Expanding Performance Leadership in Cochlear Implants

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Normal Acoustic Hearing

Acoustic Input via External Ear Canal

Neural Activity to CNS
Cochlear Implant Stimulation

Acoustic Input via External Ear Canal

Neural Activity to CNS
How a Cochlear Implant works

- **Sound Processor**
  - Captures sound from the environment
  - Processes sound into digital information
  - Transmits to the implant

- **Implant**
  - Converts transmitted information into electrical signals
  - Delivers signals to the electrode array for stimulating the hearing nerve

- **Hearing Nerve**
  - Transmits the signal which will be perceived by the brain as sound
1981: UCSF reported first open-set speech discrimination results (40-50% on spondaic words & sentences)

1983: Licensed implant patent portfolio to Storz Instrument to create UCSF/Storz implant

16 patients implanted between 1985–1986

1987: Entered into partnership with Mini-Med Technologies to develop commercial multi-channel cochlear implant system

1993 Foundation of Advanced Bionics
During the Last 15 Years

CI Industry
16 independent current sources: 120 spectral bands (Maestro: 12, Freedom: up to 22)

Industry’s fastest stimulation rate: 83,000 pps (Maestro: 50,000 pps, Freedom: 32,000 pps)

Input Dynamic Range: 80 dB (Maestro: 55 dB, Freedom: 45 dB)

Industry’s highest case impact resistance: up to 6 Joules (Freedom: 1 Joule)
Hearing Performance with CI*

*Medical School Hannover, Buechner et al., 2011
During the Last 15 Years
In the past 20 years Phonak has built up a unique design and manufacturing expertise, starting with invention of the dual-microphone technology in early 1990.
The Best of Two Worlds: Naída CI

The strongest value proposition for CI users and professionals
quantum leap forward
in performance & wireless connectivity
with a chic, modern instyle™ design
What if I am in a Noisy Restaurant?
Unique Selling Proposition (USPs)
T-Mic™ – Clinical Results*

N=10, mean ± 1SD

-1.9

-2.4

SRT [dB]

Omni

T-Mic

*N=10, mean ± 1SD

In collaboration with MHH, Büchner et al., ESPCI 2013
Unique Selling Proposition (USPs)
Adaptive directional microphones (Phonak UltraZoom) drastically improve speech in noise understanding for CI users.

- Signals from the front are kept, while signals from the side and back are reduced
- Continuous adaptation of the directivity pattern to the noise field
- Estimation of the direction of noise incidence and cancellation of the dominant noise source
- Signal-noise-ratio gain by 6.0 dB with UltraZoom.
- This is even more significant than for hearing aid users.

*In collaboration with MHH, Büchner et al., ESPCI 2013
What if I am in a Noisy Restaurant?
The Best of Two Worlds: Naída CI

Unique Selling Proposition (USPs)

- T-Mic™ 2
  Natural Microphone Placement

- ClearVoice™*
  Unique Speech Enhancement

*Not approved for pediatric use in the U.S.
FDA approved ClearVoice with superiority claim in May 2012

In the FDA trial, 93% of recipients indicated they choose ClearVoice for hearing all day, every day, everywhere\(^1\)

9 out of 10 recipients reported that listening in real-world settings is easier, less stressful, less tiring, and more enjoyable\(^1\)

Signal-to-noise ratio gain by 6.8 dB with UltraZoom + ClearVoice.

*In collaboration with MHH, Büchner et al., ESPCI 2013*
What does +6.8 dB SNR mean?

Example

![Graph showing the improvement in speech intelligibility with a 6.8 dB SRT Gain.]
What happens in situations with *speech from the side*, e.g. in a car?

*In collaboration with MHH, Geissler et al., 2013*
Unique Selling Proposition (USPs)

- **T-Mic™ 2**: Natural Microphone Placement
- **ClearVoice™**: Unique Speech Enhancement
- **UltraZoom**: The Adaptive Beamformer
- **ZoomControl**: Dual-microphone with VoiceStream

The Best of Two Worlds: Naída CI
- Streaming of the speech signal to the contralateral side, which is acoustically shaded by the head (~6 dB loss!)
- Attenuation of the "noisy" contralateral microphone signal
- Both ears get the "better signal", especially useful for asymmetric hearing capabilities

Binaural VoiceStream Technology™
ZoomControl – Clinical Results*

- ZoomControl is the best option for speech from the side
- ClearVoice doubles the improvement!

*In collaboration with MHH, Geissler et al., 2013
What if I like Music?
Enjoyable music perception with CI requires an accurate coding of the physical parameters
*Intensity, Frequency and Time*

AB offers a unique feature set to support music perception with CI

*from «This is your brain on music», D. Levitin
**The Best of Two Worlds: Naída CI**

**Unique Selling Proposition (USPs)**

- **T-Mic™ 2**
  Natural Microphone Placement

- **ClearVoice™**
  Unique Speech Enhancement

- **HiRes Fidelity 120™**
  120 Spectral Bands

- **UltraZoom**
  The Adaptive Beamformer

- **ZoomControl**
  Dual-microphone with VoiceStream

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Current steering technology:
- Stimulating 2 adjacent electrodes in parallel
- Creating intermediate pitch percepts between electrodes
- Pitch is steered by the ratio of the 2 electrode currents
- On average 7 discriminable virtual channels between 2 contacts
- Improvement of frequency resolution
Conventional frequency coding

Cochlea

Piano
Frequency coding with current steering

Cochlea

Piano

Creation of intermediate pitch percepts between electrode contacts
Enjoyable music perception with CI requires an accurate coding of the physical parameters *Intensity, Frequency and Time*.

AB offers a unique feature set to support music perception with CI.

*from «This is your brain on music», D. Levitin
Temporal Coding and Rhythm

CIS Envelope (400 Hz)

Low Rate Stimulation (10,000 pps)
Temporal Coding and Rhythm

AB HiRes Envelope
(5,800 Hz)

AB HiRes Stimulation
(83,000 pps)
The Best of Two Worlds: Naída CI

Unique Selling Proposition (USPs)

- **T-Mic™ 2**: Natural Microphone Placement
- **ClearVoice™**: Unique Speech Enhancement
- **HiRes Fidelity 120™**: 120 Spectral Bands
- **HiFocus™ Mid-Scala**: Perimodiolar Electrode

**UltraZoom**: The Adaptive Beamformer

**ZoomControl**: Dual-microphone with VoiceStream
HiFocus™ Mid-Scala Electrode

- Designed to avoid trauma
- Electrode located close to the modiolus
- Ideal placement for high frequencies*
- Ideal positioning for maximum performance**

*Frijns et al, 2009
** Holden, Finley et al, 2013
Enjoyable music perception with CI requires an accurate coding of the physical parameters *Intensity, Frequency and Time*.

AB offers a unique feature set to support music perception with CI

*from «This is your brain on music», D. Levitin*
Music has a wide dynamic range from very soft levels around 40 dB to levels above 100 dB:

- In the past, the input dynamic range (IDR) focused on speech, and was really rather limited at around 30 dB

- For AB speech processors with AutoSound™ technology, the default IDR is 60 dB, but this can be expanded out to 80 dB capturing almost all of the musical input we encounter
Unique Selling Proposition (USPs)

T-Mic™ 2
Natural Microphone Placement

ClearVoice™
Unique Speech Enhancement

HiRes Fidelity 120™
120 Spectral Bands

HiFocus™ Mid-Scala
Perimodiolar Electrode

AutoSound™
Widest (80 dB) Dynamic Range

UltraZoom
The Adaptive Beamformer

ZoomControl
Dual-microphone with VoiceStream

The Best of Two Worlds: Naída CI
The Importance of Dynamic Range*

Percentage of 7 adult AB Harmony users who preferred a wider IDR (70 dB vs. 40 dB) for listening to three different styles of music.

Enjoyable music perception with CI requires an accurate coding of the physical parameters *Intensity, Frequency and Time*.  

AB offers a unique feature set to support music perception with CI  

*from «This is your brain on music», D. Levitin*
What if I am Talking on the Phone?
The Best of Two Worlds: Naída CI

Unique Selling Proposition (USPs)

- **T-Mic™ 2**
  Natural Microphone Placement

- **ClearVoice™**
  Unique Speech Enhancement

- **HiRes Fidelity 120™**
  120 Spectral Bands

- **HiFocus™ Mid-Scala**
  Perimodiolar Electrode

- **AutoSound™**
  Widest Dynamic Range

- **UltraZoom**
  The Adaptive Beamformer

- **ZoomControl**
  Dual-microphone with VoiceStream

- **DuoPhone**
  Phone call streaming to both ears
Phonak Binaural VoiceStream Technology™

PHONAK Binaural VoiceStream Technology™
Unique Selling Proposition (USPs)

- T-Mic™ 2
  Natural Microphone Placement

- ClearVoice™
  Unique Speech Enhancement

- HiRes Fidelity 120™
  120 Spectral Bands

- HiFocus™ Mid-Scala
  Perimodiolar Electrode

- AutoSound™
  Widest Dynamic Range

- UltraZoom
  The Adaptive Beamformer

- ZoomControl
  Dual-microphone with VoiceStream

- DuoPhone
  Phone call streaming to both ears

- ComPilot
  Wireless streaming with Bimodal

The Best of Two Worlds: Naída CI
100% wireless connectivity to consumer electronics

wireless streaming to Bluetooth devices, phones and countless other popular consumer electronics by leading brands, including Apple, Samsung and Nokia

Apple® is a registered trademark of Apple Inc.
Samsung is a registered trademark of Samsung Electronics Co., Ltd.
Nokia is a registered trademark of Nokia Corporation.
What if I Need to Hear over a Distance?
**Unique Selling Propositions (USPs)**

- **T-Mic™ 2**
  Natural Microphone Placement

- **ClearVoice™**
  Unique Speech Enhancement

- **HiRes Fidelity 120™**
  120 Spectral Bands

- **HiFocus™ Mid-Scala**
  Perimodiolar Electrode

- **AutoSound™**
  Widest Dynamic Range

- **UltraZoom**
  The Adaptive Beamformer

- **ZoomControl**
  Dual-microphone with VoiceStream

- **DuoPhone**
  Phone call streaming to both ears

- **ComPilot**
  Wireless streaming with Bimodal

- **RemoteMic**
  Wireless solution for noisy places
What if I Need to Hear in School?
Unique Selling Proposition (USPs)

- **T-Mic™ 2**
  - Natural Microphone Placement

- **ClearVoice™**
  - Unique Speech Enhancement

- **HiRes Fidelity 120™**
  - 120 Spectral Bands

- **HiFocus™ Mid-Scala**
  - Perimodiolar Electrode

- **AutoSound**
  - Widest Dynamic Range

- **UltraZoom**
  - The Adaptive Beamformer

- **ZoomControl**
  - Dual-microphone with VoiceStream

- **DuoPhone**
  - Phone call streaming to both ears

- **ComPilot**
  - Wireless streaming with Bimodal

- **RemoteMic**
  - Wireless solution for noisy places

- **Roger**
  - Design-Integrated DM
Design-Integrated DM Link
What if the Vol. of my TV is Annoying Others?
Unique Selling Propositions (USPs)

- T-Mic™ 2: Natural Microphone Placement
- ClearVoice™: Unique Speech Enhancement
- HiRes Fidelity 120™: 120 Spectral Bands
- HiFocus™ Mid-Scala: Perimodiolar Electrode
- AutoSound™: Widest Dynamic Range

- UltraZoom: The Adaptive Beamformer
- ZoomControl: Dual-microphone with VoiceStream
- DuoPhone: Phone call streaming to both ears
- ComPilot: Wireless streaming with Bimodal
- RemoteMic: Wireless solution for noisy places
- Roger: Design Integrated DM
- TVLink: Wireless solution for TV
What if I Want to Hear in and under Water?
Unique Selling Proposition (USPs)

- **T-Mic™ 2**: Natural Microphone Placement
- **ClearVoice™**: Unique Speech Enhancement
- **HiRes Fidelity 120™**: 120 Spectral Bands
- **HiFocus™ Mid-Scala**: Perimodiolar Electrode
- **AutoSound™**: Widest Dynamic Range
- **AquaMic**: Waterproof Headpiece

**UltraZoom**: The Adaptive Beamformer

**ZoomControl**: Dual-microphone with VoiceStream

**DuoPhone**: Phone call streaming to both ears

**ComPilot**: Wireless streaming with Bimodal

**RemoteMic**: Wireless solution for noisy places

**TVLink**: Wireless solution for TV

**Roger**: Design-Integrated DM

*available soon*
AquaMic Waterproof Headpiece
What if I Desire a Smaller Processor?
Unique Selling Propositions (USPs)

- **T-Mic™ 2**
  Natural Microphone Placement

- **ClearVoice™**
  Unique Speech Enhancement

- **HiRes Fidelity 120™**
  120 Spectral Bands

- **HiFocus™ Mid-Scala**
  Perimodiolar Electrode

- **AutoSound™**
  Widest Dynamic Range

- **AquaMic**
  Waterproof Headpiece

- **HiRes™ Optima**
  Optimized Battery Life

- **UltraZoom**
  The Adaptive Beamformer

- **ZoomControl**
  Dual-microphone with VoiceStream

- **DuoPhone**
  Phone call streaming to both ears

- **ComPilot**
  Wireless streaming with Bimodal

- **RemoteMic**
  Wireless solution for noisy places

- **TVLink**
  Wireless solution for TV

- **Roger**
  Design-Integrated DM
As Thin as a Hearing Aid

40% smaller than AB's previous behind-the-ear sound processor... and as thin as the industry-leading power hearing aid!

always instyle™
The Best of Two Worlds: Naída CI

Unique Selling Proposition (USPs)

- T-Mic™ 2 Natural Microphone Placement
- ClearVoice™ Unique Speech Enhancement
- HiRes Fidelity 120™ 120 Spectral Bands
- HiFocus™ Mid-Scala Perimodiolar Electrode
- AutoSound™ Widest Dynamic Range
- AquaMic Waterproof Headpiece
- HiRes™ Optima Optimized Battery Life
- Rechargeable
- Zinc-Air
- UltraZoom The Adaptive Beamformer
- ZoomControl Dual-microphone with VoiceStream
- DuoPhone Phone call streaming to both ears
- ComPilot Wireless streaming with Bimodal
- RemoteMic Wireless solution for noisy places
- TVLink Wireless solution for TV
- Roger Design-Integrated DM
Naída CI
quantum leap
forward
in performance & wireless connectivity
with a chic, modern instyle™ design

Naída CI Q70
By Advanced Bionics
Focused Innovation

1) Hearing Preservation
2) Reduce Power Consumption
3) Reduce Size
4) Signal Processing
5) Wireless Connectivity
6) Bimodal
Sustainable Technological Advantage

Binaural VoiceStream Technology™
delivering the best in bilateral hearing

- **DuoPhone**: automatic streaming of phone calls to both ears
- **ZoomControl**: microphone technology for focused hearing
- **QuickSync**: one-touch control of two processors

AB PHONAK | Partners for Better Hearing
bimodal technology
stream media simultaneously to a Phonak hearing aid and AB sound processor

1. stream to one
   AB sound processor

2. stream to two
   AB sound processors

AB PHONAK | Partners for Better Hearing

PHONAK | Partners for Better Hearing
Accelerating Innovation Rate