algorithms
 - ▶ What does your manufacturer do?
 - ▶ Force aids into directional??
 - ▶ Front-back vs. front-side

- ## Problem
- ▶ Primary differences between high and mid is the function of the d-mics—right?
 - ▶ Binaural integration of directional microphone
 - ▶ How do we verify???
 - ▶ Take a step back....



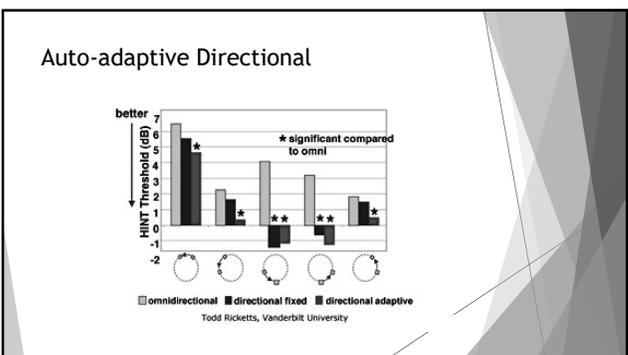
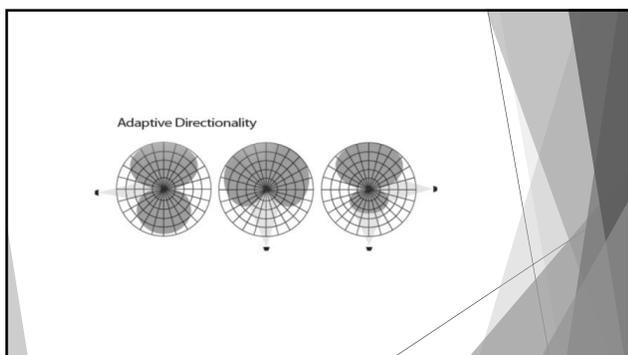
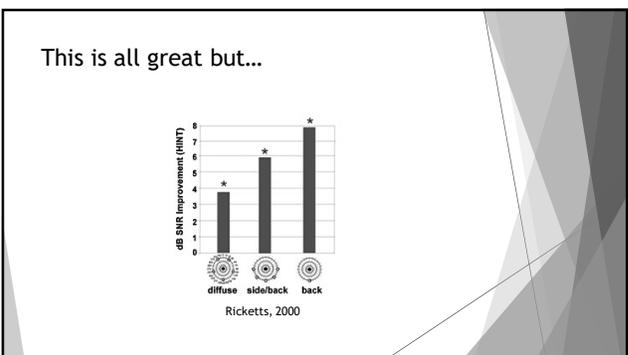


What are you verifying?

- ▶ Auto-function?
 - ▶ What does your manufacturer do?
 - ▶ What settings in the verification system?
- ▶ Manual program?
 - ▶ What does your manufacturer do?
- ▶ Something else?

Directional Benefit

- ▶ Discussion:
 - ▶ Difference between high and entry product levels?
- ▶ HOW would you verify this???



But!

- ▶ Unless you have access to a multi speaker array— you can't really verify it.
 - ▶ Unless you are Ruth Bentler or Todd Ricketts
- ▶ How do you "fake" it?

Effects of Debris

- ▶ Significant change in directional microphone benefit
- ▶ Patients reporting difficulty!

Why would I do this?

Remote Mics & Cros/Bicros

Remote Microphones / CROS

- ▶ Connectivity to HA, CI, and OIDs
 - ▶ Integrated receiver
 - ▶ Audio shoe/boot
 - ▶ Intermediary
- ▶ Electroacoustic verification
- ▶ Behavioral verification methods
 - ▶ Speech recognition testing
 - ▶ Compare results with and without remote microphone

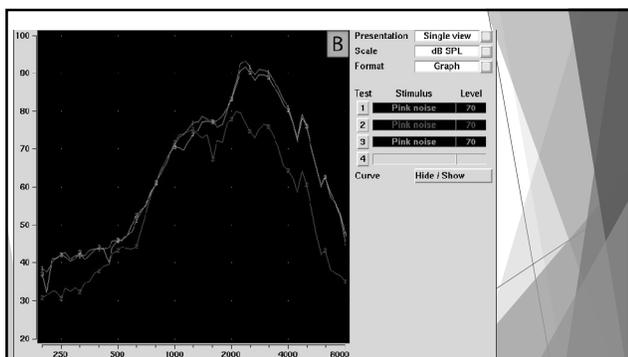


Difference:

- ▶ FM system vs. Remote mic??
 - ▶ vs CROS
- ▶ Mixing ratios

How to fit a

- 1) CROS
 - a) Fit the aid (REUR & REAR)
 - b) make sure didn't lose any gain
 - b) Verify the transmitter
- 2) BICROS
 - a) Fit the aid (REAR)
 - b) Verify the transmitter
- 3) Remote device
 - a) Fit the aid
 - b) Verify the transmitter



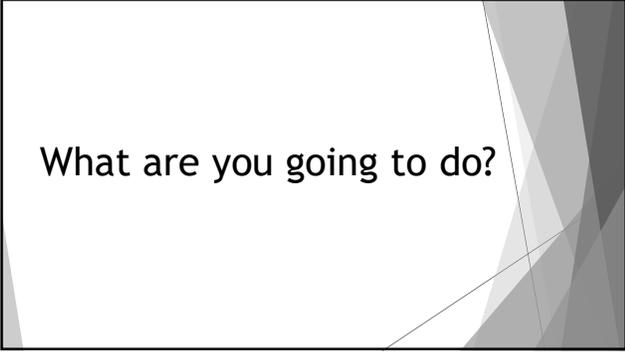
What about other transmitters?



Why would I do this?

REMEMBER:

If you order the device for a specific reason, VERIFY IT!



What are you going to do?