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Programa de Audiologia, University of Texas at Dallas
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- Investiga sobre la percepción del habla y el procesamiento auditivo en niños hipoacúsicos y sobre los resultados de los sistemas de amplificación y de las ayudas técnicas
- Miembro del comité ANSI para el desarrollo de normas para la evaluación electroacústica de ayudas técnicas
- Directora de los programas de audiología y de entrenamiento de especialistas en rehabilitación auditiva pediátrica

FUNDACION RAMON ARECES

Unidad de Sordera y Vértigo

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Integración de las tecnologías de apoyo en bebés con pérdida auditiva para optimizar los beneficios auditivos

Integrating assistive technology for infants with hearing loss to maximize auditory benefits

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Integrating assistive technology for infants with hearing loss to maximize auditory benefits

Linda M. Thibodeau, Ph.D.

University of Texas at Dallas
Advanced Hearing Research Center
Callier Center for
Communication Disorders

II International Symposium Early Identification, Diagnosis and Treatment of Deafness in Infants
Ramon Areces Fundacion
Madrid, Spain

Acknowledgements

Ramón Areces Fundacion

- Phonak
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  - Jessica Sullivan

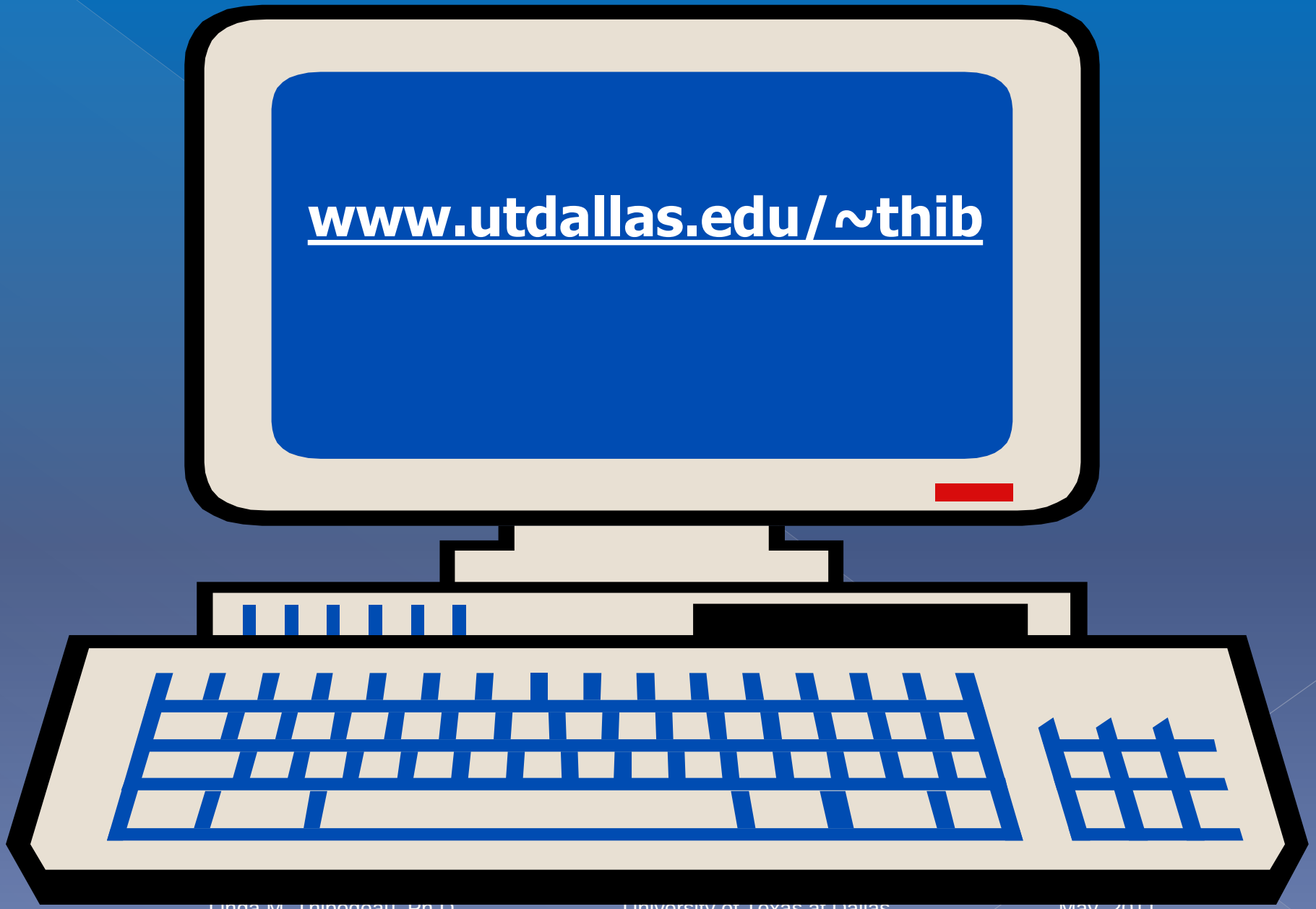
University of Texas at Dallas

Callier Center for Communication Disorders

Advanced Hearing Research Center

Main Campus, Richardson, TX

Callier Center at Richardson


www.utdallas.edu/~thib

Overview

- Rationale for Assistive Technology
  - Remote Microphone Systems
- Types of Remote Microphone Systems
- Speech Recognition Benefits with Remote Microphone Systems
- Verification of Remote Microphone Systems
- New Ideas re: Assistive Technology
- Summary

Optimal Acoustic Environment

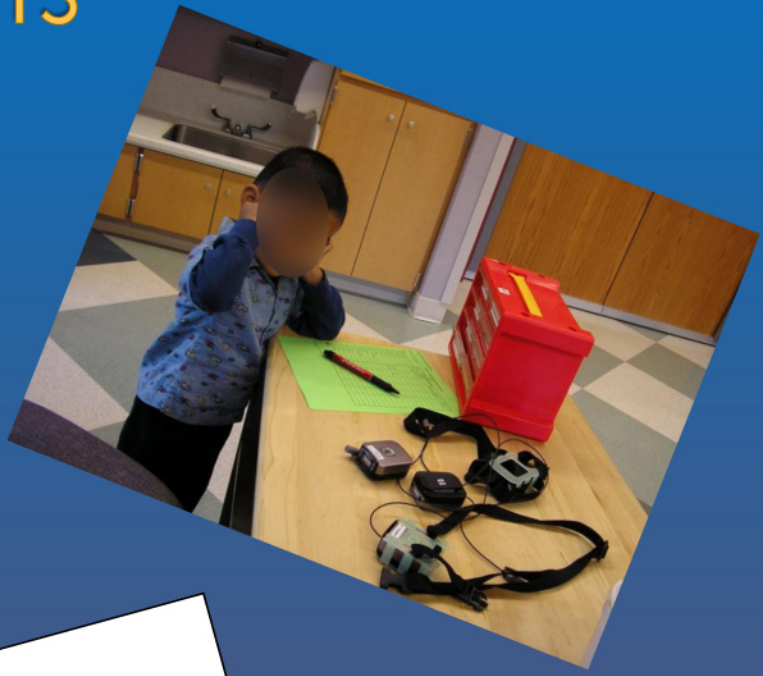
Ideally, communication occurs in a positive signal-to-noise ratio

To provide an optimal acoustic signal for the development of speech and language we should minimize negative effects of:

Reverberation – Distance - Noise

Typical Environments can be Noisy!

- Home
- Daycare
- Riding in the car
- Family Meal Time



Remote Microphone System

We can always improve hearing in noise by placing the microphone closer to the source and transmitting the signal wirelessly to the listener!

- FM System
- Bluetooth Microphones
- Digital Streamers

Basic FM Arrangement

FM RECEIVER

FM TRANSMITTER

Frequency-modulated Signal
Assigned Frequency Channel

Progression of FM Receivers

FM Receivers for Cochlear Implants

Some implants can use universal FM receivers

Some have dedicated FM receivers

Benefits of Hearing Aids can be Significantly Increased

Remote microphone systems allow for:

1) an increased signal-to-noise ratio for speech perception
2) consistency of signal level

FM Demo

- Helpful to demonstrate for teachers, parents and administrators
- Can access from the EARRING CD ROM on webpage

  www.utdallas.edu/~thib
- Recordings made in a room with typical Classroom Noise

Linda M. Thibodeau, Ph.D.

Welcome to my web site!

I am a Professor at the

University of Texas at Dallas

and work at

The Advanced Hearing Research Center

which is a part of the

Callier Center for Communication Disorders.

Navigation Links

Pediatric Aural Habilitation Specialists Training Program

Auditory Perception Journal Group

Class Information

Aural Habilitation

- Information for Parents of Children with Hearing Loss
- Information for Teachers of Children with Hearing Loss
- FM and Environmental Microphone Recordings
- Educational Needs for Students with Hearing Loss
- EARRING-Educational Resources for Reducing Interference

AHRC

- **Handout from ASHA 2005: Optimal FM Systems for Cochlear Implant Users**
- **Tutorials**
  - Troubleshooting Hearing Aids
  - Troubleshooting FM with Cochlear Implants
  - Coping Skills for Teens with Hearing Loss
  - Transition after High School
  - Interfacing FM with Audio Equipment
- **Pediatric TELEGRAM**
- **SPRINT CHART**

The links to the right are related to my teaching and research activities. Special thanks to

FM Demo

- Helpful to demonstrate for teachers, parents and administrators
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  www.utdallas.edu/~thib
- Recordings made in a room with typical Classroom Noise

HA Only

HA+ FM

Reasons to Fit FM Systems for Infants

- Increase audibility for language input
- Reduce hearing aid feedback
- Interface transmitter with audio sources
- Allows parent to feel "connected" and be reminded to provide speech input
- Provide opportunity for Parents to model use of technology

Reasons to Fit FM Systems for Infants

- Close the "distance gap"
- Increase communication in the car
- Increase high-frequency gain
- Provide full access to primary care giver
- Provide access to toddler activities such as story-time at the library
- Increase incidental learning

Reasons not to fit FM Systems on Infants

- Lack of parental motivation
- Infants are already close to the speaker
- Lack of funding or experience with systems
- Concern re: parental use in natural way
- Parental compliance/overload
- Aid is not FM compatible
- Interference with development of localization

New Developments in FM Technology
ADAPTIVE FM TECHNOLOGY

- Traditional FM System
  - Level of FM signal is fixed above level of HA signal
  - +10 signal-to-noise ratio (SNR)
- New Adaptive FM System
  - SNR varies depending on ambient noise level
  - If noise exceeds 57 dB SPL…a signal is sent to FM receiver to increase the SNR

Research at UTD with Adaptive FM Technology

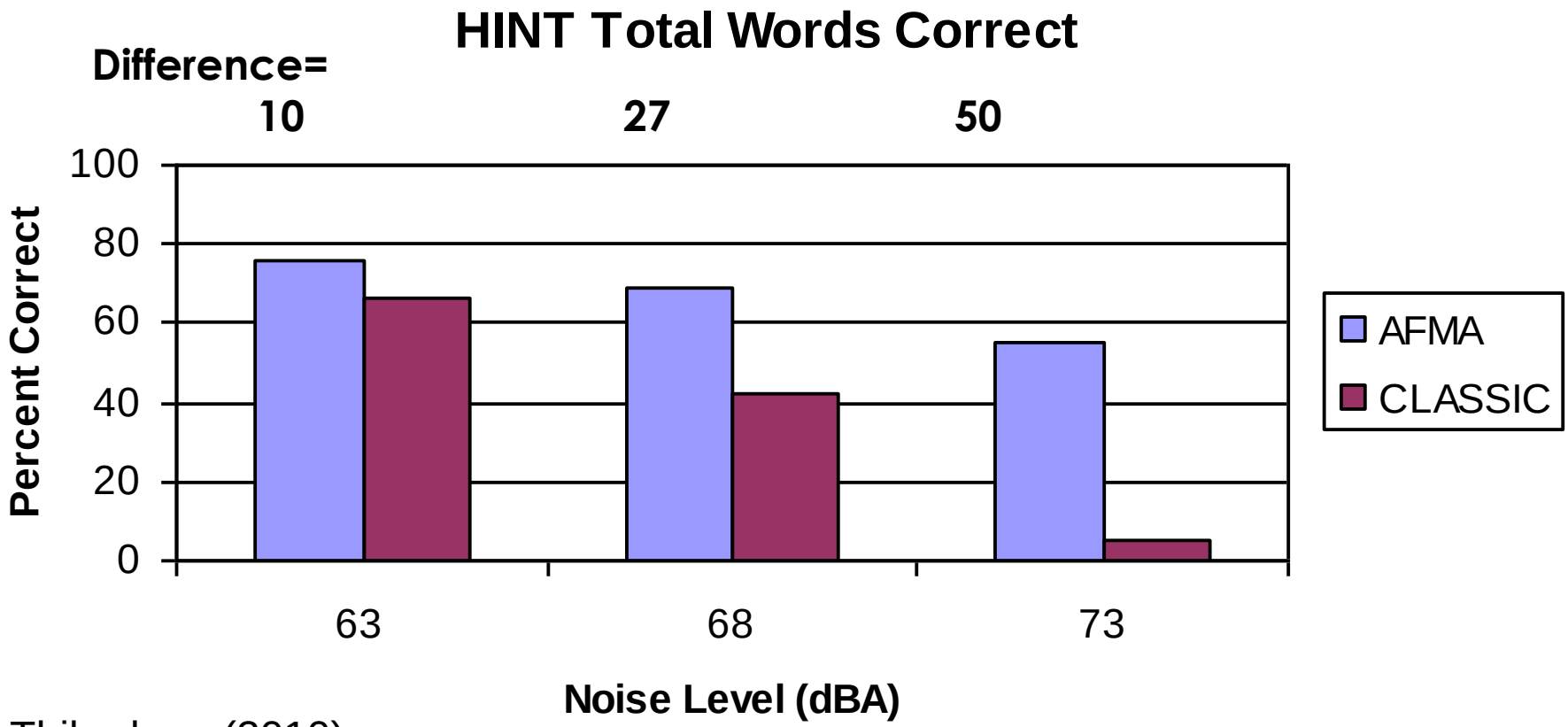
- Subjects: 5 adults and 5 teens with primarily moderate-to-severe hearing loss
  - binaural behind-the-ear hearing aids
  - experienced FM users
  - agreed to use the system for one-week period

Test Arrangement for Objective Measures in a Noisy Classroom
Noise at 3 levels, HINT and SPIN Sentences

Tour Guide at Dallas World Aquarium

At each of 6 stations, listened to tour guide Traditional and with Adaptive FM and then completed a rating card.

Significant Benefit of Adaptive FM over Classic at higher noise levels in Classroom Measures



Thibodeau (2010)

SUBJECTIVE RESULTS

- The participants selected a preferred setting at the conclusion of each activity.
- For half of the activities, 100% of the participants chose Adaptive FM as the preferred setting.
- For the remaining activities Adaptive FM was also preferred by 80 to 90% of the participants.

Dynamic FM

- New Adaptive Feature is in all Phonak products with “i” or “+”
- (i.e. MLxi with inspiro, or Smartlink+ with ML12i)
  - SNR varies depending on ambient noise level
  - When noise exceeds 57 dB SPL…the benefit is increased-BUT BOTH TRANSMITTER AND RECEIVER MUST HAVE ADAPTIVE TECHNOLOGY!

Inspiro transmitter

MLxi receiver

UTD Research re: Typical vs. Adaptive FM in Car Noise

- Purpose: To evaluate Communication Interactions with infants and caregivers with and without FM while riding in the Car
- Video Recordings made in:
  - While parent speaks naturally during actual car ride
- First Recording done in 2009
  - Toddler (18 mos old)
  - Bilateral Cochlear Implants
  - Smartlink with MLxs Receivers

Research in Typical Noise

- Video Recordings made
  - While parent spoke naturally during actual car ride

without FM and with FM

Update with Adaptive FM -

Same Family – about 1.5 years later

To illustrate advantage of the Adaptive FM, background noise increased by adding music from the radio

Comparison – NO FM
Smartlink (Traditional FM)
inspiro (Adaptive FM)

Update with Adaptive FM -

First……riding in the car with BACKGROUND MUSIC and NO FM

Update with Adaptive FM

- Car Ride with RADIO MUSIC while using

SmartLink then Inspiro

Mother's Comment Regarding FM use in Noisy Situations

Another option for Multiple Talkers to the Infant

Companion Mic by Etymotic Research

One Receiver and Three Transmitters

Not FM……Digital Streaming Technology

Companion Mic System

- Three people can wear transmitters
- One person with loss wears the receiver
  - Voice of 3 talkers delivered to user via
    - Earphone inserted in ear
    - Direct Audio Input to Personal Aid
    - Neckloop and T-coil in Personal Aid (set to M+T)

Companion Mic System

- Advantages
  - Relatively inexpensive (entire system < 1 HA)
  - Separate volume controls for each transmitter
  - Master volume control on the receiver
- Disadvantages
  - Specific startup sequence
  - Cannot use alkaline batteries
  - Only three talkers can wear transmitters

T-Coil provides convenient access to Neckloop arrangement for infant seat

If you didn't program the HA and want to find out t-coil option, a quick way is to use a WATCH with a battery!!

If you put the HA on "T" setting and hold it on battery-powered, non-digital, watch, you can hear it TICK!
Then you know there is a T-coil program and need to proceed to verification of the T-coil.

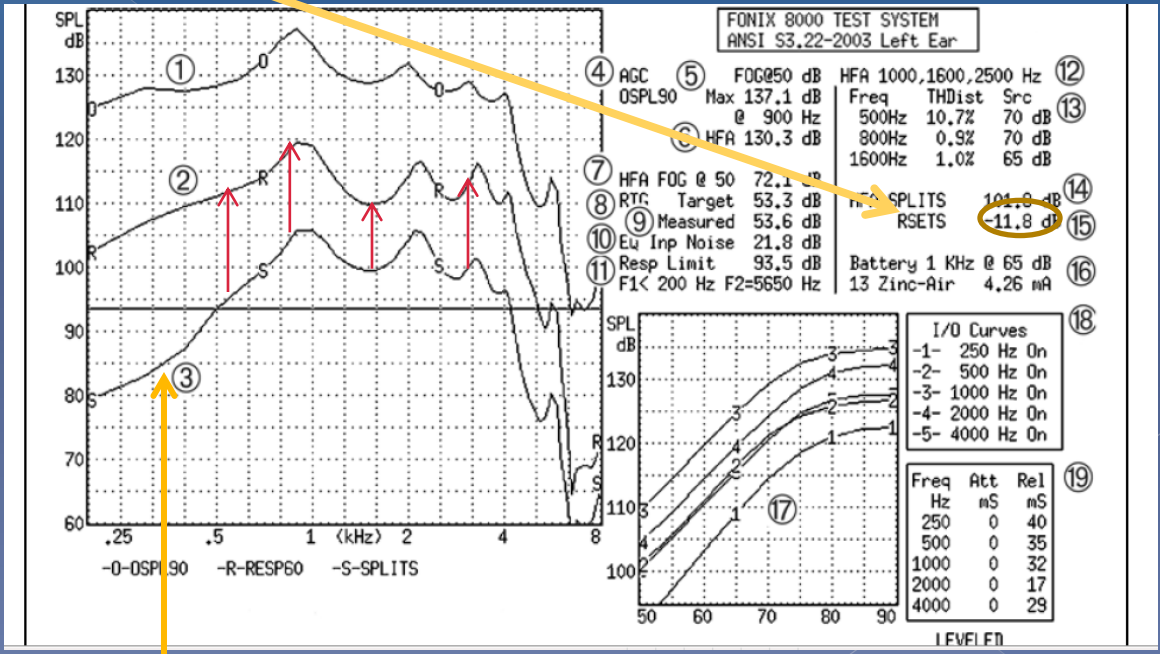
Neckloop Receiver in Infant Seat

Companion Mic System

T-Coil Verification Electroacoustically

ANSI S3.22 2003 specifies measurements of T-coil in hearing aids as part of routine electroacoustic analysis. The T-coil response will be compared to the microphone response….ideally they should match and RSETS=0.

Use Telewand to deliver electromagnetic signal



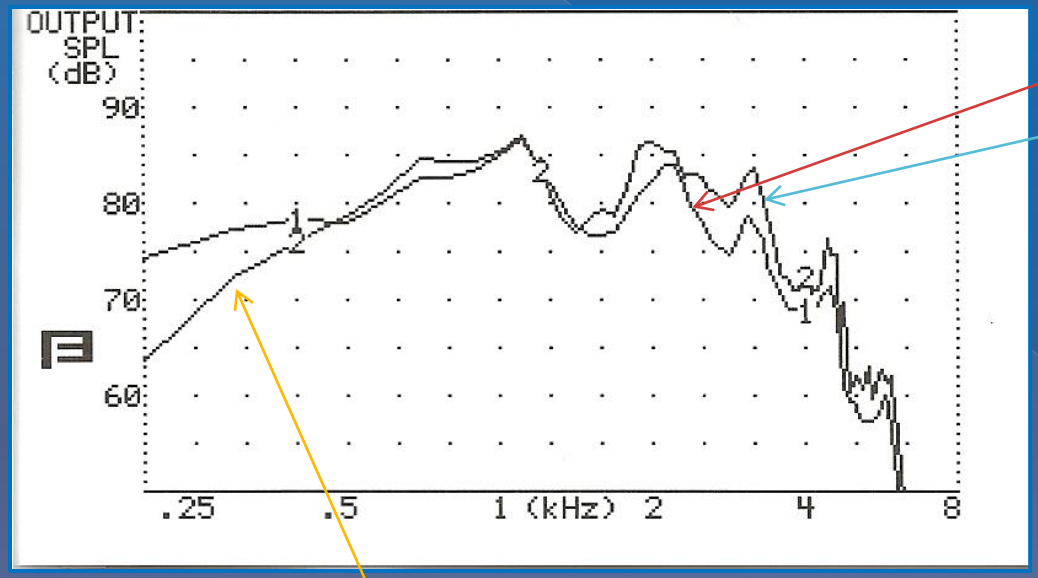
Electroacoustic Verification

Input: 65 dB SPL Digital Speech Signal re: AAA Guidelines for FM Verification

Step 1: HA alone in test box
Curve 1

Step 2: Transmitter in test box while HA near loop
Curve 2

Electroacoustic Verification



Curve 1: EHA65
Curve 2: EFMHA65

Curves should match ±5 dB

With t-coil expect to lose low frequencies

Electroacoustic Verification with T-coil Arrangements

- There can be signal variation with orientation and distance of the T-coil in the aid from the electromagnetic field of the neckloop
- Made electroacoustic measurements with neckloop of Companion Mic System taped in infant seat while moving HA into 4 positions

Electroacoustic Verification with T-coil Arrangements

TYPICAL USE

SIDE

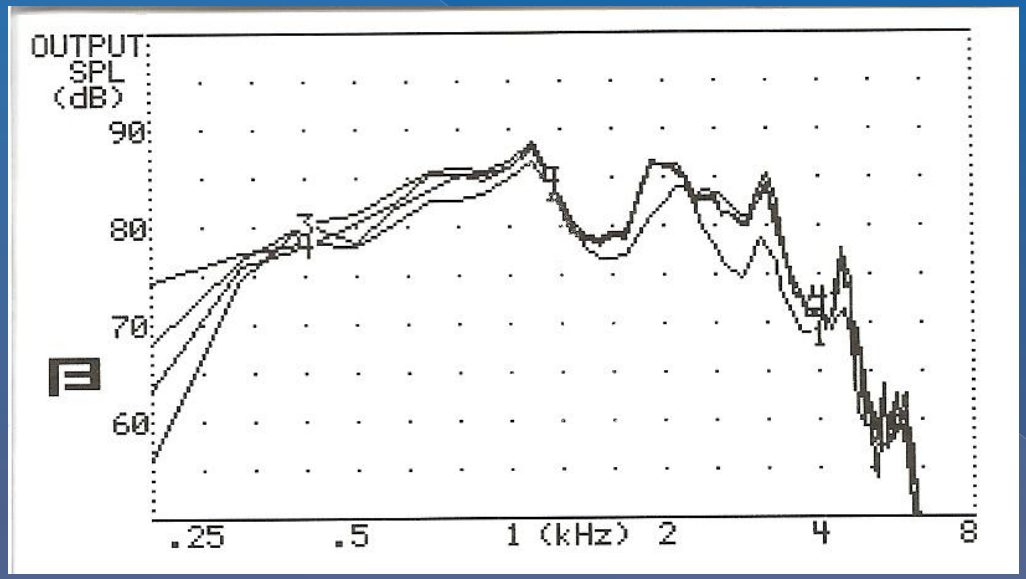
ABOVE

INFRONT

Output in the coupler measured when transmitter in the test box and HA set to "T" position is moved around the loop

Might expect signal variation as the HA moves further from the loop.

Electroacoustic Verification



Curve 1: TYPICAL USE
Curve 2: SIDE
Curve 3: ABOVE
Curve 4: IN FRONT

Curves were surprisingly similar! Slight increase in high frequencies and expected low-frequency variation; Suggests a strong neckloop!

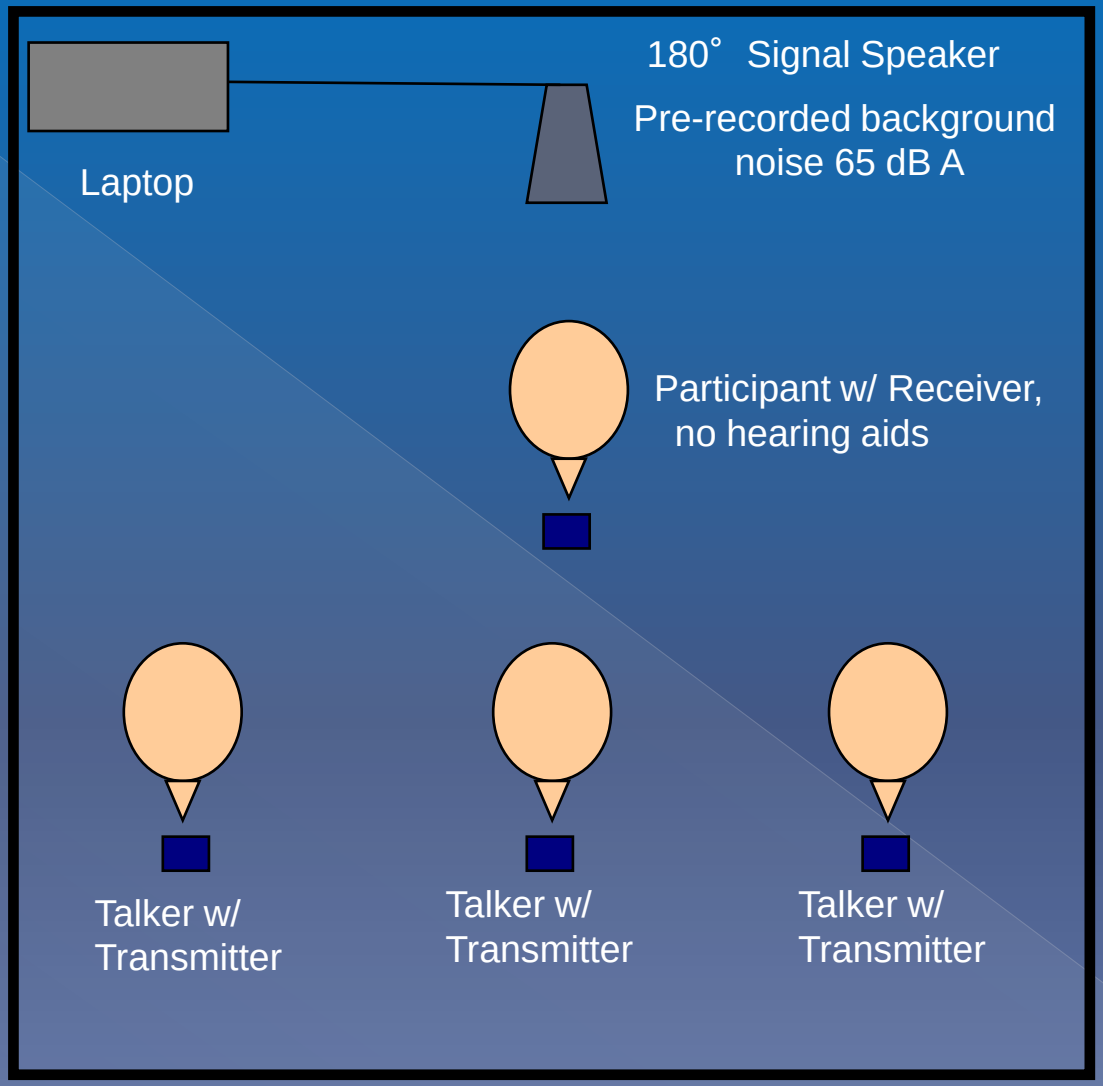
Pilot Study with Companion Mic System

Purpose: Compare speech recognition with companion mic system and 3 talkers to listening with personal hearing aid

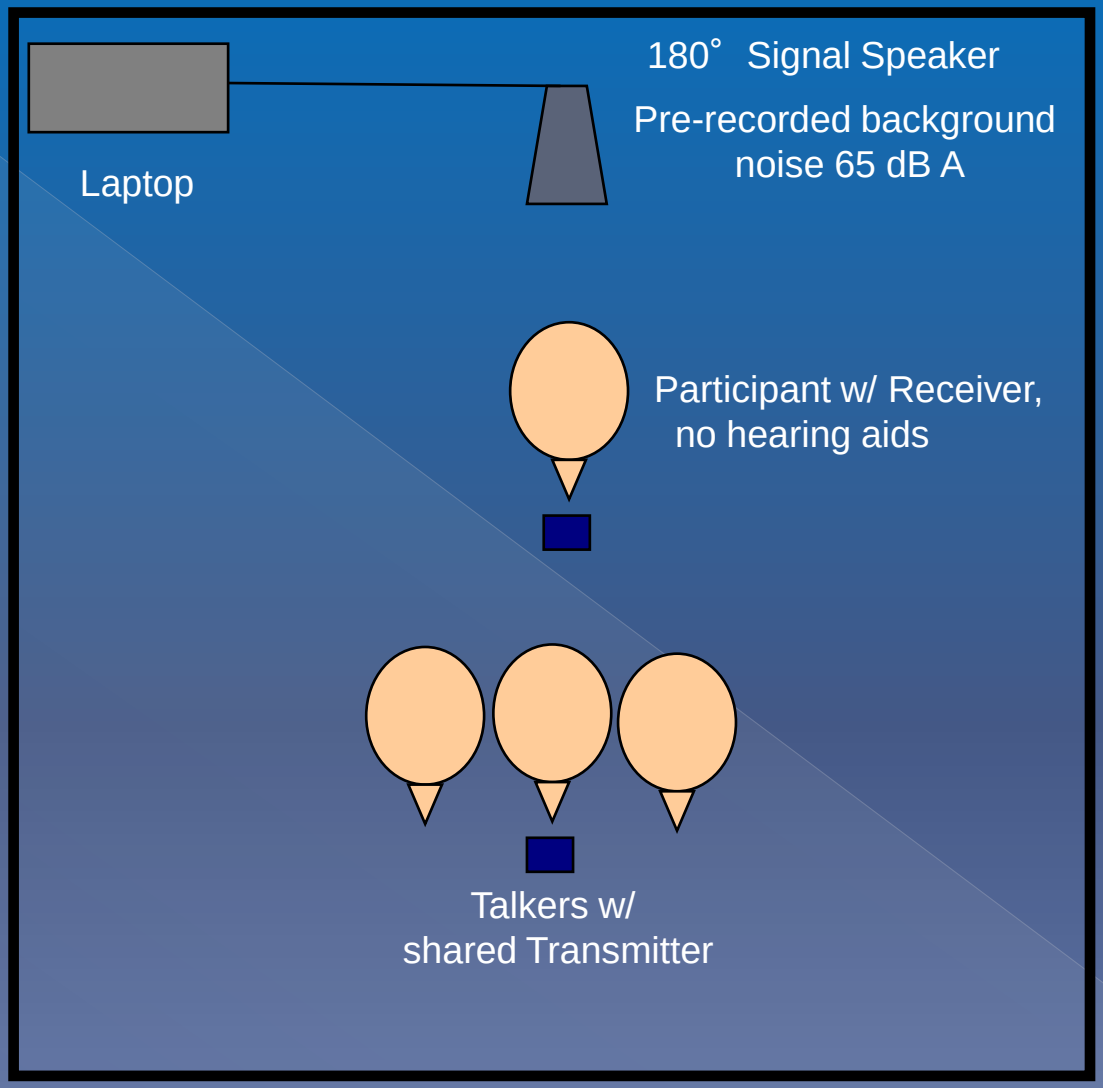
Subjects: 3 teenage, bilateral hearing users, with SNHL

Procedure: Speech recognition in 65 dBA classroom noise while talkers wore Companion Mics for two conditions and third condition was HA only

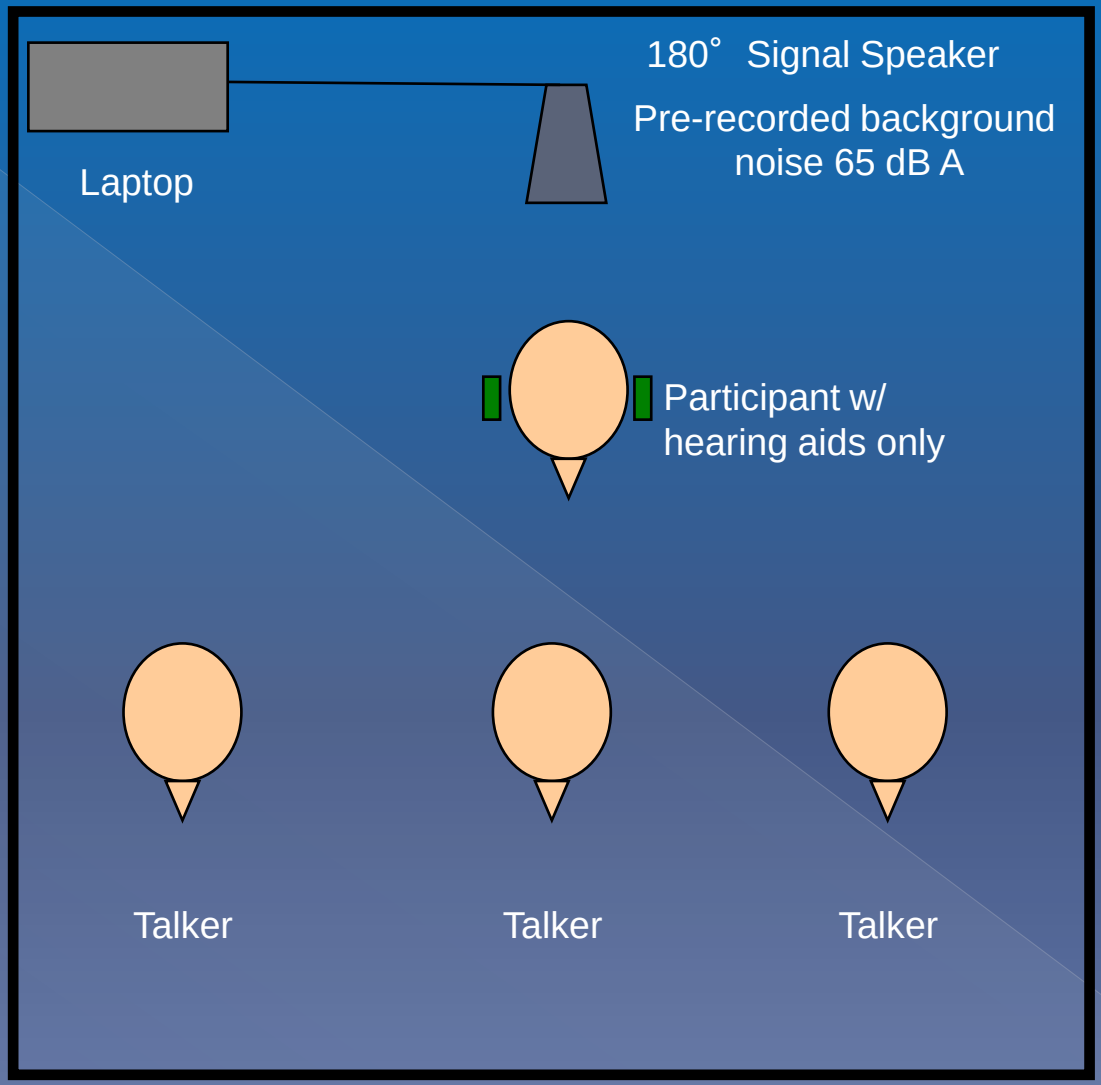
Condition # 1


180˚ Signal Speaker
Pre-recorded background noise 65 dB A
Laptop
Participant w/ Receiver, no hearing aids
Talker w/ Transmitter
Talker w/ Transmitter
Talker w/ Transmitter

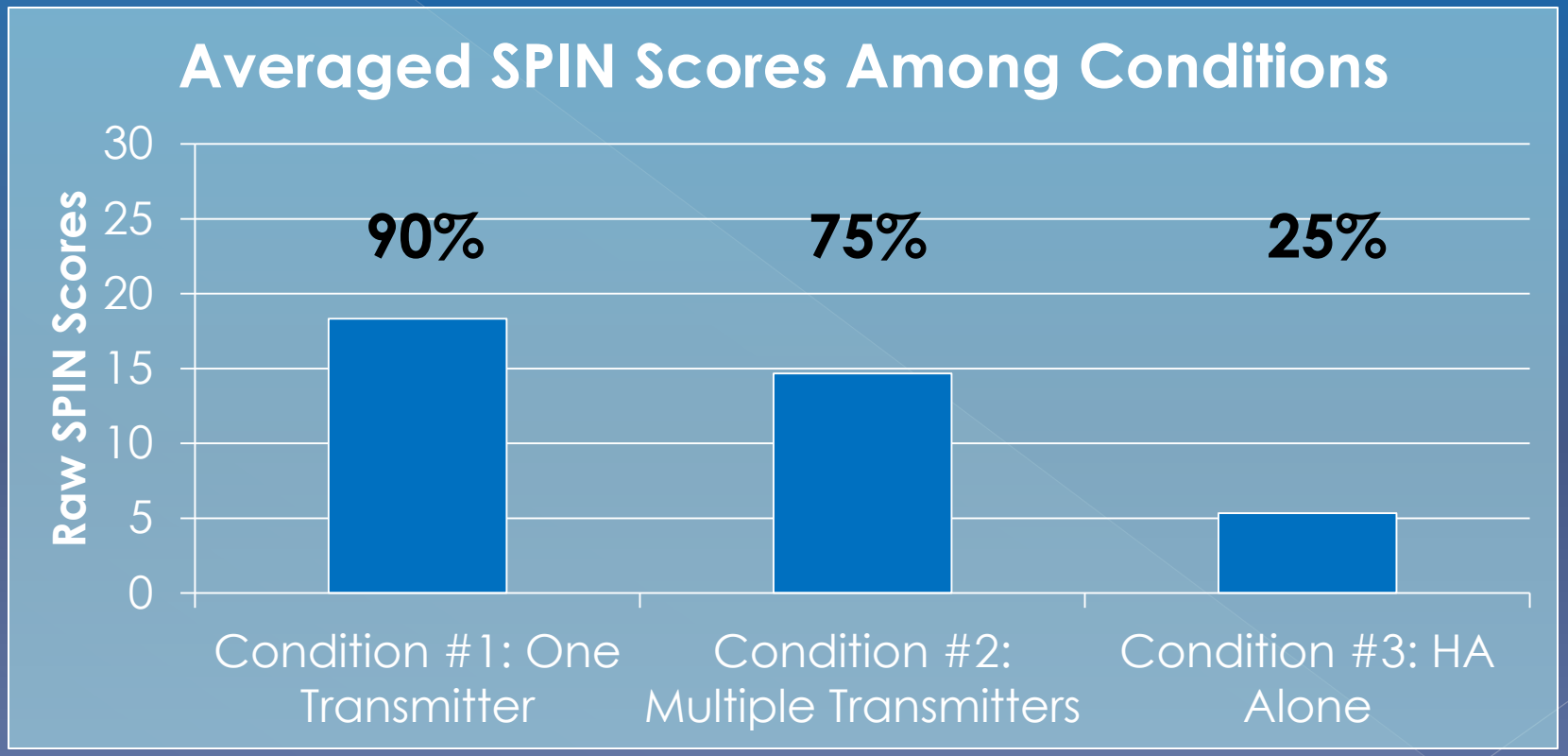
Condition # 2


180˚ Signal Speaker
Pre-recorded background noise 65 dB A
Laptop
Participant w/ Receiver, no hearing aids
Talkers w/ shared Transmitter

Condition # 3


180˚ Signal Speaker
Pre-recorded background noise 65 dB A
Laptop
Participant w/ hearing aids only
Talker
Talker
Talker

Companion Mic System



Other Loops to Consider Neckloops with internal FM Receivers

Use with ANY manufacturers' Hearing Aids set M+T

Phonak-MyLink

Oticon-Arc

Other Loops to Consider Digital Streaming Technology

Compatible with SPECIFIC manufacturer's hearing aids
Can use with cell phone via Bluetooth Connection

Phonak-iCom

Oticon-Streamer

Single vs Multiple Microphones

Oticon Streamer can interface with small clip on mics that can be worn by family members

Can use 8 clip on mics but only one person can talk at a time

SUMMARY

Every child with hearing aid or implant is a candidate for a remote mic system

Remote mic systems for infants have psychosocial benefits for parents

Every system must be verified electroacoustically

There are many options to consider for price range and communication activity


muchas
Gracias

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