Clinical Experience with the new AB Naída Bimodal System

Prof. Andreas Büchner



Overview

- Introduction of the department of otorhinolaryngology at Hannover Medical School
- Recent advances in Cochlear Implant provision
- Bimodal Hearing:
  Combined use of Hearing Aids and Cochlear Implants
- Naída Bimodal Hearing Solution
  - Bimodal fitting formula
  - Binaural VoiceStream Technology
- Summary

The Department of Otorhinolaryngology at Hannover Medical School

Chairman: Prof. Prof. h.c. Dr. med. Thomas Lenarz

Otorhinolaryngology at Hannover Medical School

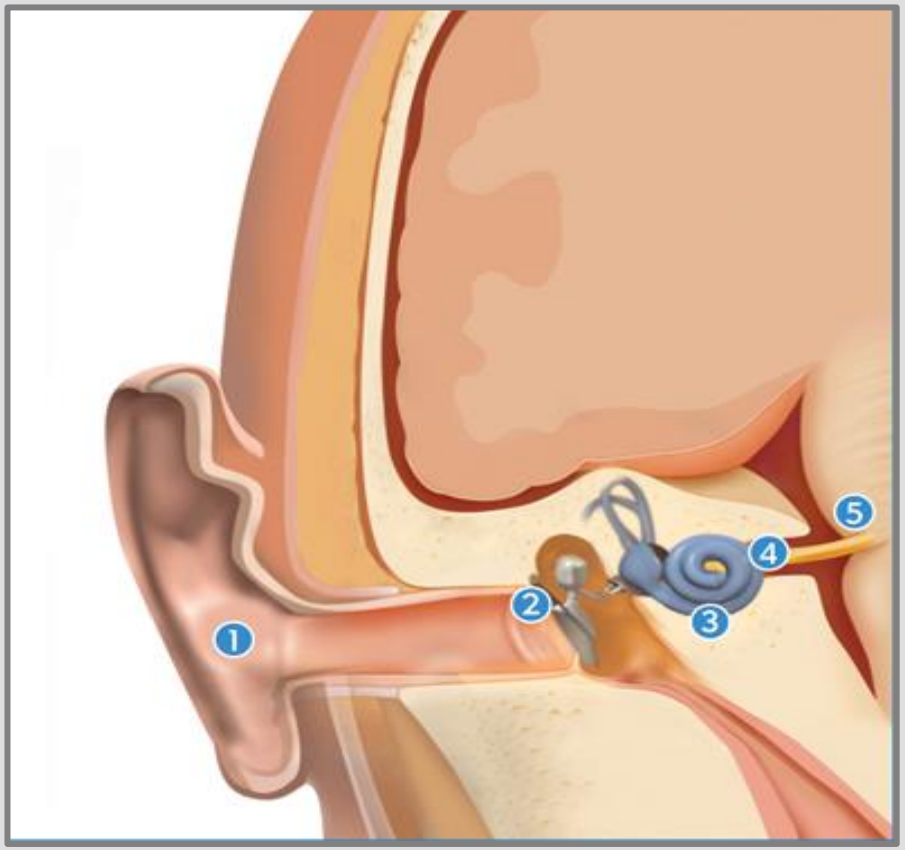
- World's largest cochlear implant (CI) program to treat severely hearing impaired patients
- More than 500 cochlear implants, 85 middle-ear implants and 100 acoustic neuromas in 2015
- More than 7,000 people have received a CI in total
- 6 wards with a total of 90 beds
- 200 employees:
  30 doctors, 20 nurses,
  9 speech therapists,
  6 engineers + additional
  technical staff and 30 scientists

German Hearing Center (DHZ)

- One-stop provider of
  - Latest diagnostic methods and therapies
  - technical guidance and support
  - auditory training provided by education professionals and speech therapists
  - fitting of hearing systems at the highest international standards
- Interdisciplinary team
  - ENT specialists
  - Electrical engineers
  - Computer scientists
  - education professionals and speech therapists
  - hearing-aid audiologists
  - manufacturers of hearing systems
  - scientists

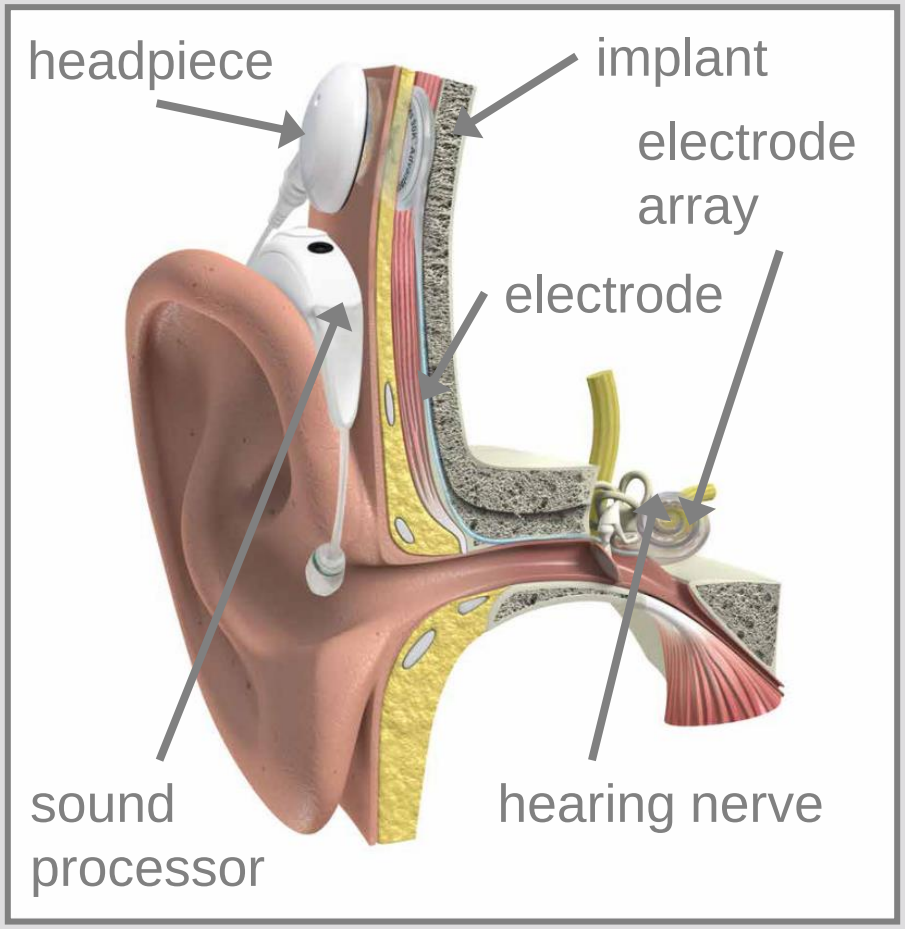
Recent advances in cochlear implant provision: Where does the journey go?

Normal Hearing



1. Outer ear collects sound waves.
2. Sound waves vibrate ear drum and the three tiny bones in the middle ear.
3. Vibrations move the tiny hairs of the sensory cells in the inner ear.
4. Sensory cells convert vibrations to electrical signals that are sent to hearing nerve.
5. Signals travel up the nerve and into the brain.

Cochlear Implant



1. The microphones capture sound waves that pass though the air.
2. The sound waves are converted into digital information by the sound processor. The magnetic headpiece sends the digital signals to the implant's electrode in the inner ear.
3. The electrode array sends the electrical signals to the hearing nerve.
4. The hearing nerve sends impulses to the brain, where they are interpreted as sound.

CI Indication Criteria 20 Years Ago

PTA bilateral profound hearing loss (National Institute of Health, 1995)	> 100 dB HL
Open-set speech recognition ability with hearing aids (monosyllables)	no
US: minimum age (children) for implantation	2 years

MHH: avg. monosyllabic word score (1995) with CI	19.4 %

1994 Clarion 1.0 speech processor

CI Indication Criteria 2000/2001

PTA (Lenarz, Balkany 2001)	> 70 dB HL
Some speech recognition ability with hearing aids (monosyllables)	< 30 %
US: minimum age (children) for implantation	12 months

MHH: avg. monosyllabic word score (2001) with CI	38.5 %

CI Indication Criteria since 2007

PTA (secondary criterion) (*)	50 dB HL
Some speech recognition ability with hearing aids (monosyllables) (*)	< 50 %
US: minimum age (children) for implantation	12 months

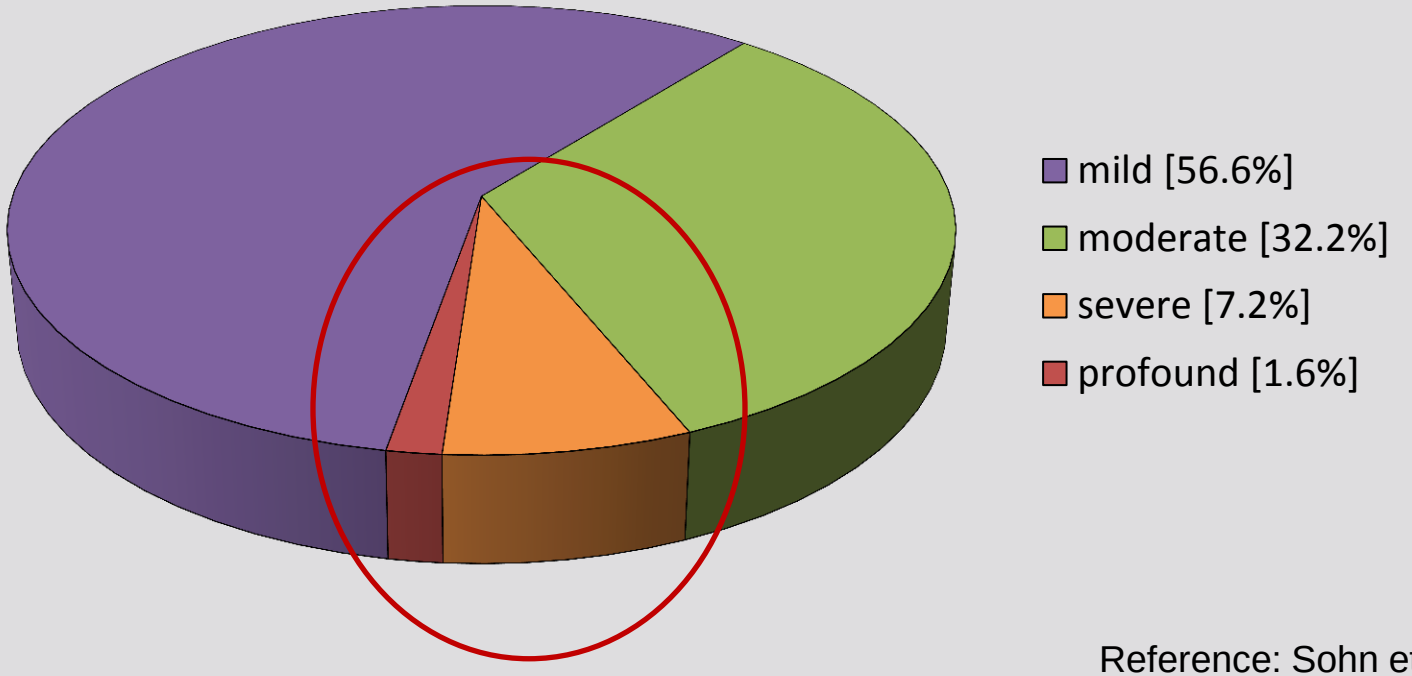
MHH: avg. monosyllabic word score (2007) with CI	51.1 %

(*) contract btw. Medizinische Hochschule & Techniker KK, Dec. 2006

Increasing Number of CI Candidates

19% of the German population (above 14 years of age) are hearing impaired

Distribution of degree of hearing loss in the group of hearing impaired people in Germany:



Reference: Sohn et al. 2000

Translation into Implant Numbers

- Conventional indication criteria for CI (1,6% + 7,2%)
- 8,8% of the hearing impaired people may benefit from a CI
- 19% of the population in Germany of 14+ years are hearing impaired
- Overall 70 Mio. of 14+ years

70 Mio * 19% * 8,8%

= **1.170.400 potential candidates**

Today, only 30.000 subjects have received a CI!

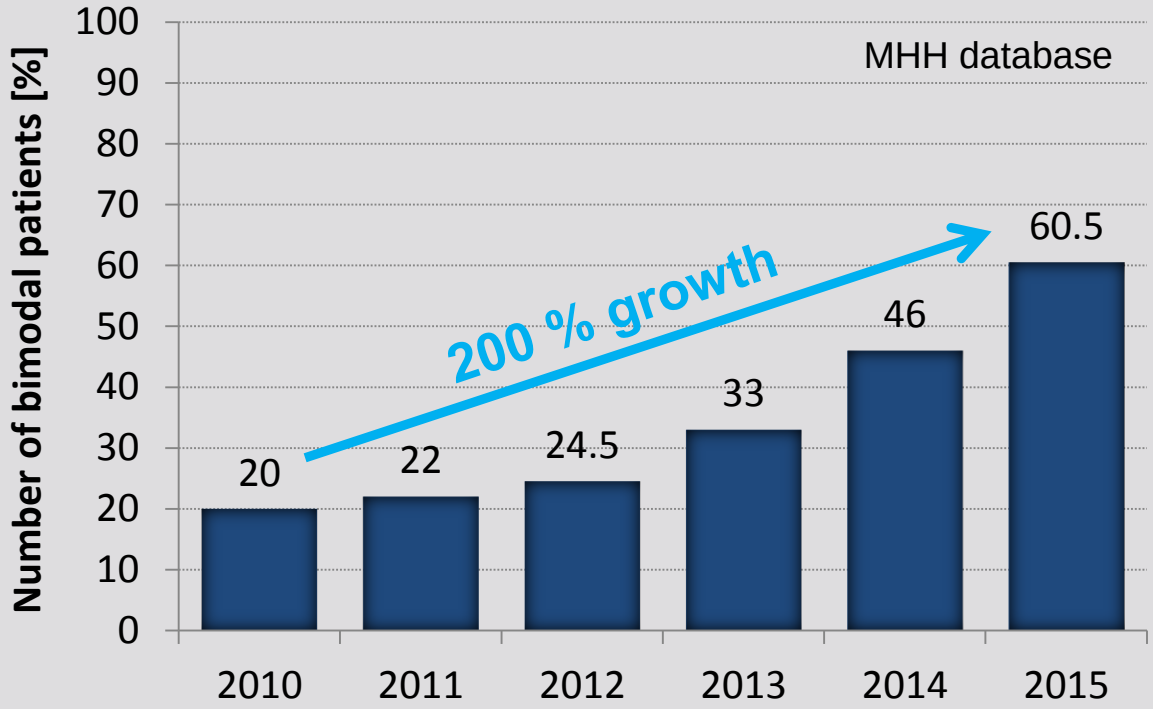
Relaxation of Indication Criteria

- More residual hearing on opposite ear
- Use of hearing aid contralaterally

➢ Bimodal Cochlear Implant user
(CI and HA)

➢ 60% of new CI users benefit from a bimodal system

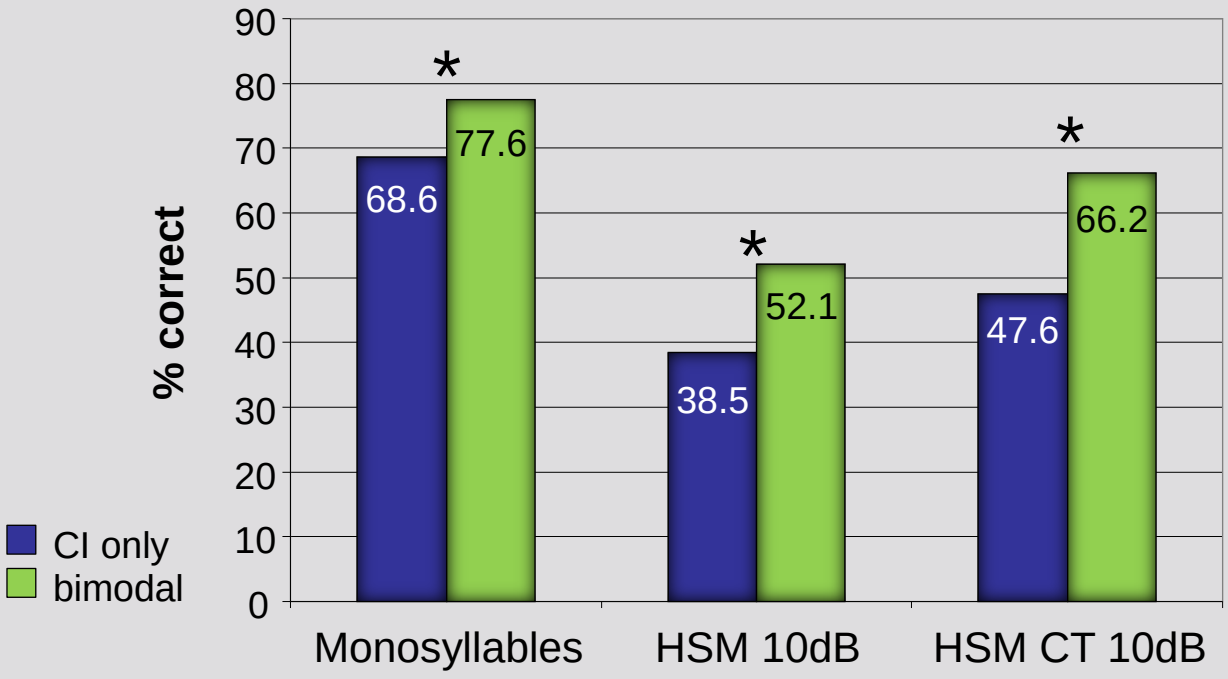
Development of Bimodal Population



Advantage of Bimodal Hearing

- Better speech understanding
  - In quiet: Dunn et al., 2005; Gifford et al., 2007, 2014; Dorman et al., 2015; Zhang et al., 2010, 2013, 2014; van Hoesel, 2012
  - In noise: Sheffield & Gifford, 2015; Zhang et al., 2010, 2013, 2014; van Hoesel, 2012
- Improved sound and music quality
  (Gfeller et al., 2007; Prentiss et al., 2015)
- Enhanced voice pitch perception
- Enhanced localization abilities
  (Potts et al., 2009; Davidson et al., 2015; Dorman et al., 2016)
- Reduced auditory deprivation in the non-implanted ear

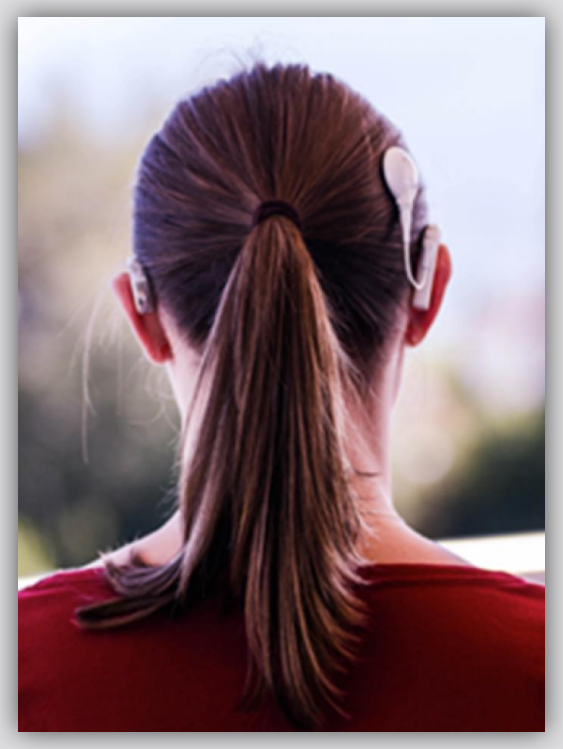
Advantage of Bimodal Hearing



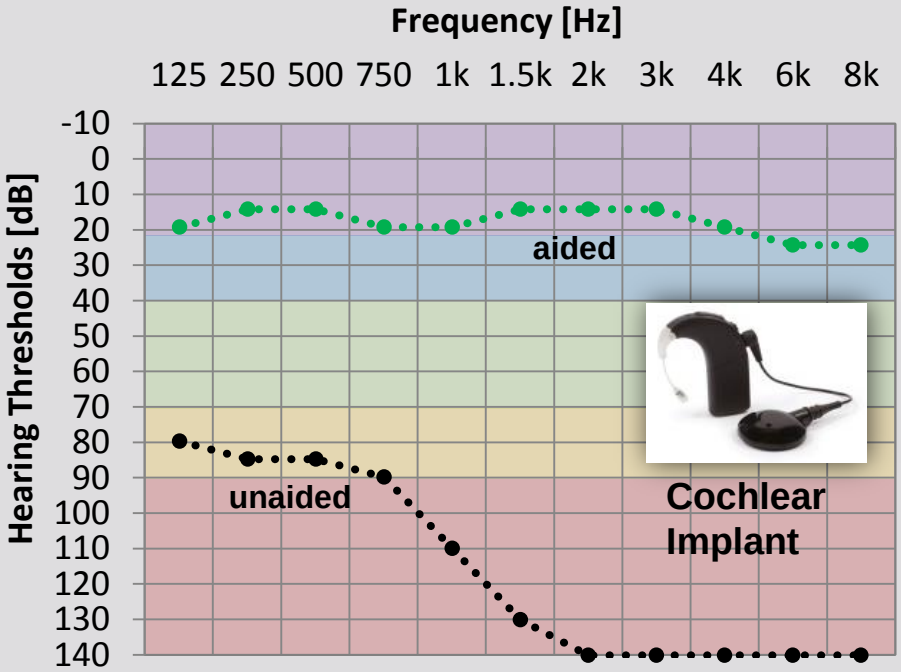
N = 141 (MHH database, all manufacturers)

Illg et al. Otol Neurotol. 2014 Oct;35(9):e240-4.

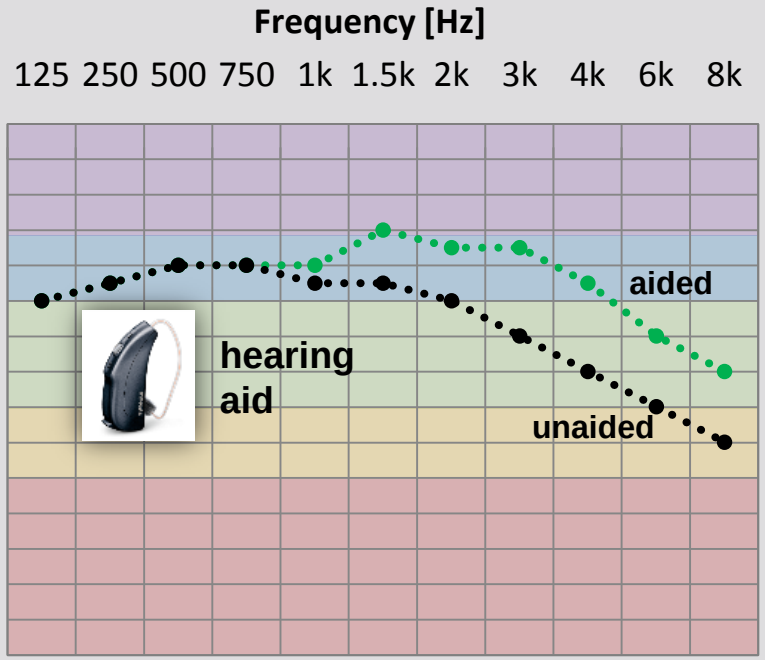
Bimodal Fitting



Typical Example of Bimodal Patient



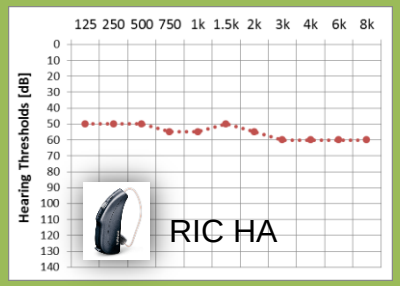
right ear

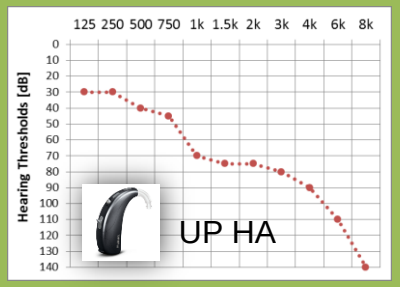


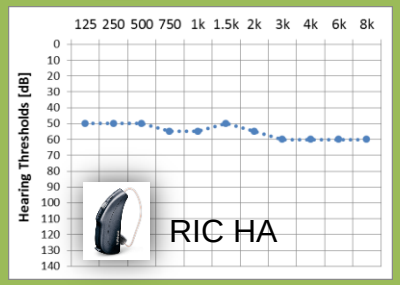
left ear

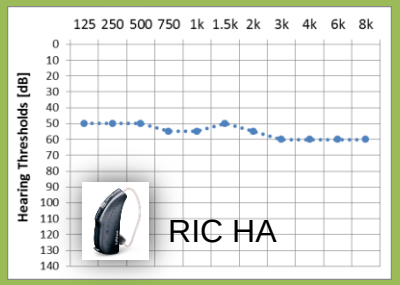
Recipient Journey

Hearing Aid Recipient

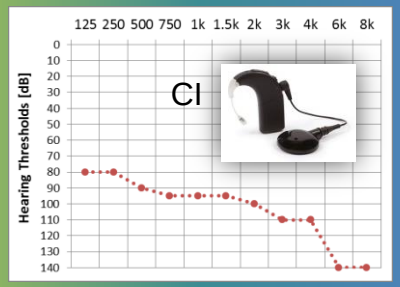


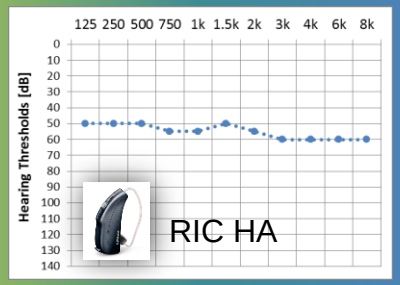




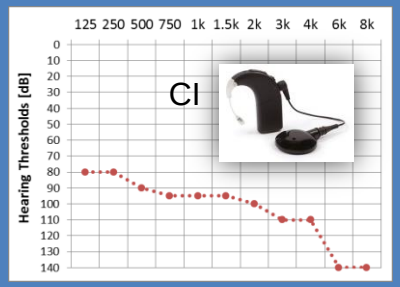


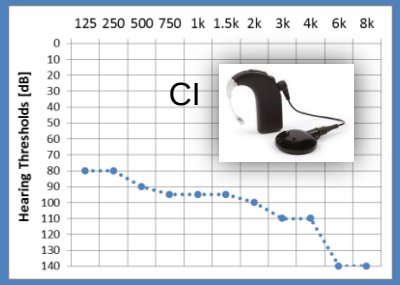
Bimodal Recipient





Cochlear Implant Recipient



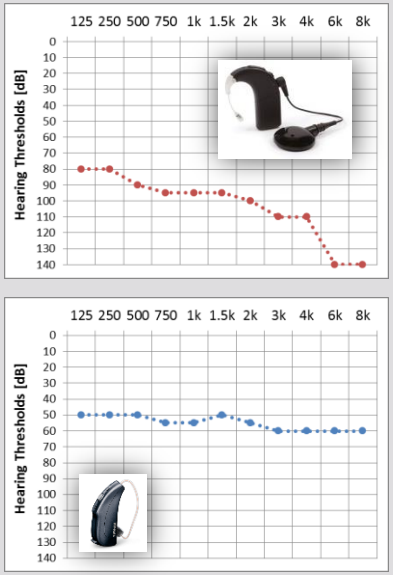


Fitting by HA acoustician
Fitting with HA software
Customer service via HA acoustician
Handling of HA
Sound quality of acoustic amplification

Fitting by CI audiologist
Fitting with CI software
Customer service via CI manufacturer
Handling of CI
Sound quality of electric stimulation

Complexity of Bimodal Fitting

Bimodal Recipient



- Time consuming
- Equipment intensive
- Sound perception not aligned
- Different handling of devices
- Difficult communication between fitting parties
- Different service partners
- Features not in accordance

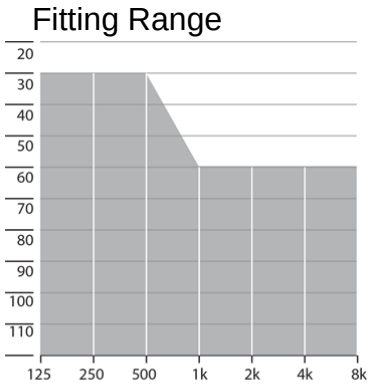
Naída Bimodal Hearing Solution

Unique Key Features

- New Phonak Naída Link hearing aid specially designed to work with the Naída CI Q70 and Q90
- Distinctive Bimodal Fitting Formula
- Shared Front-End Processing and Automation
- Shared Controls (QuickSync)
- Bimodal wireless solutions
- Ear-to-Ear Audio Sharing
  (Binaural VoiceStream Technology™)

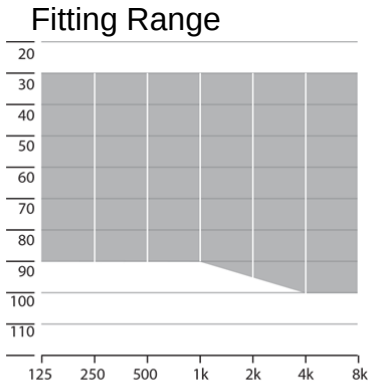
Phonak Naída Link Hearing Aid

Ultra Power (UP)



Severe to Profound HL

Receiver-in-the-Canal (RIC)



Moderate to Profound HL

The entire range of hearing loss is covered.

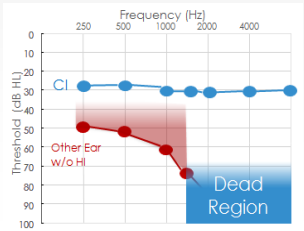
The Naída Bimodal Hearing Solution has a hearing aid option for every bimodal recipient.

Adaptive Phonak Digital Bimodal Fitting Formula

Automatic calculation steps of the 1-click procedure:

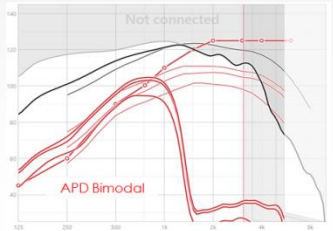
Alignment of Frequency Response

- Optimized bandwidth
- Reduced gain in dead regions



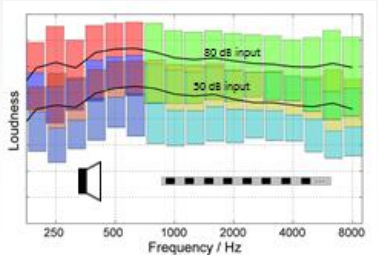
Alignment of Loudness Growth

- Optimized low frequency gain
- Maximized effective audibility*



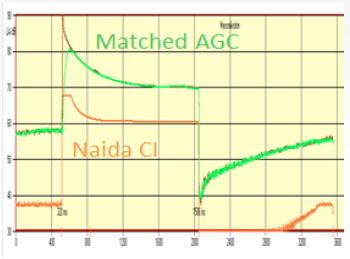
*based on Ching et al, 1998, Keidser et al, 2011

- Matched I/O curves

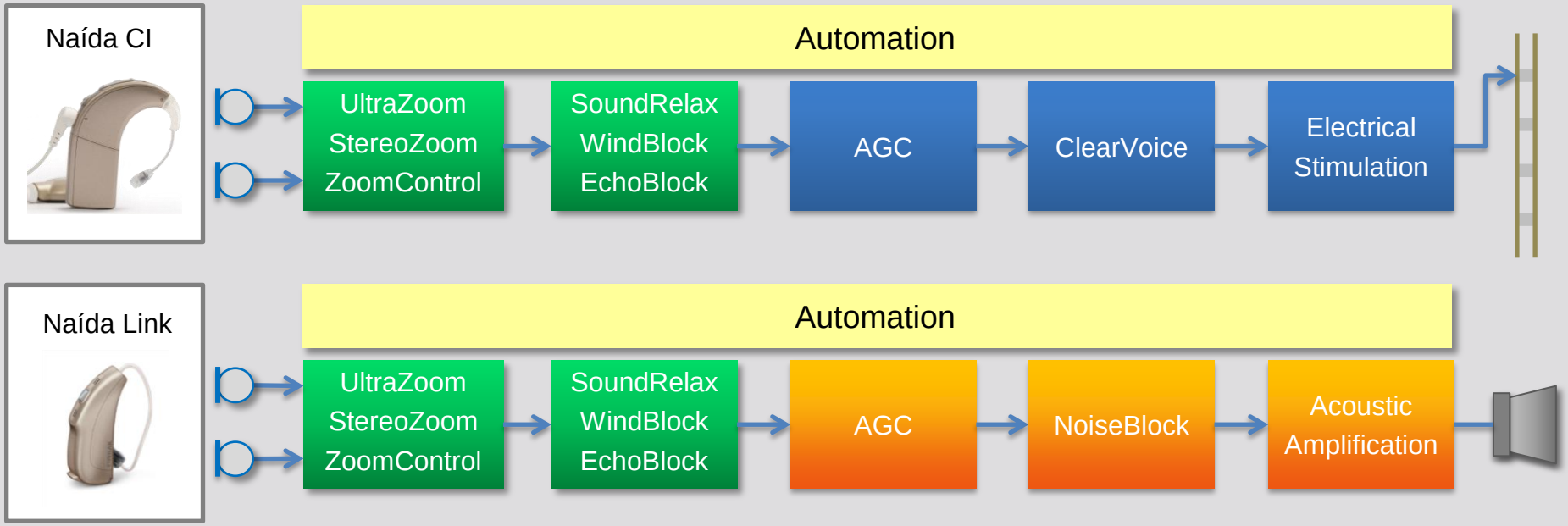


Alignment of Dynamic Behaviour

- Matched dynamic compression characteristics
- Same dual-loop AGC



Shared Front-end Processing and Automation

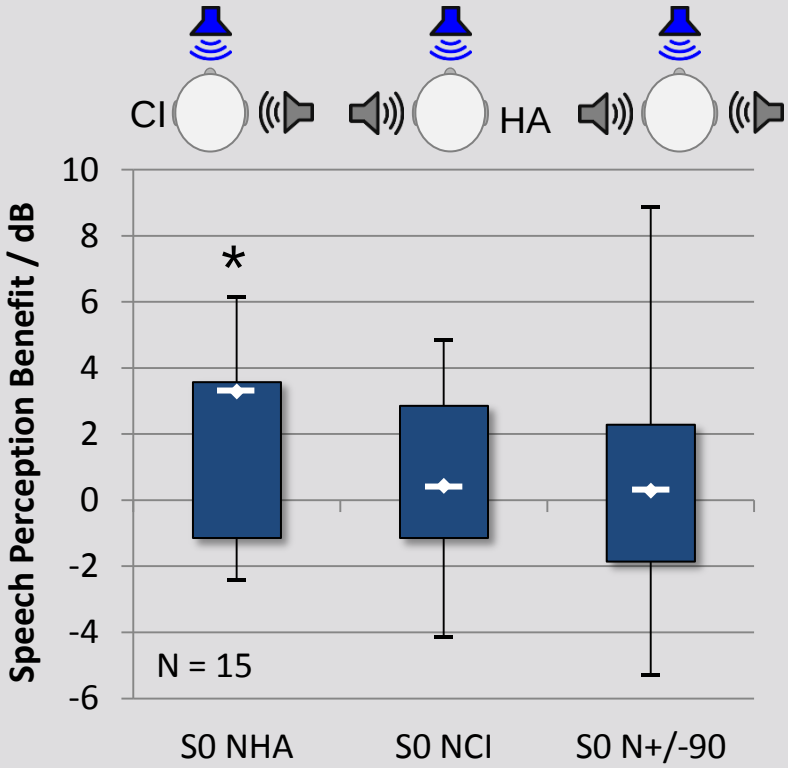


Both devices process sound in the same way. Many features are automated.

Clinical Study – Results from Nijmegen

- List, adaptive, 50% correct SRT
- Noise, 65dB, IFFM
- S_0N_{HA}, S_0N_{CI}, $S_0N_{+/-90}$
- Commercial AGC (syllabic) vs. aligned AGC

Improvement of speech understanding by 0.3 to 3.3dB in competing talker situations through aligned AGC settings.



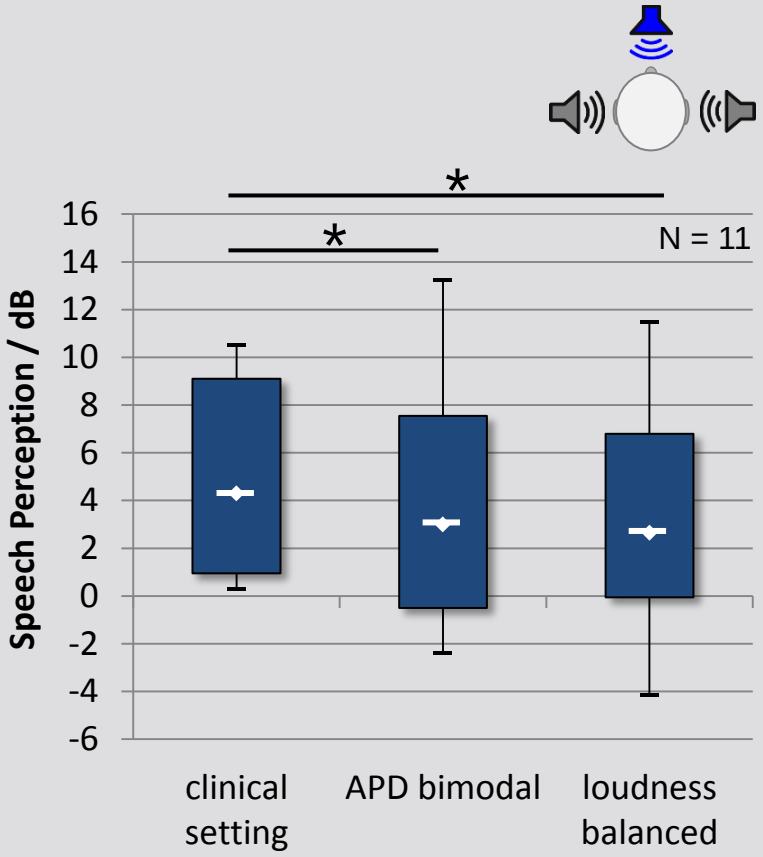
Matching Automatic Gain Control Across Devices in Bimodal Cochlear Implant Users

Lidwien C. E. Veugen,[1] Josef Chalupper,[2] Ad F. M. Snik,[3] A. John van Opstal,[1] and Lucas H. M. Mens[3]

Clinical Study – Results from Hannover

- OlSa, adaptive, 50% correct SRT
- Noise, 65dB, IFFM
- $S_0N_{+/-90}$
- Clinical setting vs. bimodal fitting formula vs. loudness balanced fitting

Improvement of speech understanding by 1.3dB with bimodal fitting formula immediately after fitting.

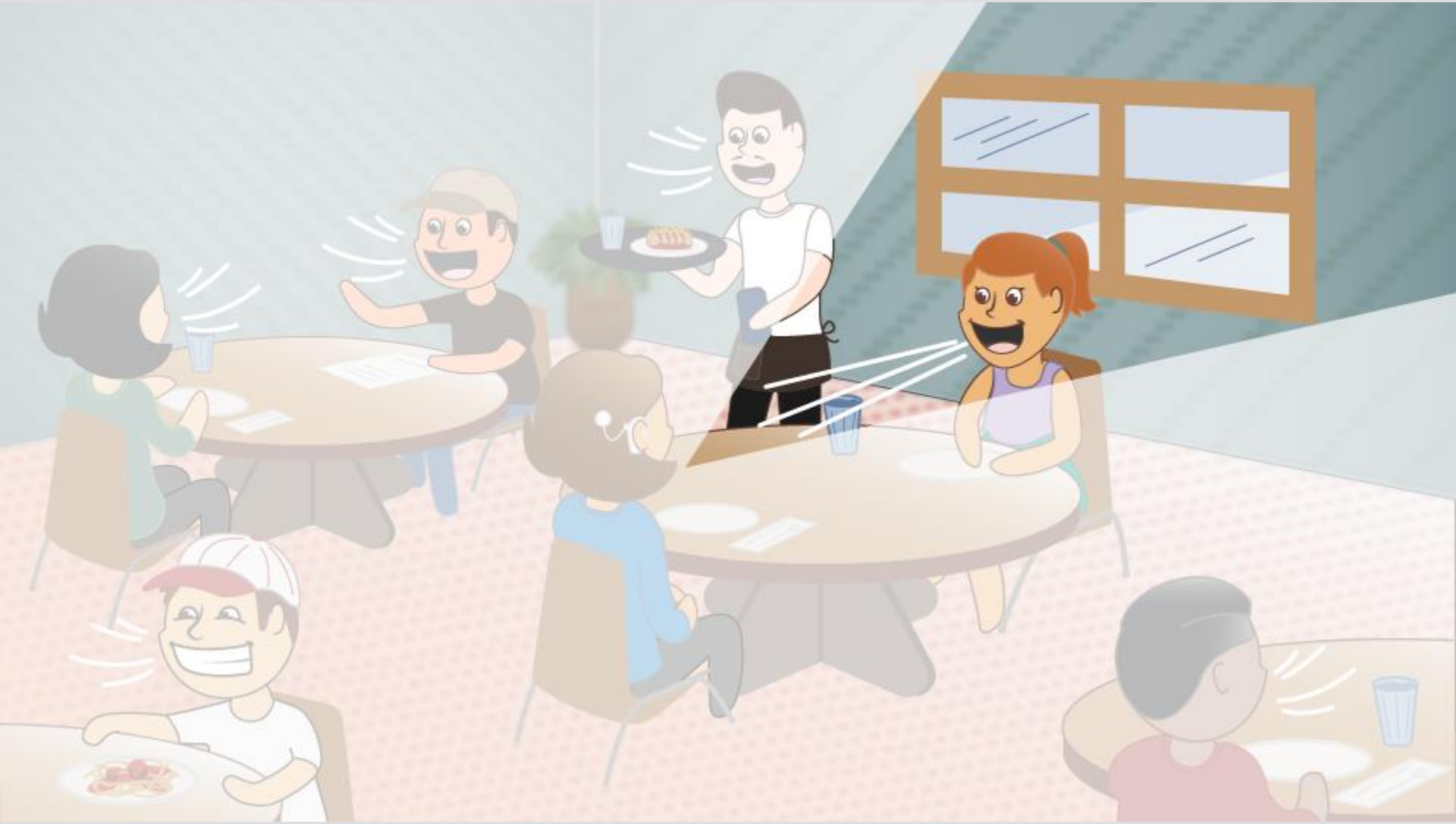


Hannover, presented at CI 2016 in Toronto

Bimodal Fitting Formula - Summary

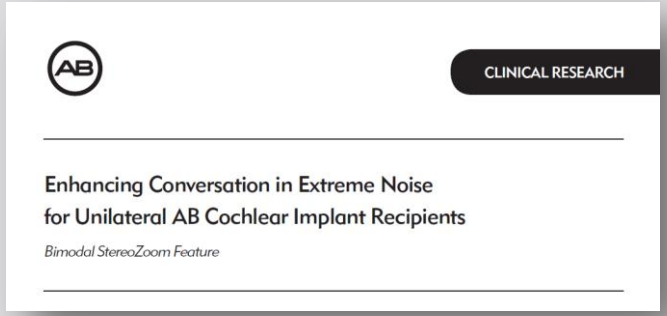
- Bimodal Fitting Formula aligns fitting parameters of hearing aid according to the Cochlear Implant
- Similar speech perception with bim FF after a “one-click” fitting compared to a fine tuned HA fitting
- Harmonized sound between hearing aid and Cochlear Implant

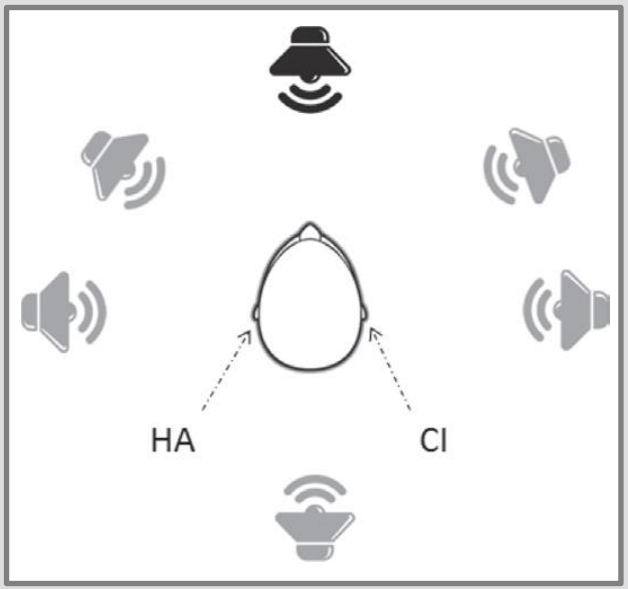
StereoZoom

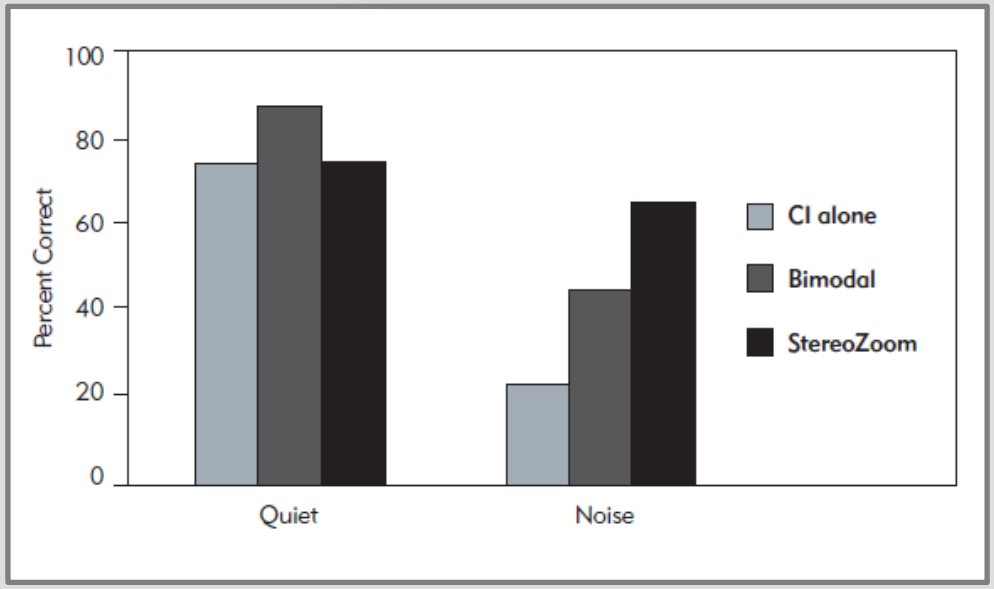


Clinical Study – Valencia

- Bimodal benefit 10% in quiet and 21% in noise
- StereoZoom benefit additional 21%

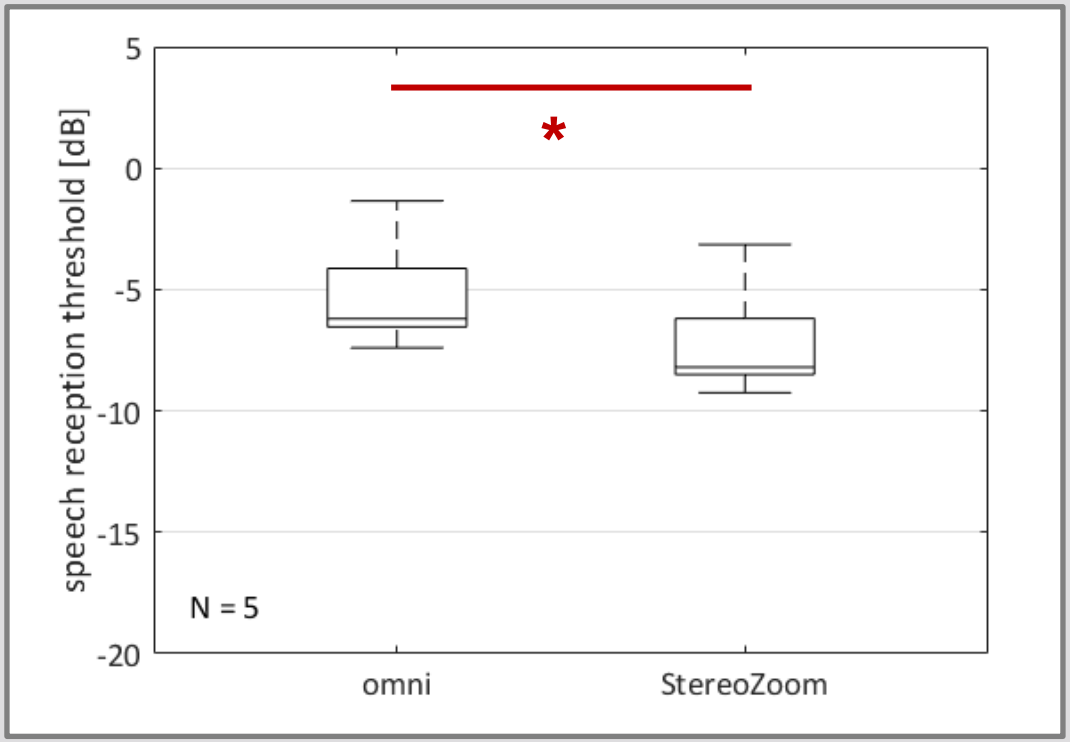


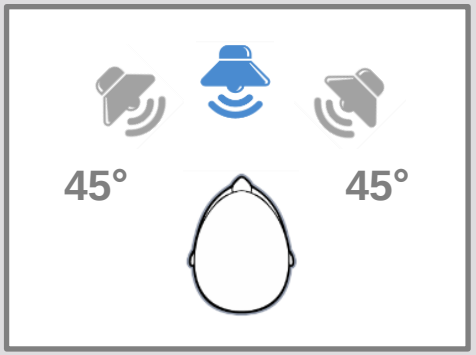




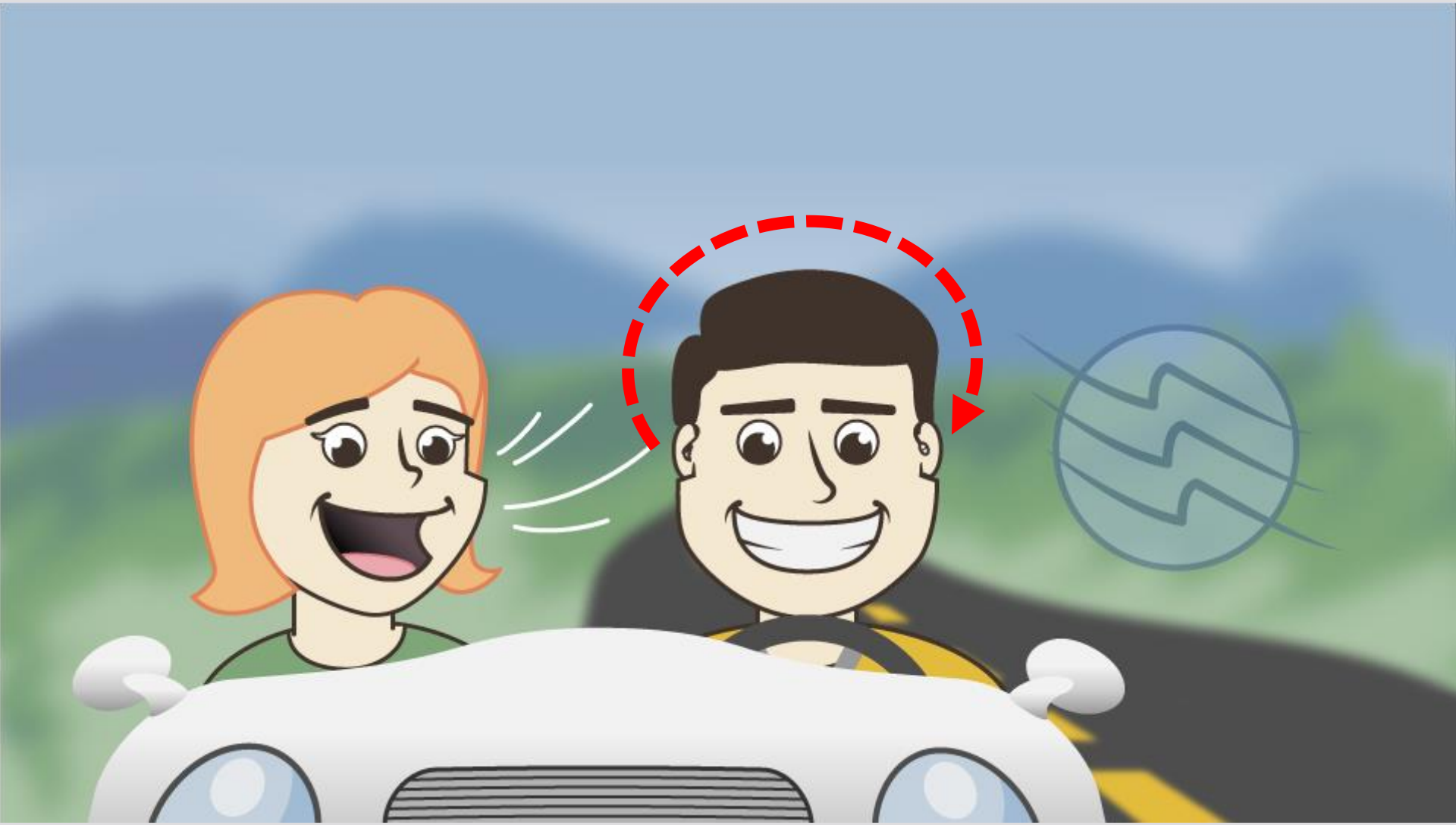
Clinical Study – Hannover

- Benefit of 2.2dB with **StereoZoom** compared to omni-directional microphones



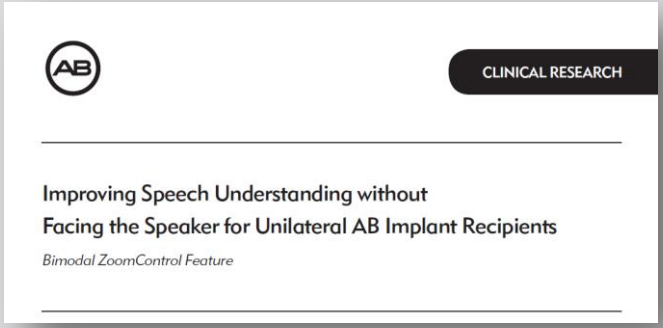


ZoomControl



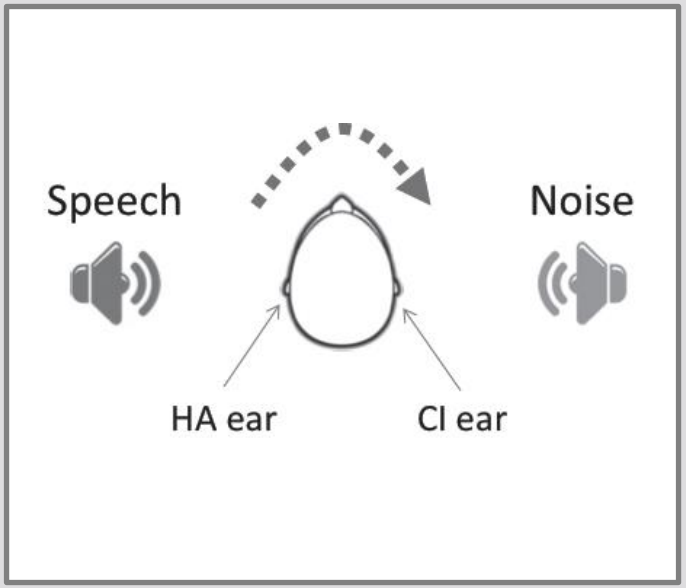
Clinical Study – Valencia

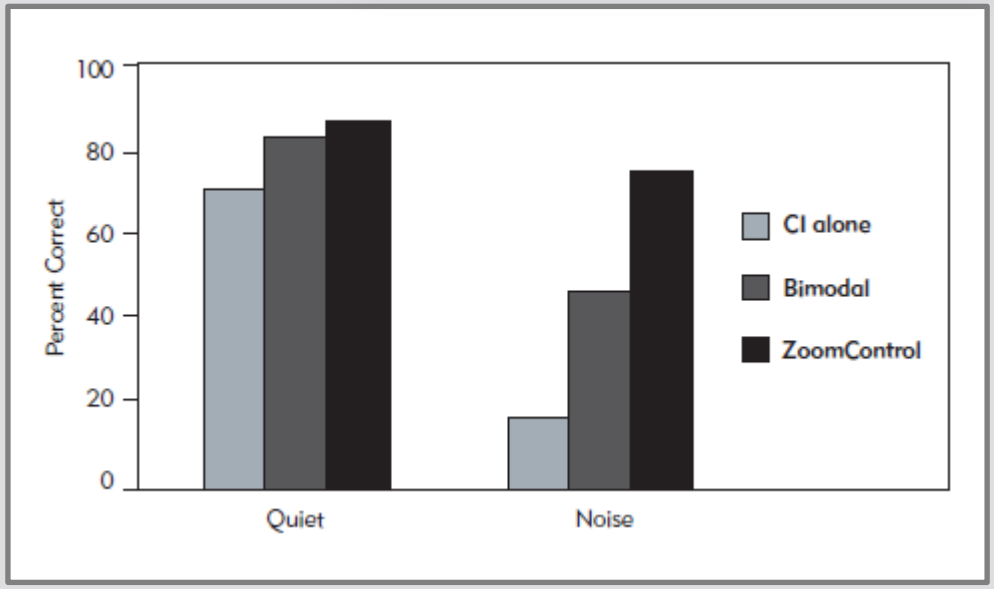
- Bimodal benefit 15% in quiet and 33% in noise
- ZoomControl benefit 3% in quiet and 28% in noise


CLINICAL RESEARCH

Improving Speech Understanding without Facing the Speaker for Unilateral AB Implant Recipients

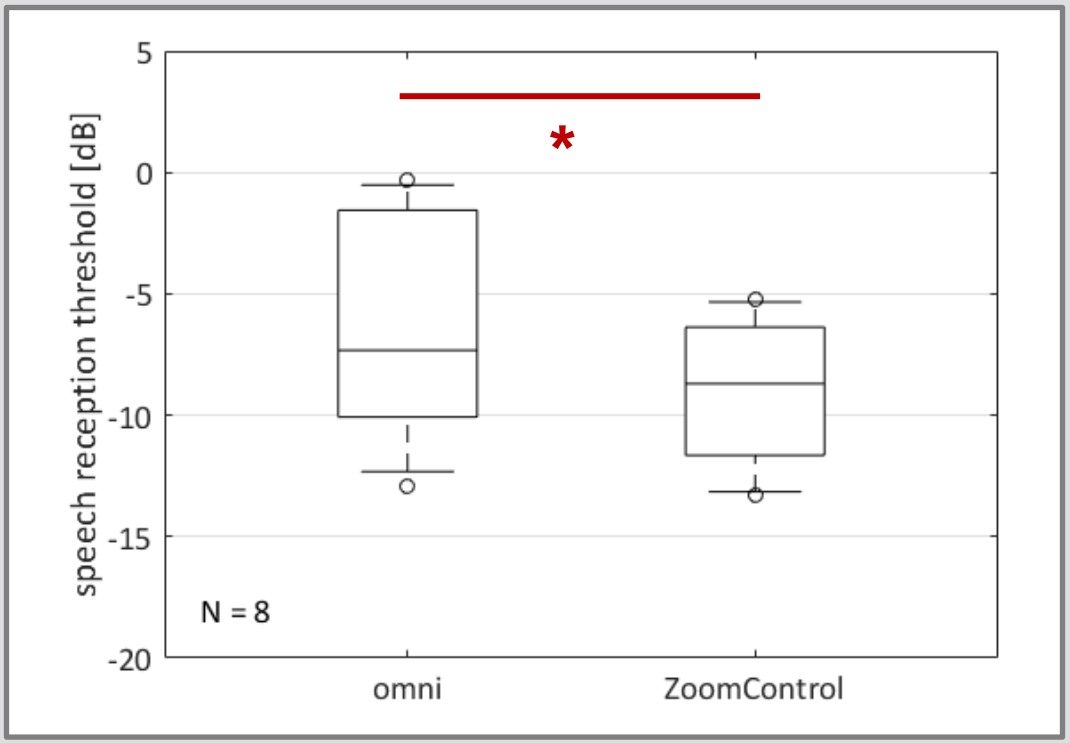
Bimodal ZoomControl Feature

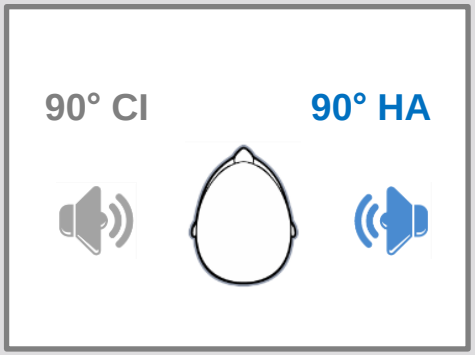




Clinical Study – Hannover

- Benefit of 0.5dB with **ZoomControl** compared to omni-directional microphones





Bimodal Wireless Streaming Technology

Bimodal compatibility with full line of Phonak wireless accessories.
Streaming audio directly to both devices for effortless hearing.

Testimonials

Bimodal Naída System

Now it sounds like having two hearing aids.

Hearing is not as exhausting as before.

Hearing music with the new devices is obviously improved. Even new music pieces.

With the new devices it sounds more natural and more precise.

The new setting is just great.

Music sounds very good and clear now.

Bimodal VST

StereoZoom is very helpful in very noisy surroundings.

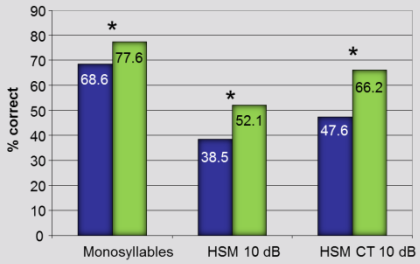
ZoomControl is very good when driving with the car because it does not kick off so much as it does with the program before.

ZoomControl quite good for telephone calls and when driving with the car.

Binaural VoiceStream Technology - Summary

- Binaural VoiceStream features improve speech perception in noisy hearing situations
- Hearing is less exhausting for Cochlear Implant users with Naída bimodal system
- Improved listening and handling comfort through aligned technologies

Summary



Benefit for hearing impaired through bimodal fitting
Increase of bimodal population

High complexity of medical care of bimodal recipients

Naída bimodal hearing solution offers

- Simplified fitting for professionals
- Improved comfort for recipients
  - Easy handling and connectivity
  - Better speech understanding and sound quality

➢ Most advanced system in the market for bimodal patients