Benefit and Clinical Applications of Roger for Children

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  - Brett Schoenberger

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OVERVIEW

- Research with Roger Technology
- How Roger Technology has solved Wireless Challenges
- Considerations in Fitting Roger Technology

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Research with Roger Technology

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Wireless Technology Advances

- Single-channel, body-worn transmitters/receivers in the 80's
- Small, multi-channel FM receivers integrated into behind-the-ear hearing aids in the 90's

- NOW…even Smaller Receivers and Clipon Microphones which may lead to greater acceptance
- NOW…advent of digital transmission which impacts not only the signal quality but also **channel** management

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Review of Signal Processing Changes

- Traditional FM System
  - Level of FM signal is fixed above level of HA signal
  - +10 signal-to-noise ratio (SNR)
- Adaptive FM System
  - SNR varies depending on ambient noise level
  - If noise exceeds 57 dB SPL…the FM Advantaged is increased
- Adaptive Digital Modulation System
  - Digital processing is intended to provide even greater SNR at higher noise levels compared to Traditional and Adaptive FM Systems.

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Benefits of Roger Technology

- This technology can be integrated into smaller components with wider bandwidth
- The signal quality can be theoretically superior because FM channel noise is most likely not present

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How much better is ROGER technology???

Based on design of 2010 study with Traditional and Adaptive FM, the merits of Roger technology were evaluated in objective and subjective measures in adults and teens in clinical and real-world settings.

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Experimental Design

- Control for Bias in Examiners and Subjects
- Evaluate in a variety of settings with adults and children
- Obtain feedback from those with previous FM experience
- Use sensitive speech recognition materials

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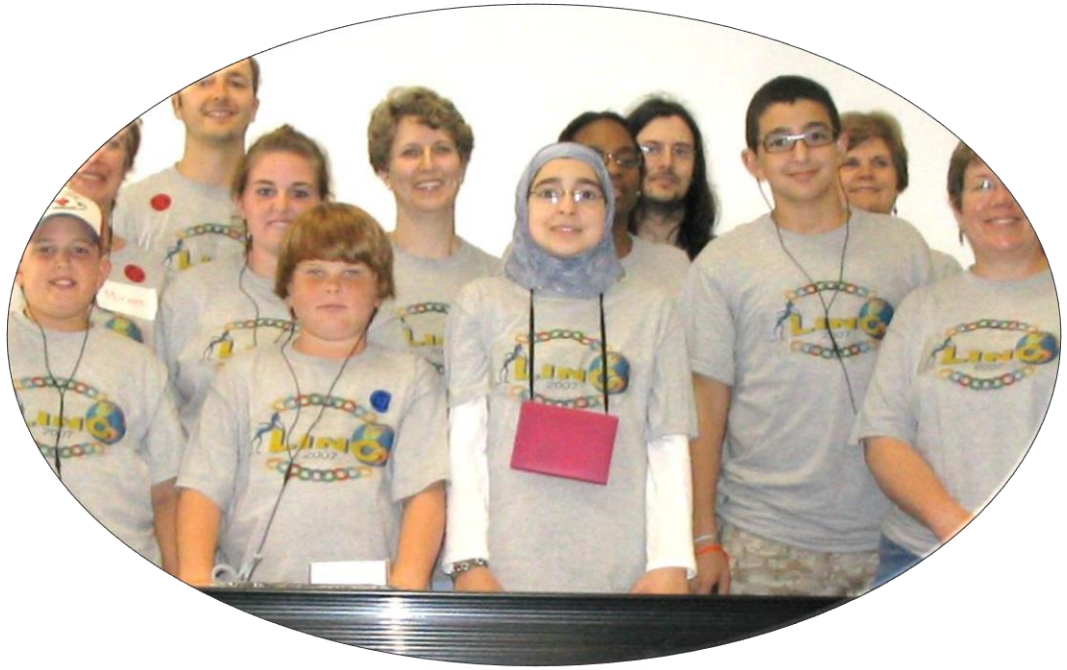
SUBJECTS

- 5 adults and 6 teens with primarily moderate-to-severe hearing loss who wore binaural behind-the-ear hearing aids
- All experienced FM users and agreed to use the system over a one-week period



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METHODS

- Audiometric evaluation
- Electroacoustic analysis of hearing aids
- Connection via DAI to body-worn test unit
- Individual and one group test session
- The sessions were conducted in a large classroom with four speakers placed at the corners to present classroom noise and one at the front to deliver the speech.
- Also had real-world evaluation at the aquarium

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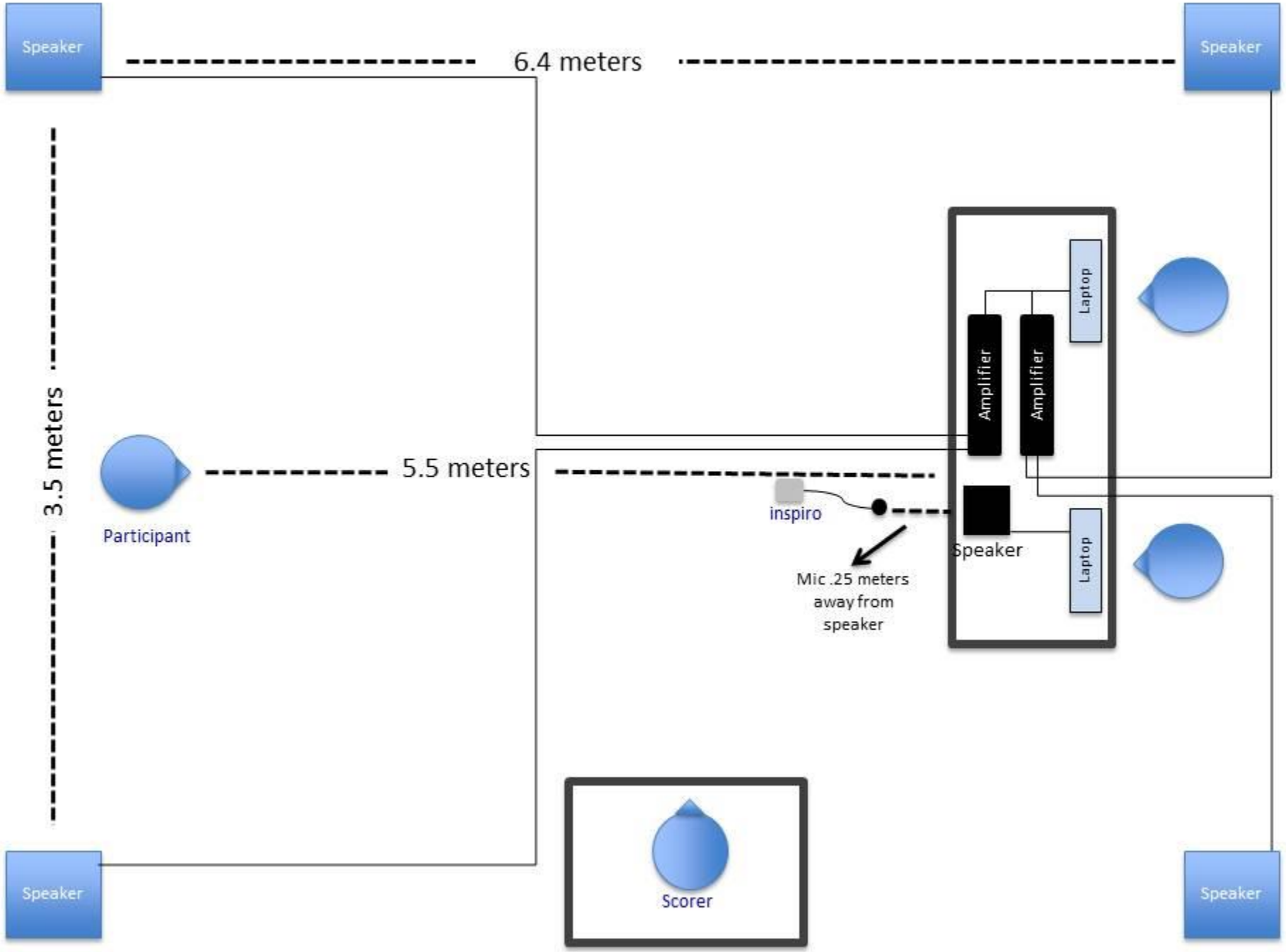
Speaker
6.4 meters
Speaker
3.5 meters
Participant
5.5 meters
inspiro
Amplifier
Amplifier
Laptop
Laptop
Speaker
Mic .25 meters
away from
speaker
Scorer
Speaker
Speaker

Stimuli

Clinical Testing

- HINT sentences presented in Quiet and 55 to 80 dBA noise
- Classroom Noise

  (Schafer & Thibodeau, 2006)

Real World Testing

Live Voice Presentation of "Lessons"

about aquarium exhibits (eg waterfall, penguins, sloth)

Ambient Noise ranged from 65 to 85 dBA

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Subjective Measures

- Four lessons were conducted in the Dallas World Aquarium
  - After listening to three to four sentences from each lesson, participants were instructed to change the setting on their test unit.
  - After each session was completed, participants rated their difficulty listening in each setting.

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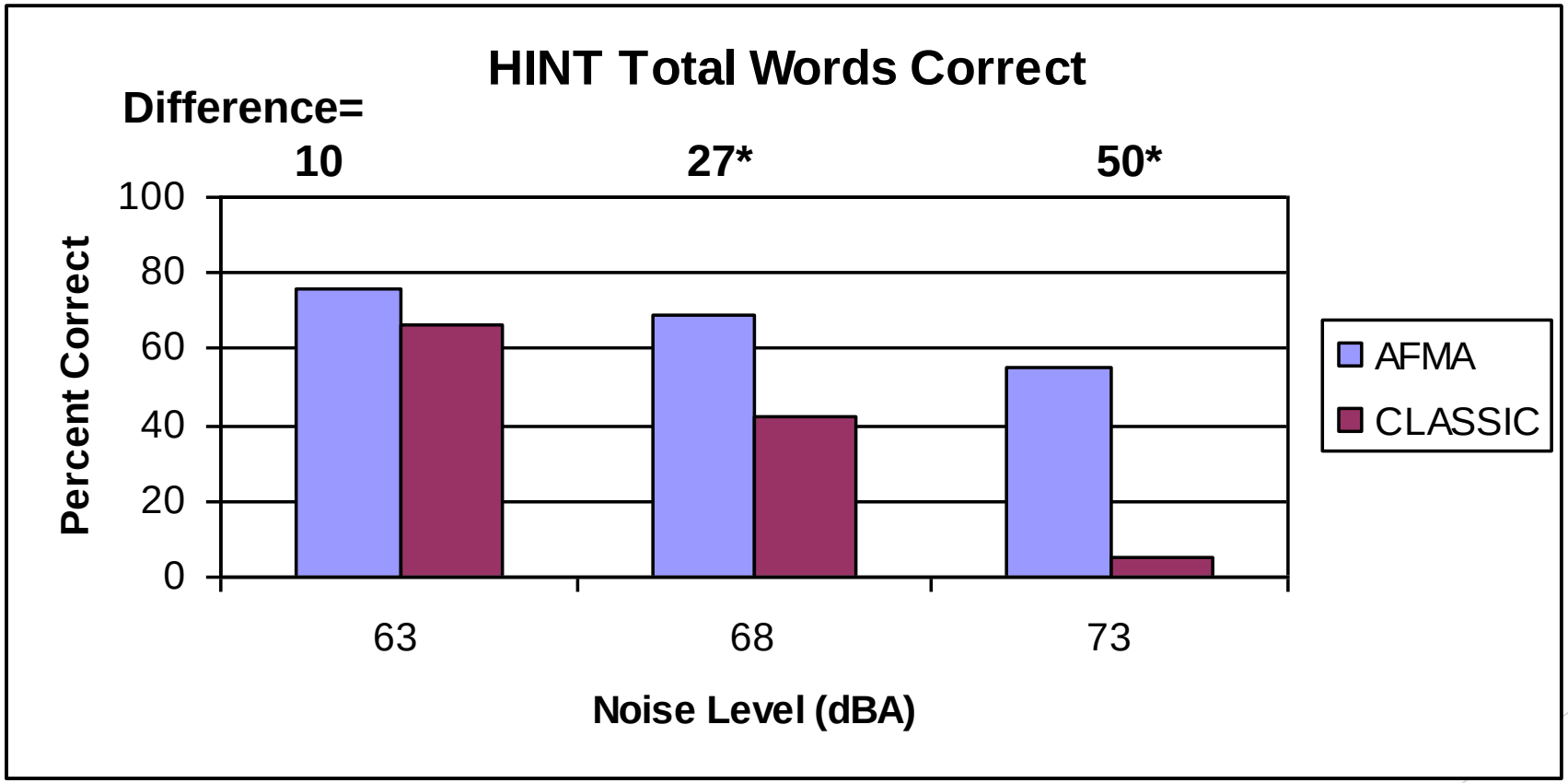
REVIEW: Traditional (classic) vs Adaptive (AFMA)
Thibodeau (2010)



Thibodeau, L. (2010). Benefits of Adaptive FM Systems on Speech Recognition in Noise for Listeners who use Hearing Aids. *American Journal of Audiology, 19*, 1-10.

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Challenging Listening at the 80 dBA Level in the INITIAL study

- 80 dBA – Not included in the statistical analysis because most listeners could not tolerate that listening condition!

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ROGER RESULTS

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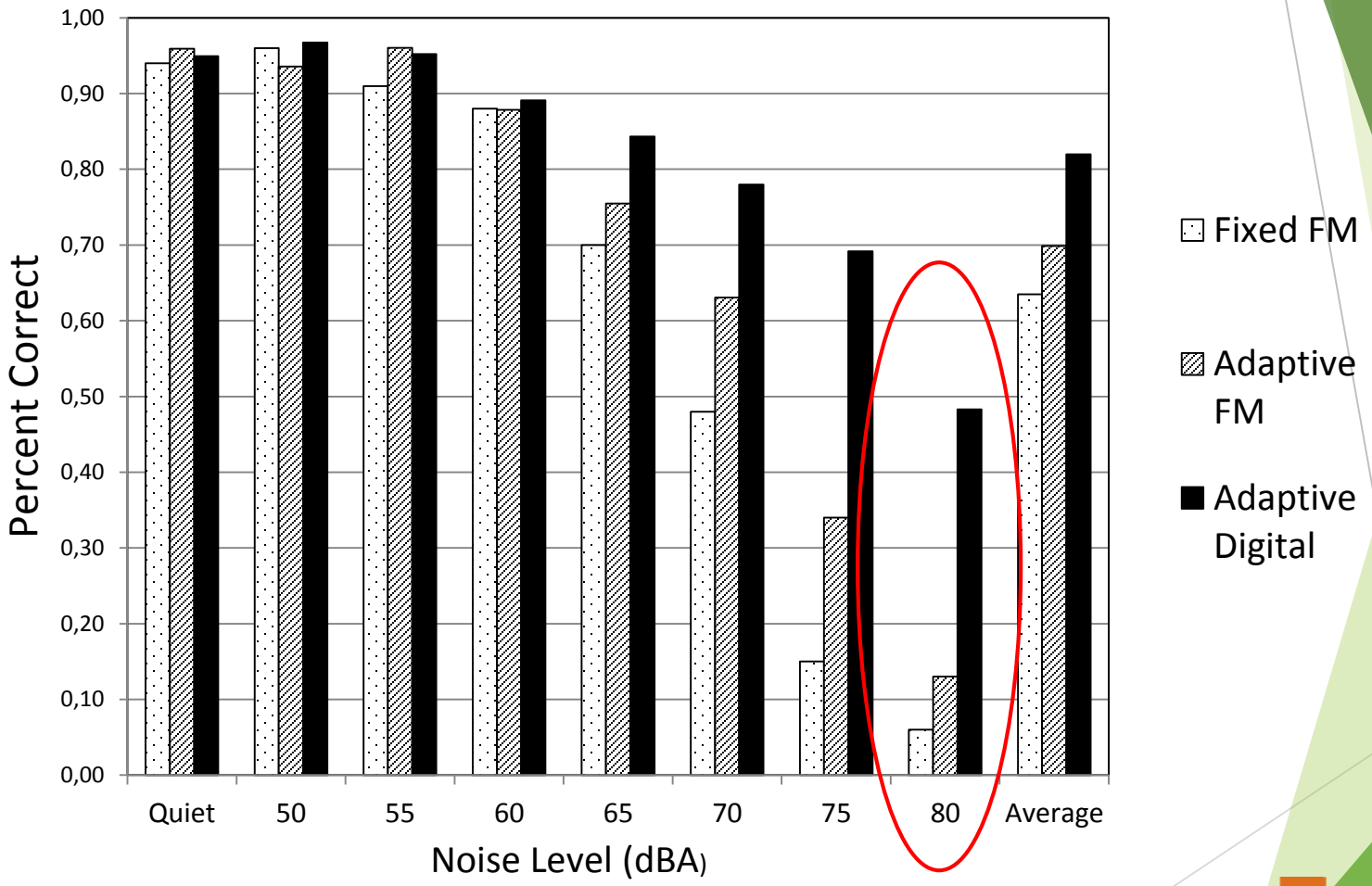
HINT Results (N=10)

Thibodeau (2014)



Thibodeau, L. (2014). Comparison of Speech Recognition with Adaptive Digital and FM Wireless Technology by Listeners who use Hearing Aids. *American Journal of Audiology, 23*, 201-210.

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Objective Measures

- Roger technology resulted in significant improvements for 65, 70, 75, and 80 dBA noise levels over Fixed and Adaptive technology.
- The average improvement in speech recognition at the **80dBA** level by
  - Roger over the current Adaptive FM was 35%!
  - And Roger over Fixed FM technology was 42%!

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INDIVIDUAL RESULTS

At the 80 dBA noise level…..

9 scored <10% for Fixed FM

6 scored <10% for Adaptive FM,

1 scored <10% for the Roger

The highest score at the 80 dBA noise was 81% (#2) for the Roger technology!

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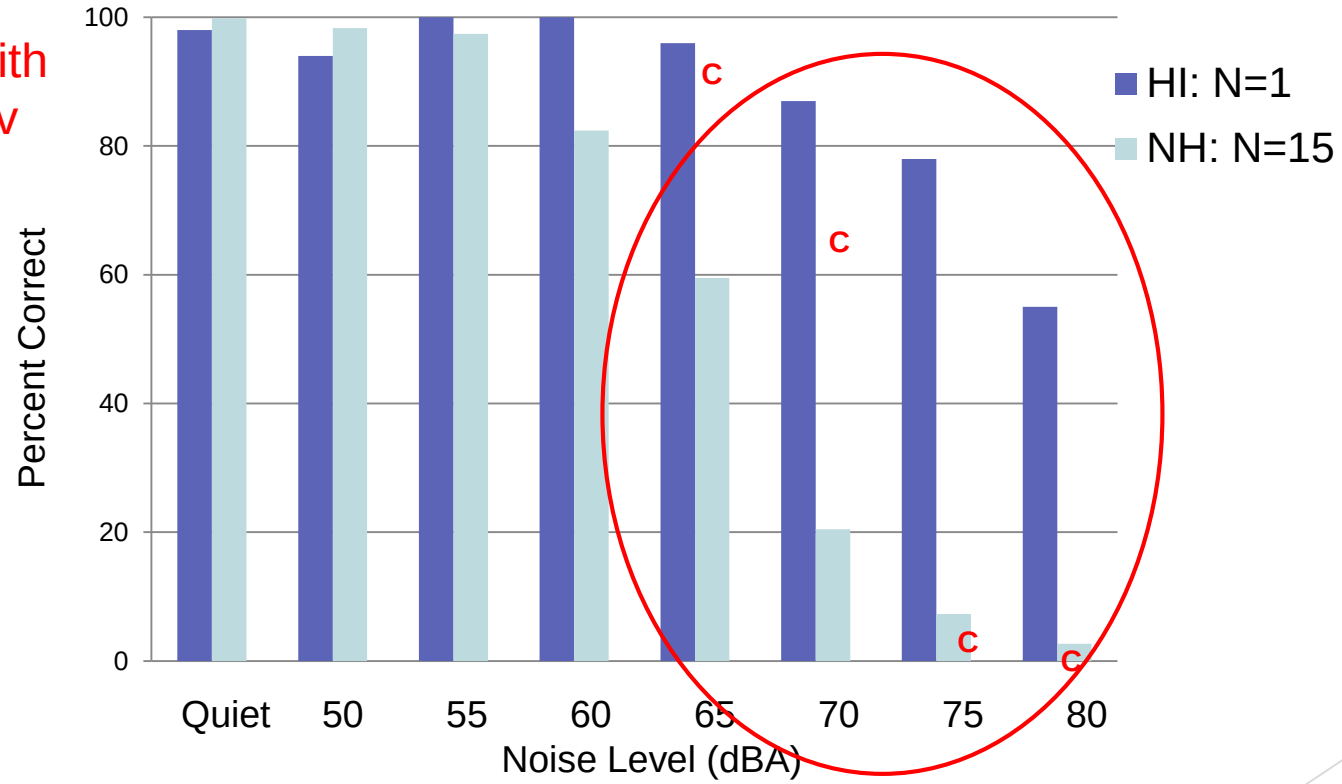
Followup Results

HI performed significantly better using her Compilot/MLxi/Smartlink+ than the young adults with normal hearing

C= Scores with Fixed FM Adv



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SUBJECTIVE RESULTS

- The participants selected a preferred setting at the conclusion of each activity.
- Eight of the participants (73%) selected the Adaptive Digital Technology as the preferred setting at the four stations.
- One selected Adaptive FM (#4) and one selected both Adaptive Digital and Adaptive FM (#7) across the listening stations.
- One of the participants who participated in the previous study (Thibodeau, 2010) commented that this new system was a “dramatic improvement” over the best one she tried in the previous study.

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SUMMARY

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ROGER vs Previous Technology

- The ROGER processing resulted in significant improvements for participants in the four highest noise level conditions.
- The benefits of ROGER processing increased with increasing noise levels.
- ROGER processing was also the preferred technology for most of the listeners in the real-world setting.

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New Work to Show Verification of FM Advantage across different Microphones

- Typical Verification is to compare output of Hearing Aid alone to the output of Hearing Aid + FM in SEQUENTIAL TESTING MANNER
- In the real world, the inputs are simultaneous
- Following method used by Platz (2012) we created two complex stimuli with 4 tones each
  - Class Noise: 375, 750, 1500, 3000 Hz
  - Teacher Voice: 500, 1000, 2000, 4000 Hz

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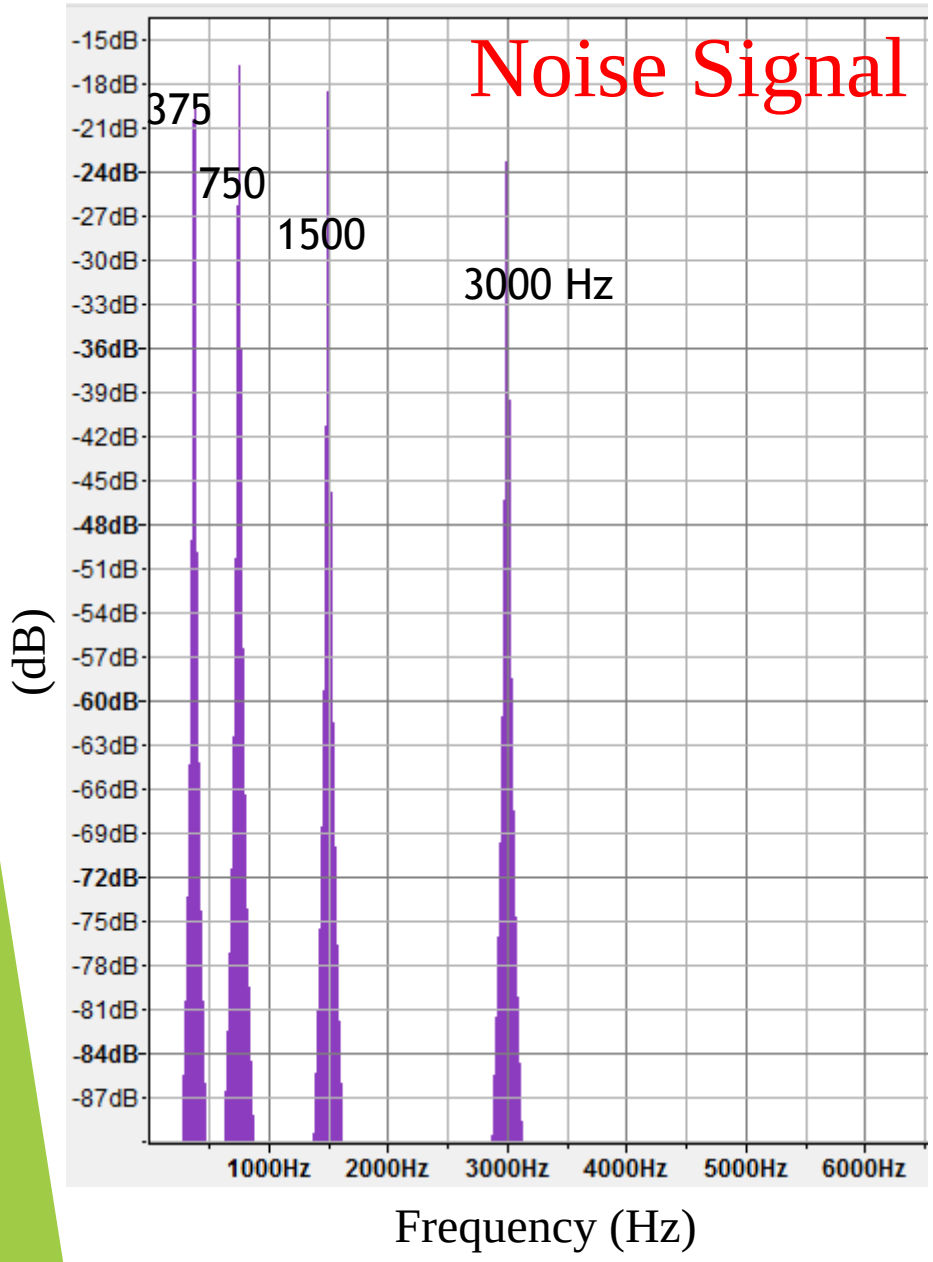

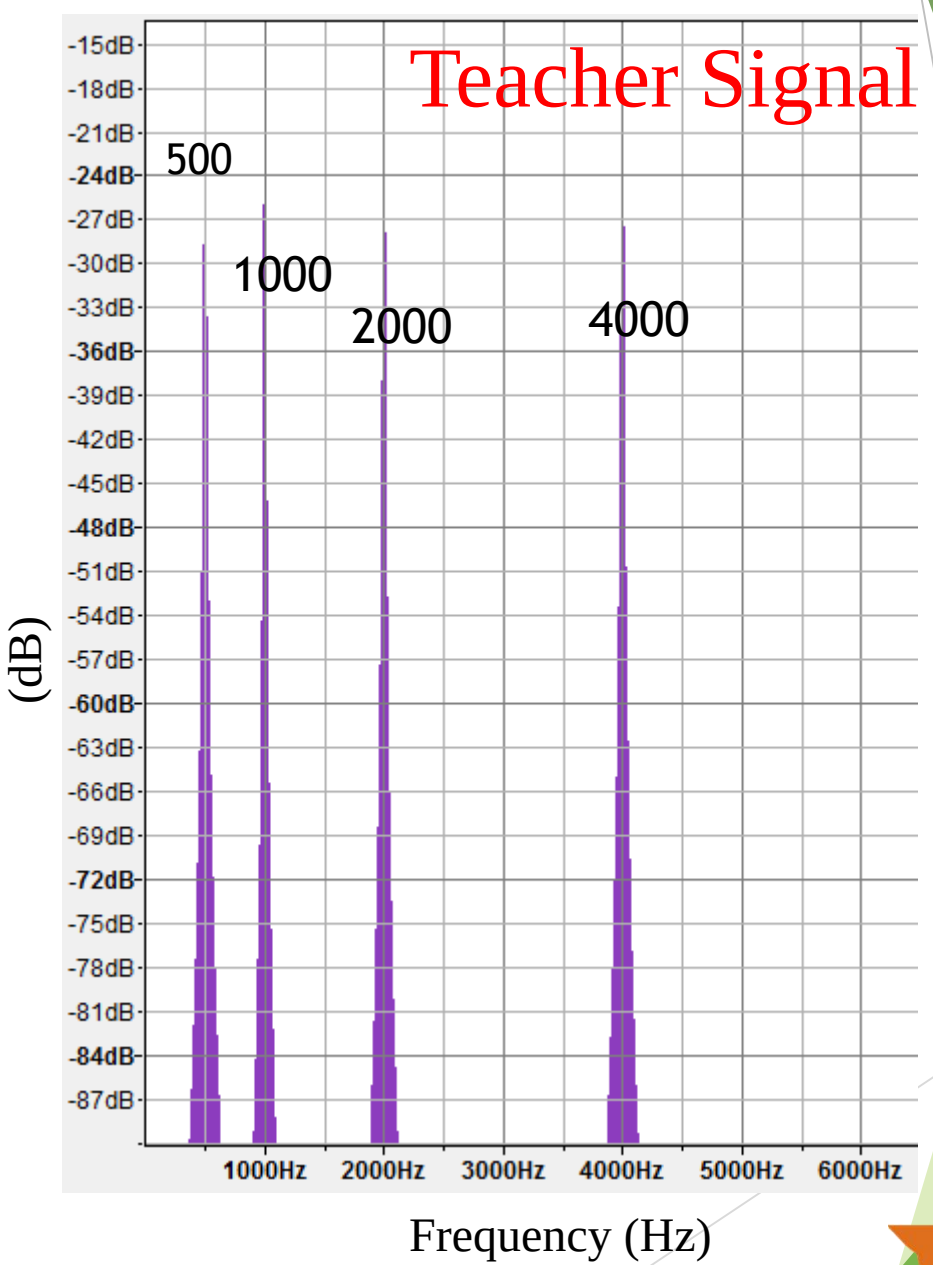

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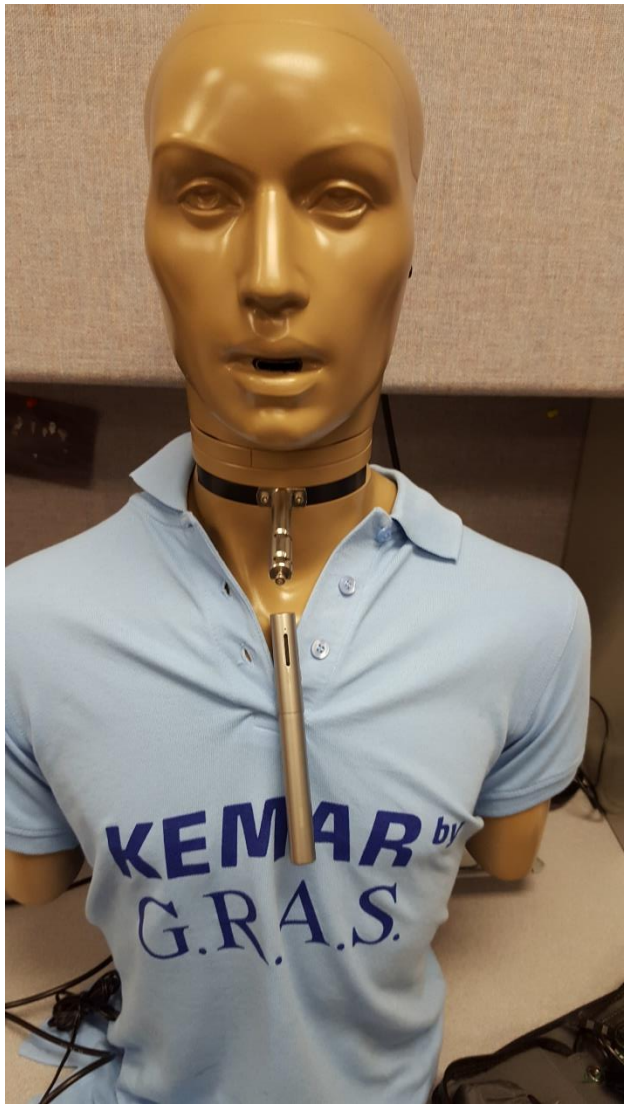
Teacher KEMAR
Wore Roger Pen



Student KEMAR
Wore HA attached to 2CC coupler

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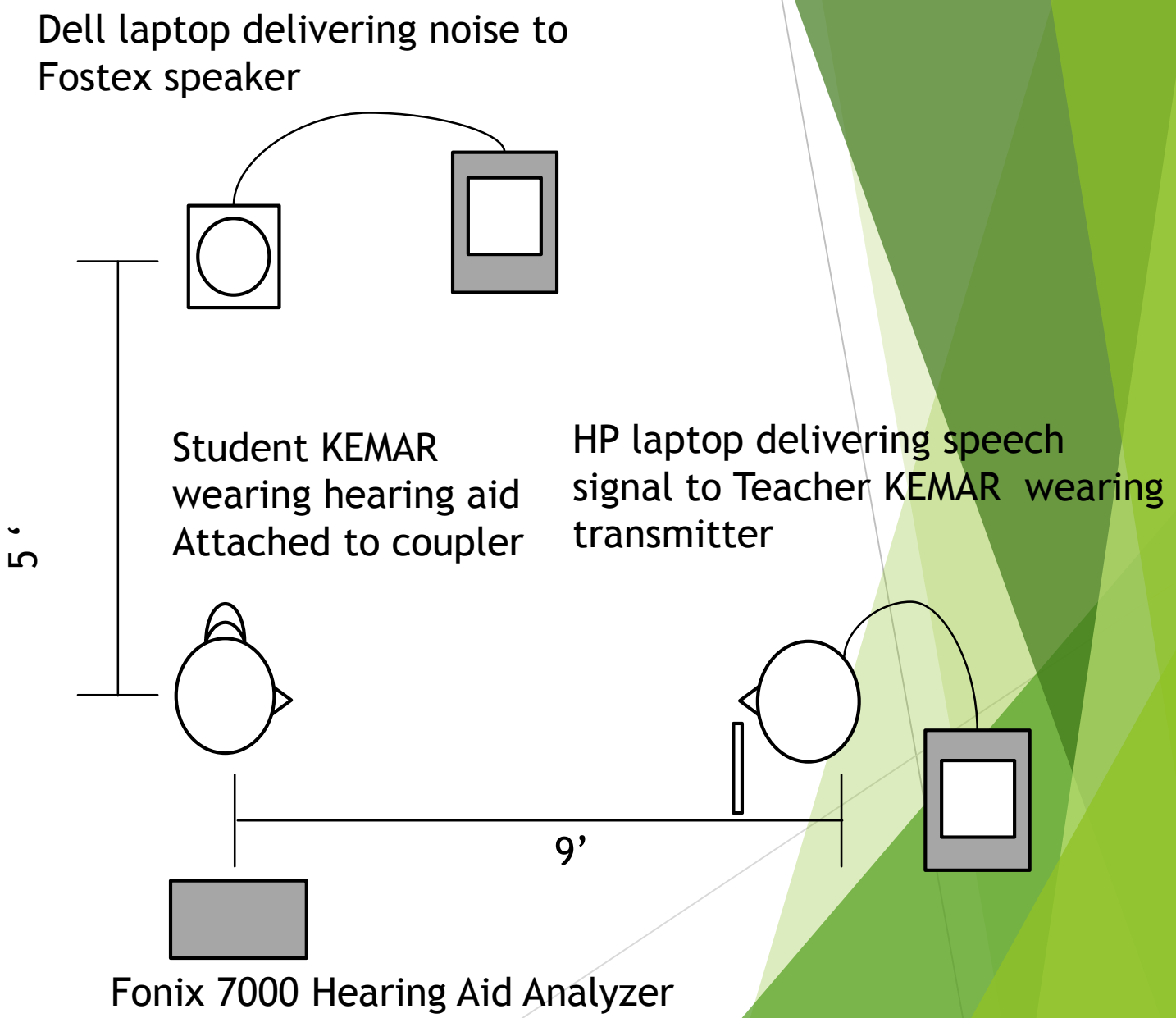
Set-up

- Noise Presented at 65 dBA measured at Student KEMAR's head
- Speech Signal Presented at 80 dBA measured 6" below teacher KEMAR's mouth (62dBA measured at Student KEMAR's head



Hearing Aid Programming-Bolero Q50

- MPO set to maximum limits
- Programmed for flat 50dB hearing loss
- DSL 5.0 as starting point
- Fine tuned- noise stimuli resulted in 75 dB output as measured by 2-cc coupler at all frequencies (375, 750, 1500, 3000 Hz) ± 3 dB
- During wireless system testing, hearing aid microphones were set on mute

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Procedure

- Each wireless system was analyzed using the following procedure
  (1)Hearing Aid alone
  (2)Hearing Aid + Wireless System

  For both conditions frequency response of the hearing aid was measured using the “live” test box feature of the 7000 FONIX hearing aid analyzer

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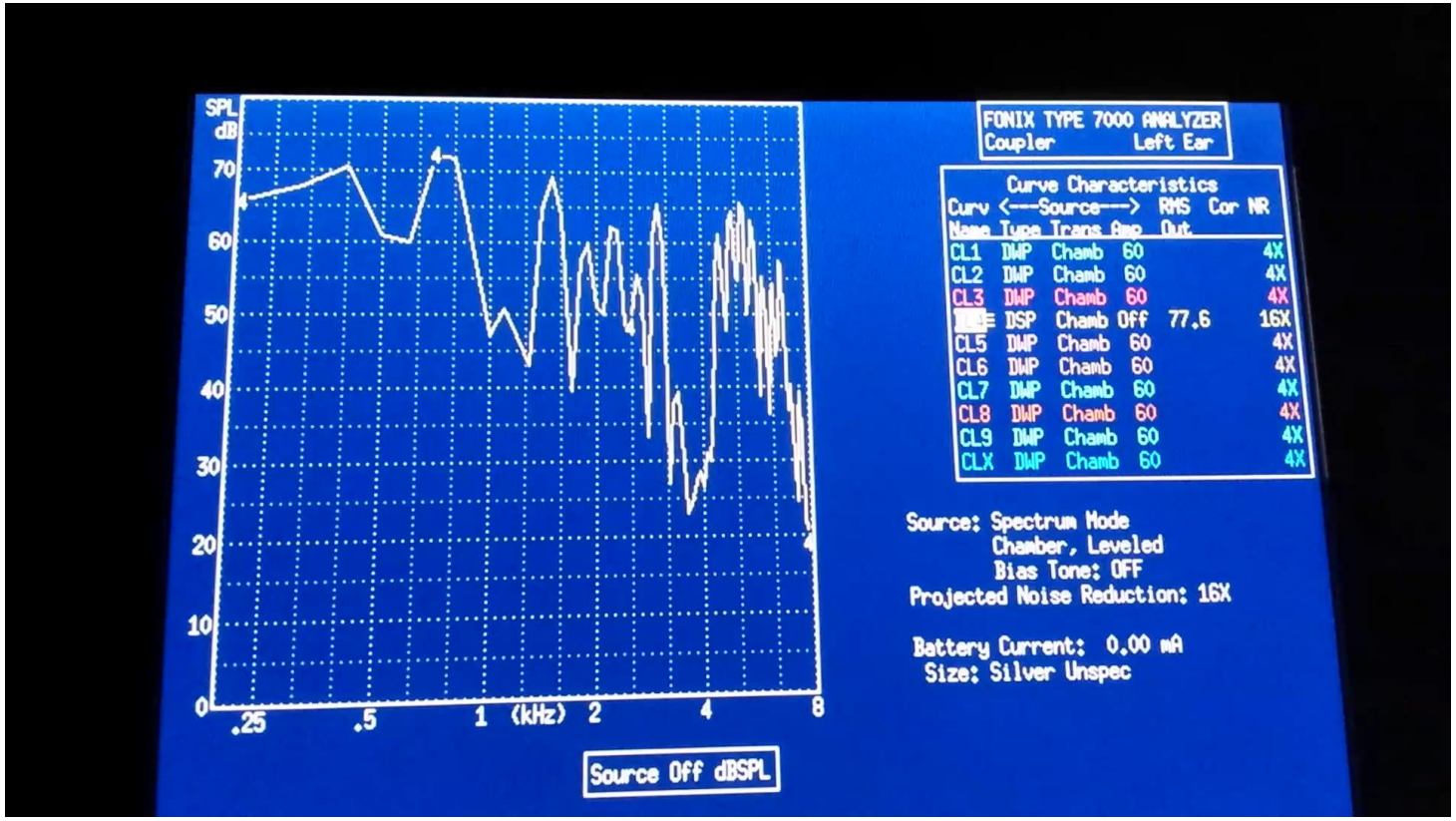
Movie of the Spectrum of HA Output NO Roger System



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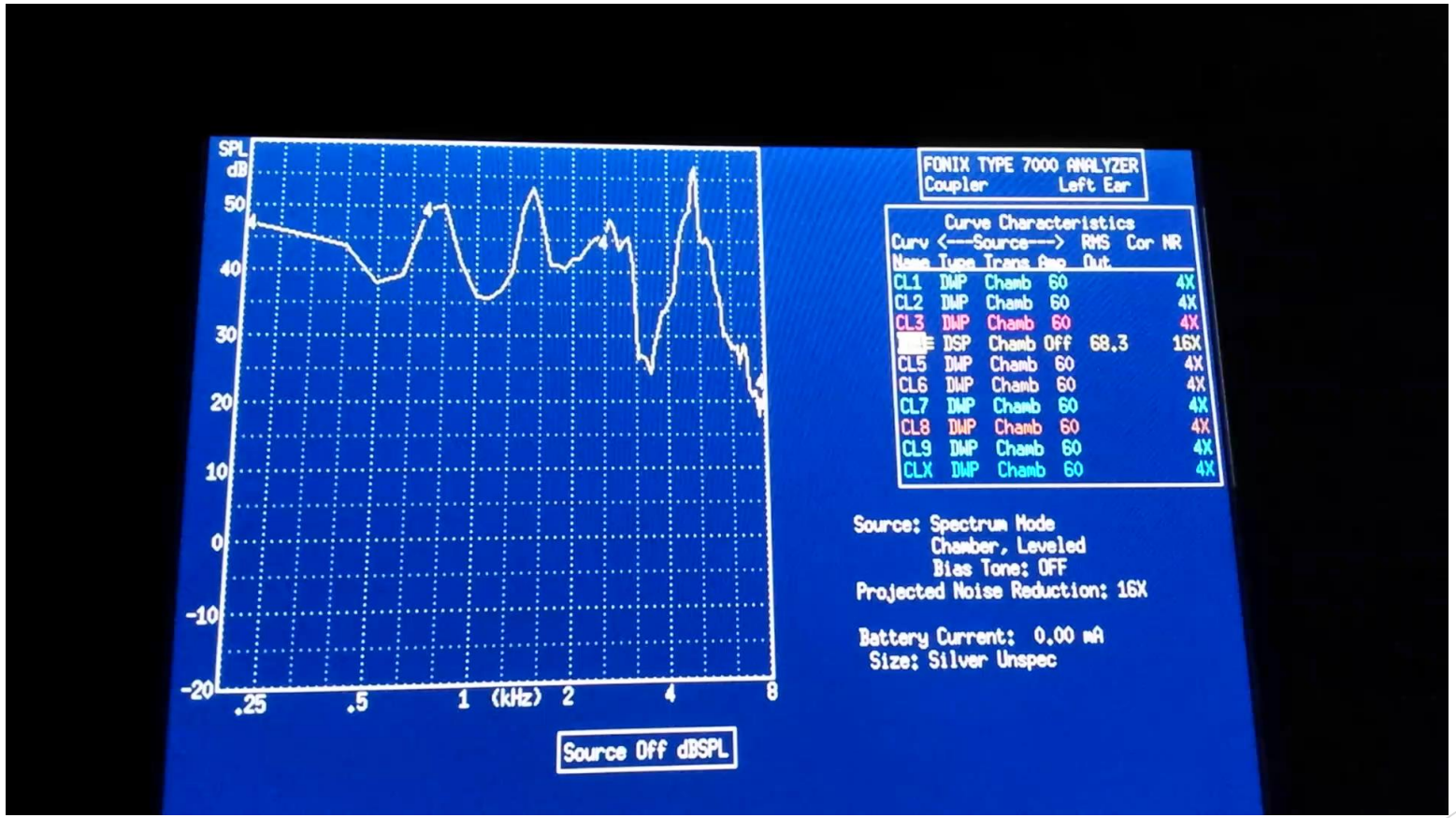
Movie of the Spectrum of HA Output WITH Roger System



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How Roger Technology has solved Wireless Challenges

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#1 CASE OF ROGER REMOVES RELUCTANCE

- JM – seventh grade – bilateral implants said he didn't like to use the FM system mainly because of the transmitter.
- Uses inspiro Transmitter with MyLink Receiver
- Reportedly, when he gives it to the teacher, often the class is held up to get it on.
- He asked about a new system that was like a pen that I had mentioned last fall.
- He wants to use a transmitter that could stay on his desk.

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#1 CASE OF ROGER REMOVES RELUCTANCE

- He was offered an Easylink to try for a week.
- When asked about using the MLxi with Euroadapters, he doesn't want ear level receivers as he believes they are too heavy.
- He agreed to MAYBE set the transmitter on the teacher’s desk to perhaps improve his reception rather than hold it on his desk.
- He was VERY excited to try the Easylink but most of his questions centered around the Roger Pen.

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#1 CASE OF ROGER REMOVES RELUCTANCE

Seventh Grader:

Hi Dr Thibodauu, I was wondering when you planned to come see me again. I'm very excited about the new FM system and have been researching and telling my parents and teachers about it.I like the one I'm using and it is working OK but I would really love to use the newer model.**I can't wait to see you!!**
Thank you, JM

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#1 CASE OF ROGER REMOVES RELUCTANCE

- Verification with modified BKB SIN test at school
- Use a modified BKB Sin test with portable speaker and cell phone!

Jam Speaker
Pair with Cell phone
To present Classroom Noise

BKB Sin noise ONLY
stored on Dropbox for
access via phone

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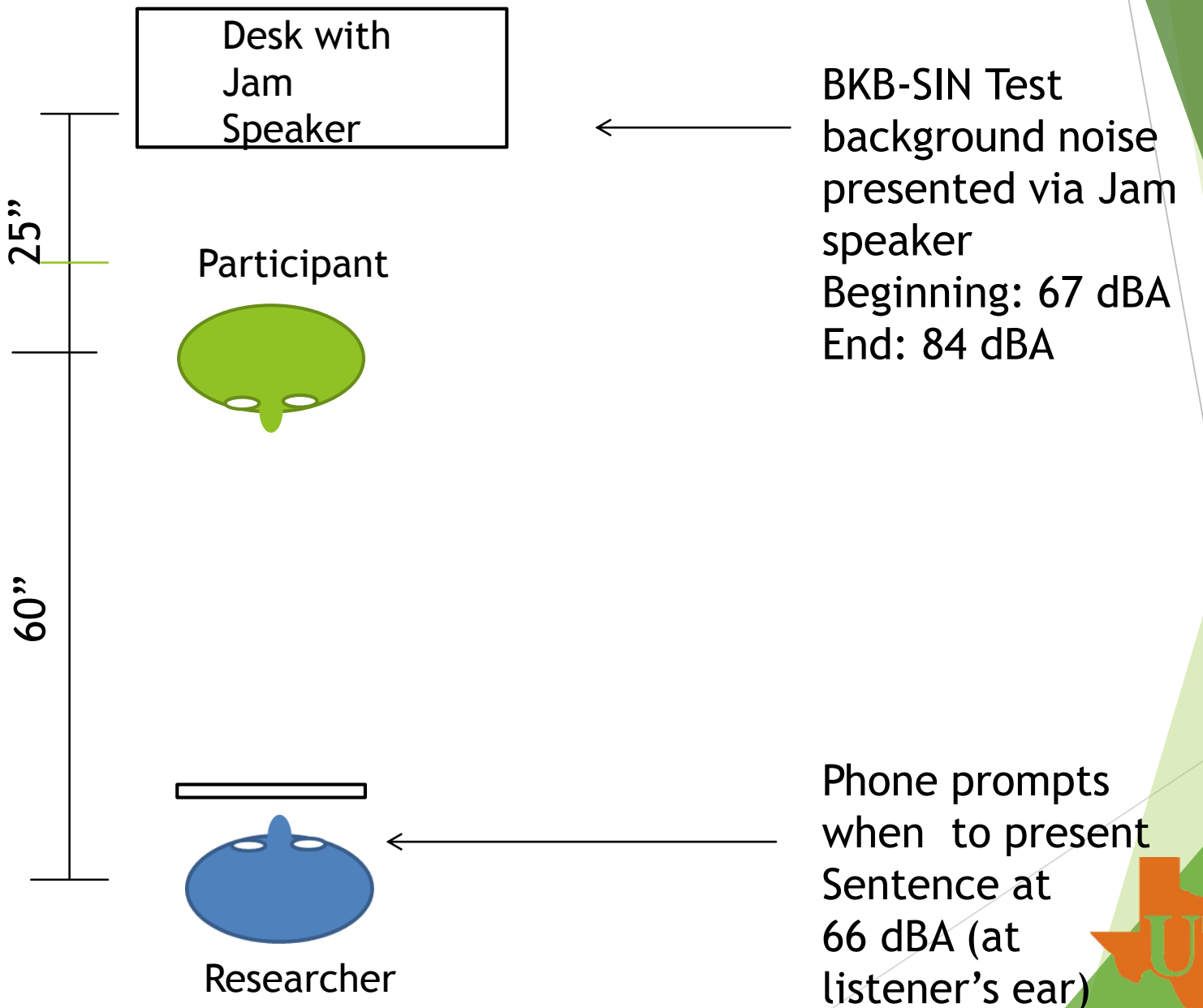
Classroom Condition



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#1 CASE OF ROGER REMOVES RELUCTANCE

- Test results scored as percent correct key words repeated
- CIs only:19%
- CIs+Mylink+Inspiro: 100%
- CIs+Mylink+Easylink worn by LT: 95%
- CIs+Mylink+Easylink held by JM: 42%
- Cis+Rogerx+Roger Pen worn by LT: 100%

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#2 CASE OF ROGER RESCUES RADIO

- Sixth grader with considerable FM experience getting set up for new school year with NEW ROGER system
- Step one: ANSI S3.22 Verification of Personal Aids- Oticon Safari P 900
- Step two: AAA Protocol for Verification of Transparency with Roger Receivers added to the aids
- Step three: Behavioral Testing???? Only if needed to convince student, school, parents of need for wireless system OR if student wears cochlear implants.

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#2 CASE OF ROGER RESCUES RADIO

ANSI S3.22 Verification

What about ANSI Standard for Hearing Assistive Devices??

#2 CASE OF ROGER RESCUES RADIO
ANSI S3.47 Verification???

The wait is over!

ANSI S3.47-2014 Specification of Hearing Assistance Devices/Systems (HADS)

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MEASUREMENTS
ANSI S3.47 Specification of HADS

- The electroacoustic characteristics described within the standard include:
  - Family of response curves (60- to 90-dB SPL input in 10 dB increments)
  - Output sound pressure level for 90-dB SPL input
  - Frequency range
  - Total harmonic distortion
  - Noise level with no input
  - Input-output characteristics
  - Dynamic automatic gain control (AGC) characteristics
  - Gain control linearity
  - Current drain

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#2 CASE OF ROGER RESCUES RADIO

AAA Protocol Verifying Transparency

EHAFM65

EFMHA65

E-Electroacoustic; HA-Hearing Aid;
FM-Frequency Modulated; 65 dB SPL input
Transparency: Matching output with equal inputs ± 3 dB

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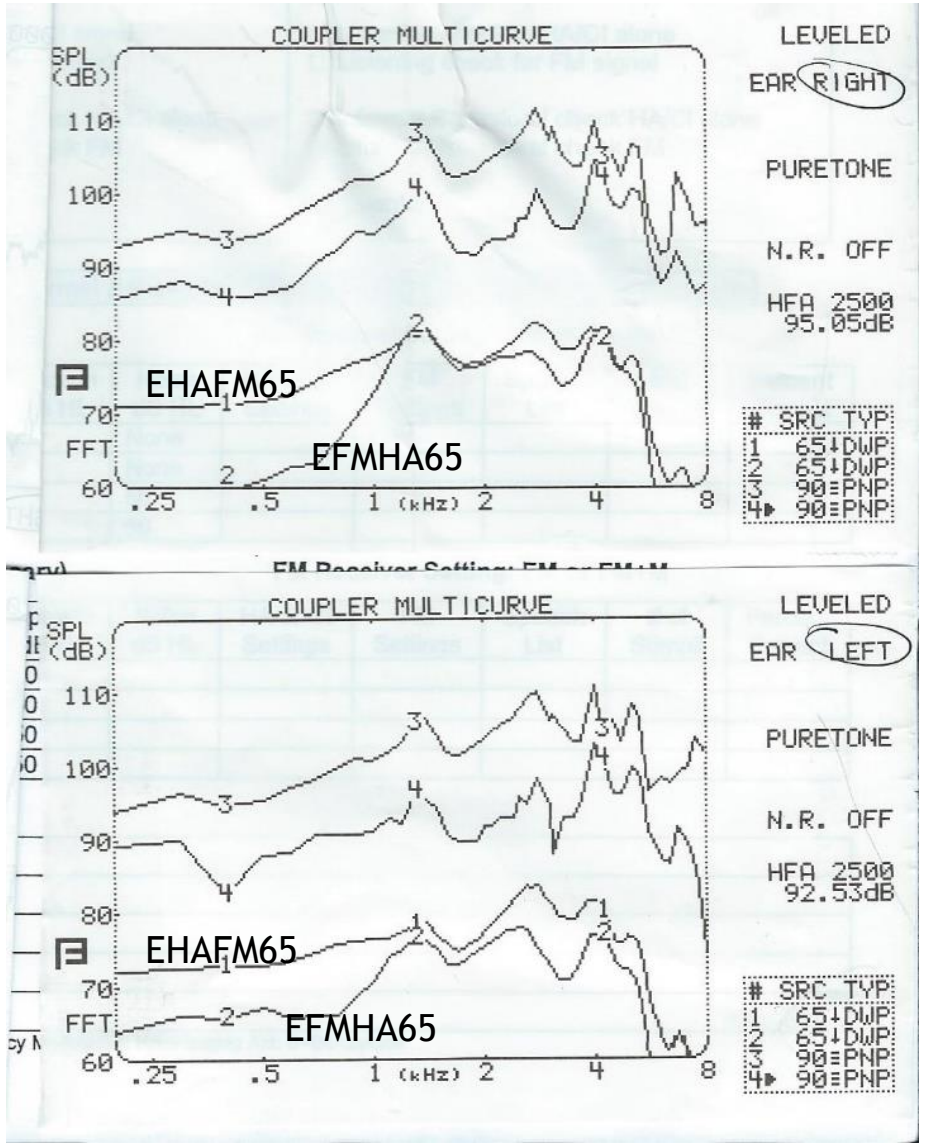
#2 CASE OF ROGER RESCUES RADIO



Transparency affected by Directional microphone because Testing NOT done in the "Verification Mode" which would turn off the directional features and curves would have better match in lows.

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#2 CASE OF ROGER RESCUES RADIO

Sixth Grader: This sounds so much better than my old system. It doesn't sound scratchy like an old 1980's radio anymore!

My Response: Were you even born in the 80's????

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#3 CASE OF ROGER Reduces Racket!

- Sixth Grade Student with Opus II Bilateral Cochlear Implants used inspiro and Mlxi successfully in elementary school
- In middle school received random static that was not related to wireless equipment, specific location, time of day, or channel
- Problem solved with Roger Inspiro and Roger X receivers!
- Also solved issue for Cochlear N5 user

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CONSIDERATIONS IN FITTING ROGER SYSTEMS

1) Don't mix FM and Roger Technology. May have timing and quality differences.

2) Unless Dual Band Transmission is needed (FM AND Roger), Set to only transmit Roger.

3) When asking teachers to do a listening check, demonstrate proper mic placement (clipped midline, 6 inches below mouth rather than whispering into mic held directly in front of mouth).

4) Show students how to HAVE FUN with wireless technology!!

Show them how to use with computer, iPad, phones, etc

Use for games at Camp??

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Have FUN with wireless technology!

Theme of Camp CHAT-
Communication Habilitation via Audition for Teens

- Baseball!
  - Start with Pre-Game Warmup-Check HA, fit Roger Systems
  - There are 9 innings –

    each with a game or set of activities
  - Grad student mentors called “coaches”

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CONSIDERATIONS IN FITTING ROGER SYSTEMS

4) Explain ROGER is the NAME of the System ….not the Rep who will check in daily

5) Explain Battery Drain increases when receivers are attached. May be strong to drive the HA but not the HA+Roger system.

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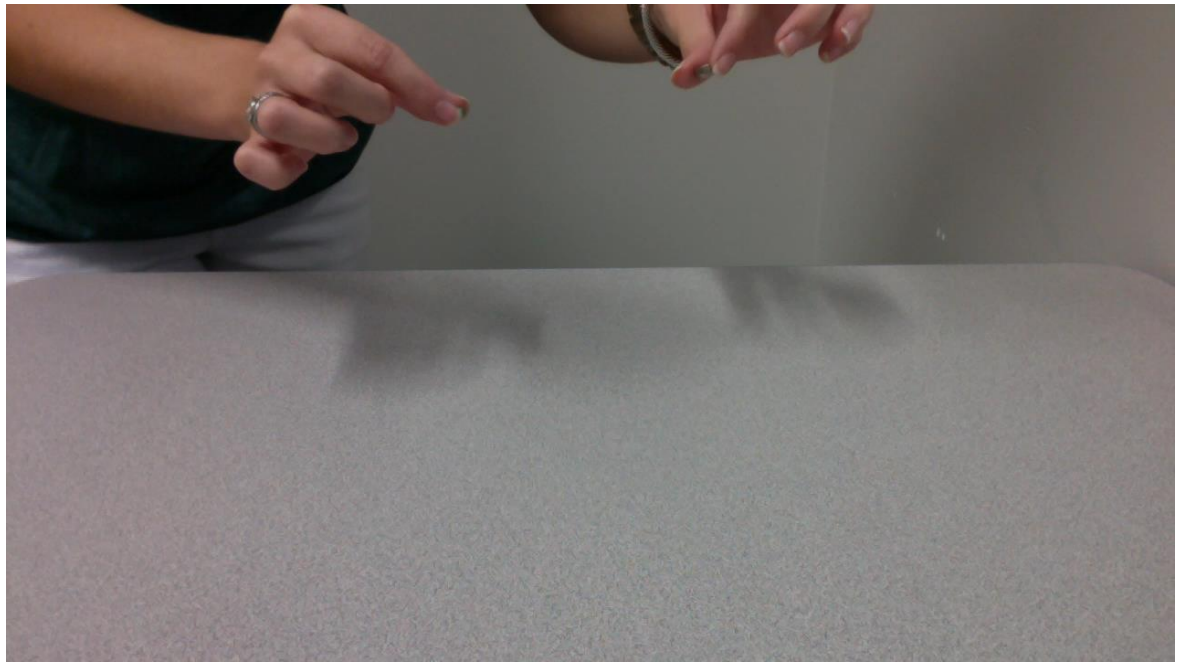
Tidbitdeau

Tidbitdeau

HOW TO TELL NEW FROM OLD BATTERIES

- Alternative for using a voltmeter
- Easy to use in the real world

FRESH BATTERIES LAND/STOP



DEAD BATTERIES BOUNCE/ROLL

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UPDATE ON ELEANOR!

- The bilateral cochlear implant young girl with faithful FM use since age 18 months
- Series of videos with the technology progression!

- Traditional-Fixed FM-Riding in the Car FCEI_Car18mths.mp4
- Adaptive FM-Riding in the Car with Music! FCEI_Car3years.mp4
- Roger-Visiting noisy mall with merry go round! FCEI_Carousel.mp4

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Summary

- Roger Technology provides significant benefit over previous devices, particularly at higher noise levels.
- Verification of wireless technology is important using ANSI standards and AAA guidelines.
- Roger Technology can help children overcome stigma, interference, and poor quality issues.
- Education for users is essential to ensure proper microphone use, battery life

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Thank you for your attention!

Obrigada!

Muchas Gracias!

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