

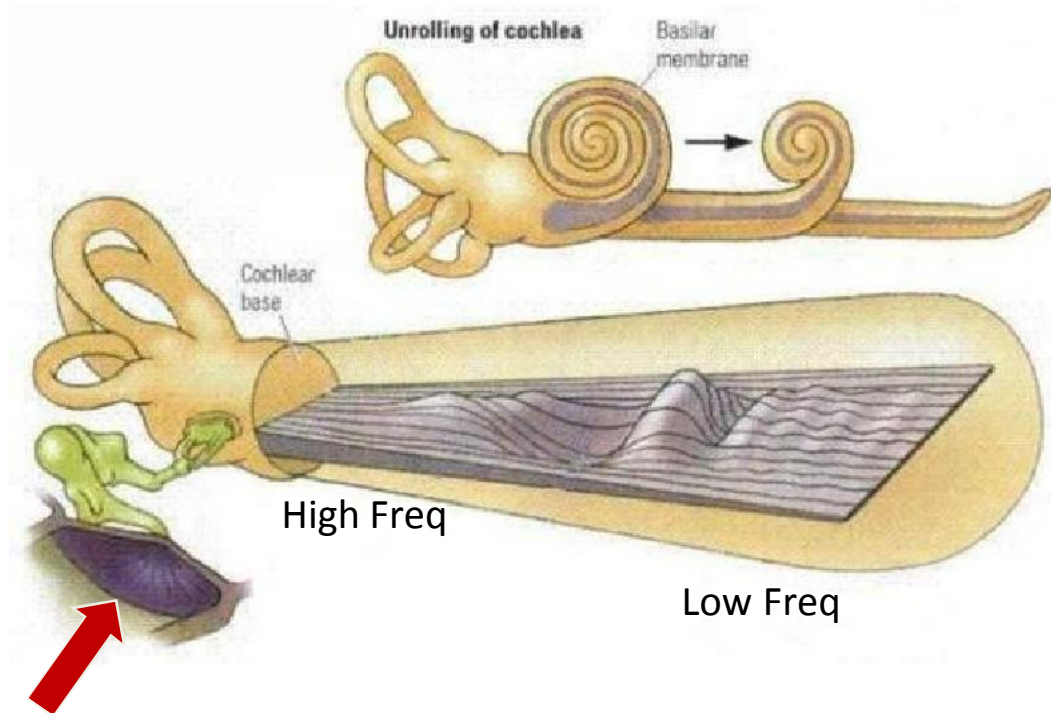
Expanding Performance Leadership in Cochlear Implants



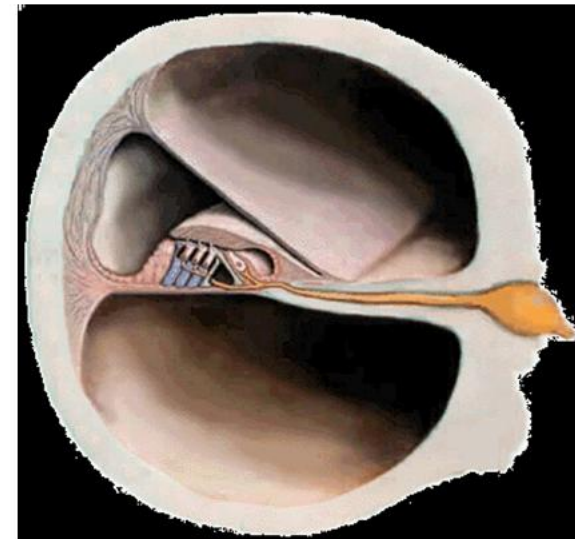
Hansjuerg Emch
President, Advanced Bionics AG
GVP, Sonova Medical



Normal Acoustic Hearing



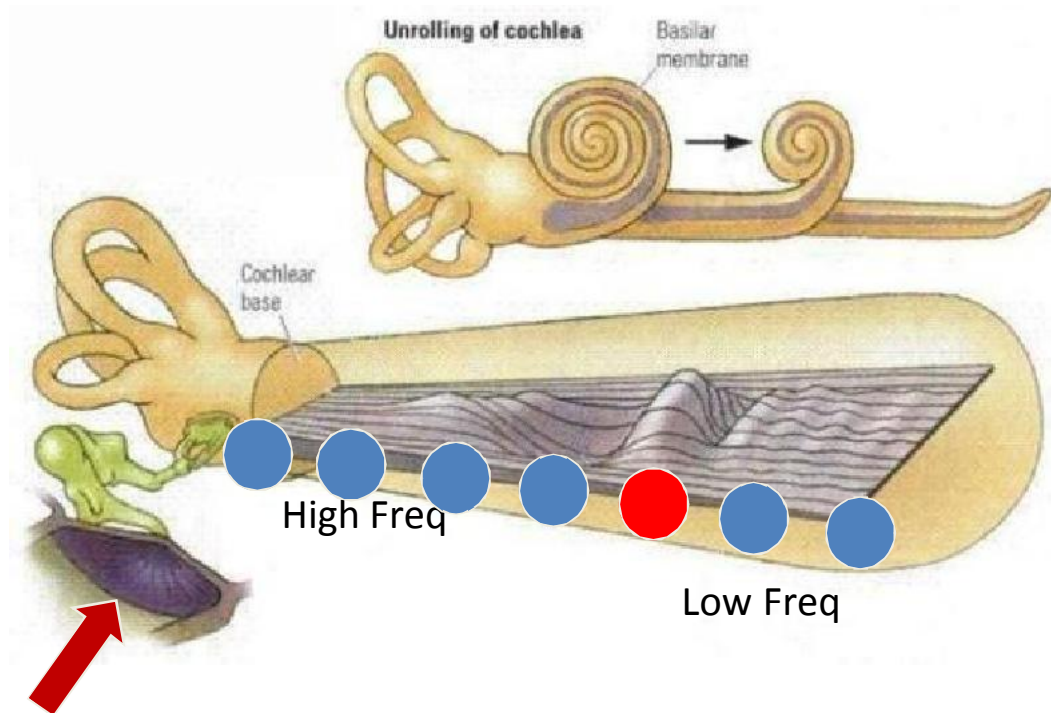
Acoustic Input via External Ear Canal



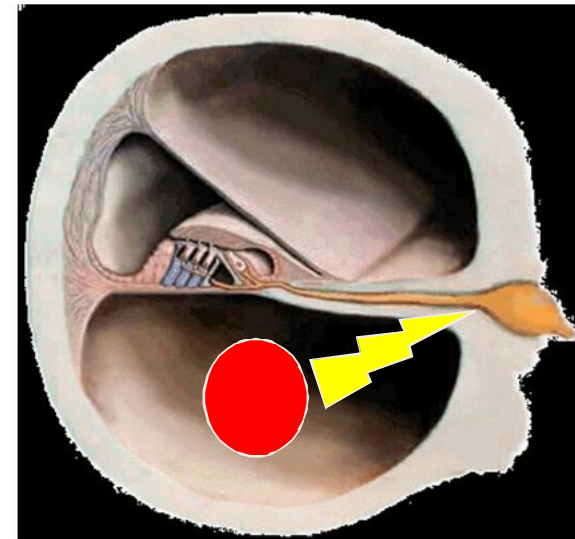
Neural Activity to CNS



Cochlear Implant Stimulation



Acoustic Input via External Ear Canal



Neural Activity to CNS



How a Cochlear Implant works

■ Sound Processor

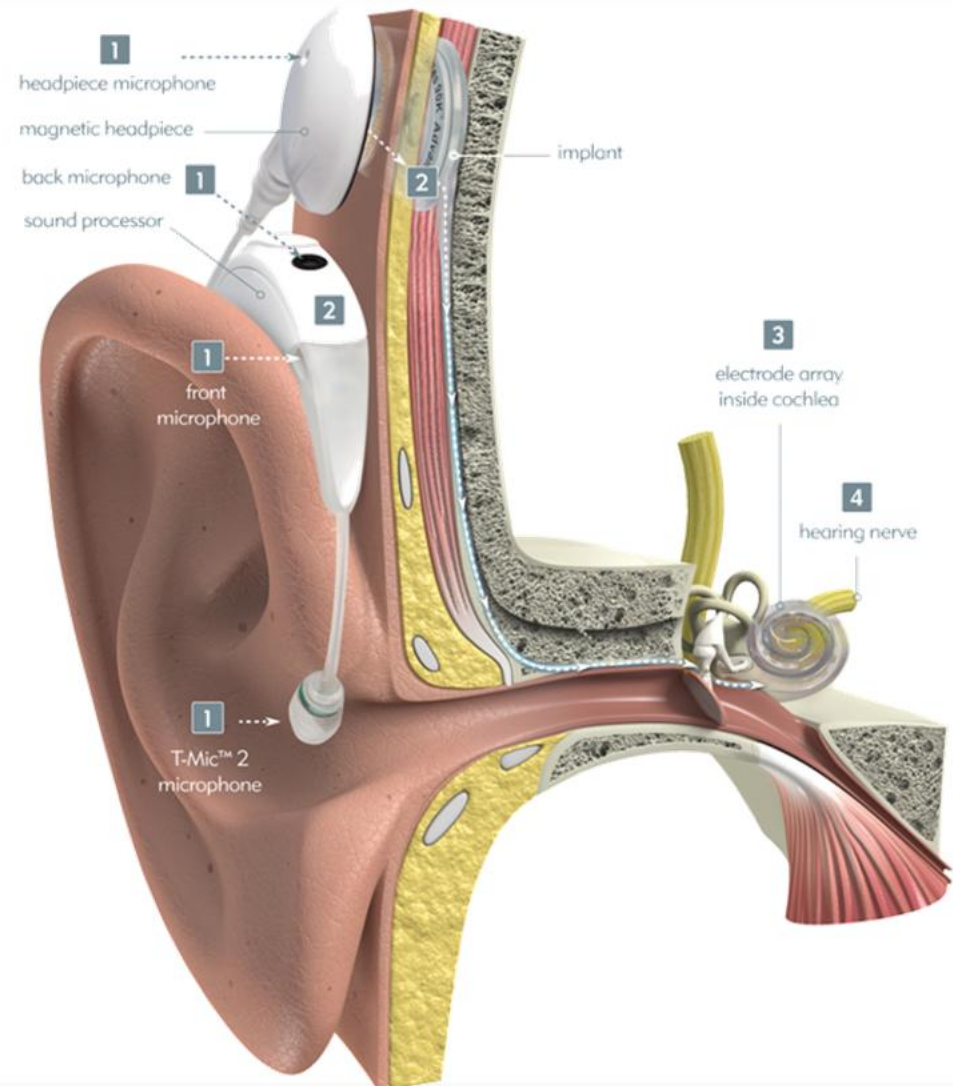
- Captures sound from the environment
- Processes sound into digital information
- Transmits to the implant

■ Implant

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

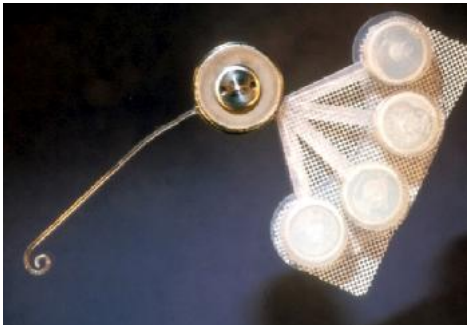
■ Hearing Nerve

- Transmits the signal which will be perceived by the brain as sound





The Beginning of Advanced Bionics



- **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

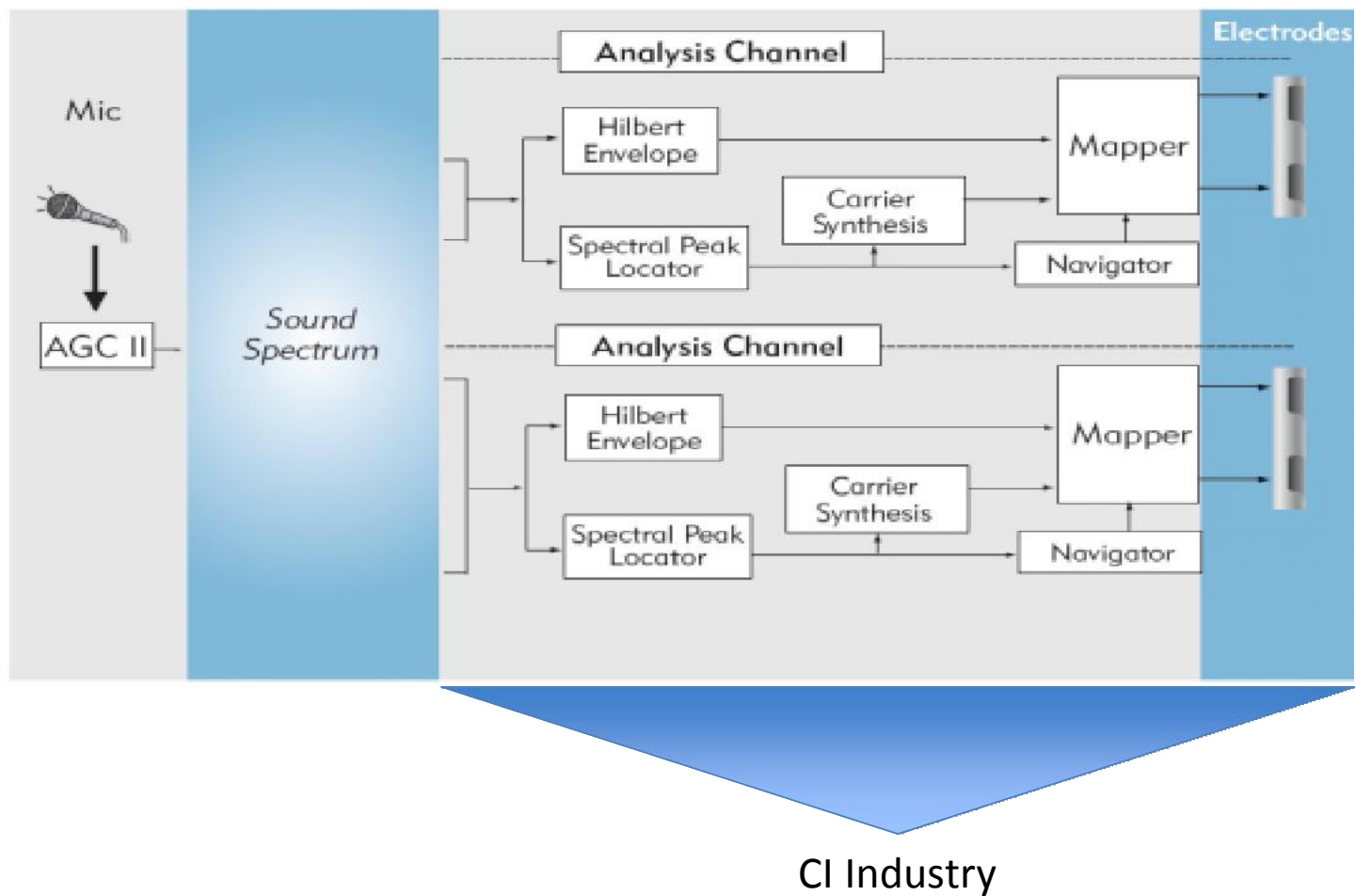


During the Last 15 Years





During the Last 15 Years





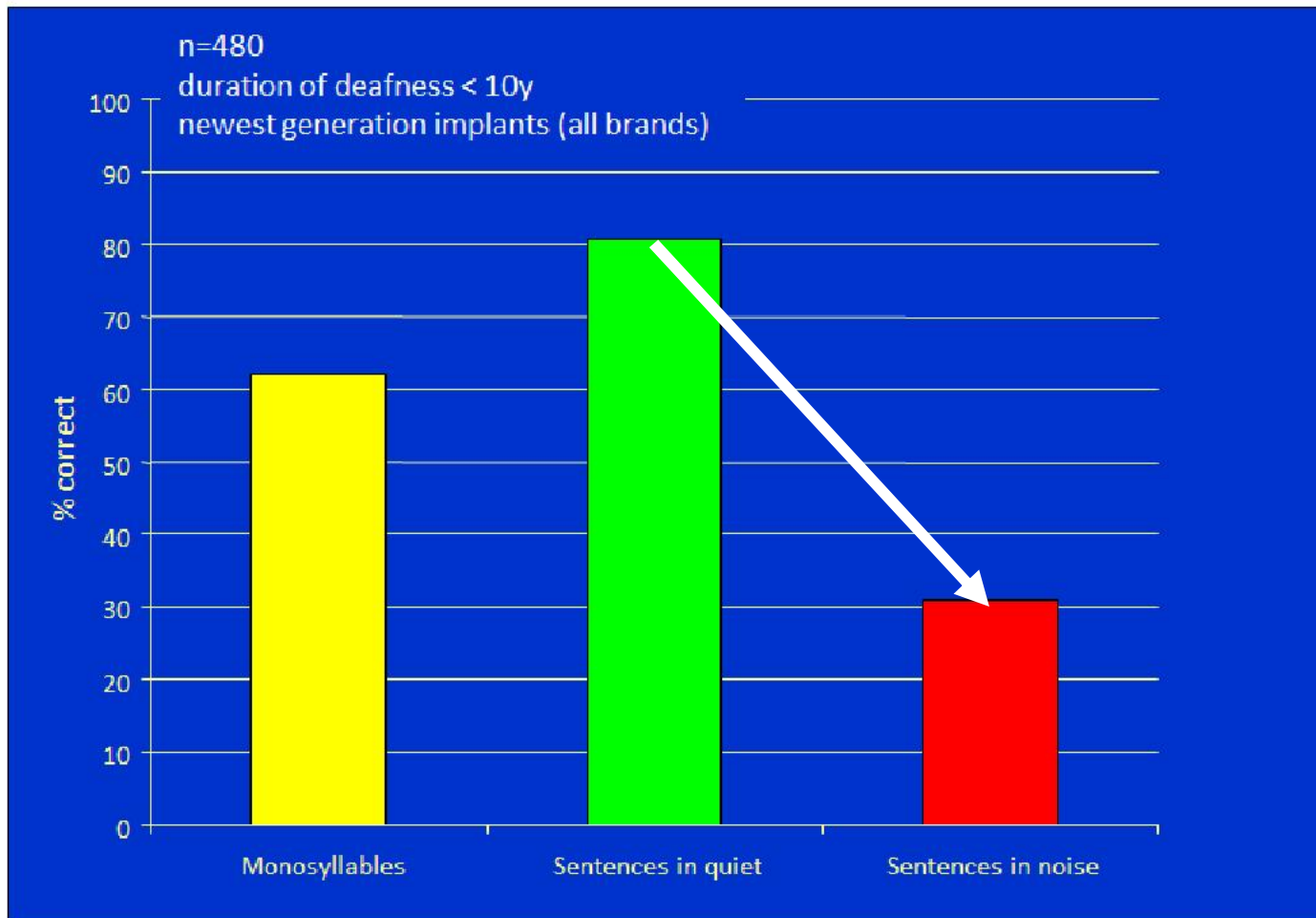
Strongest Technology Platform

- 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)





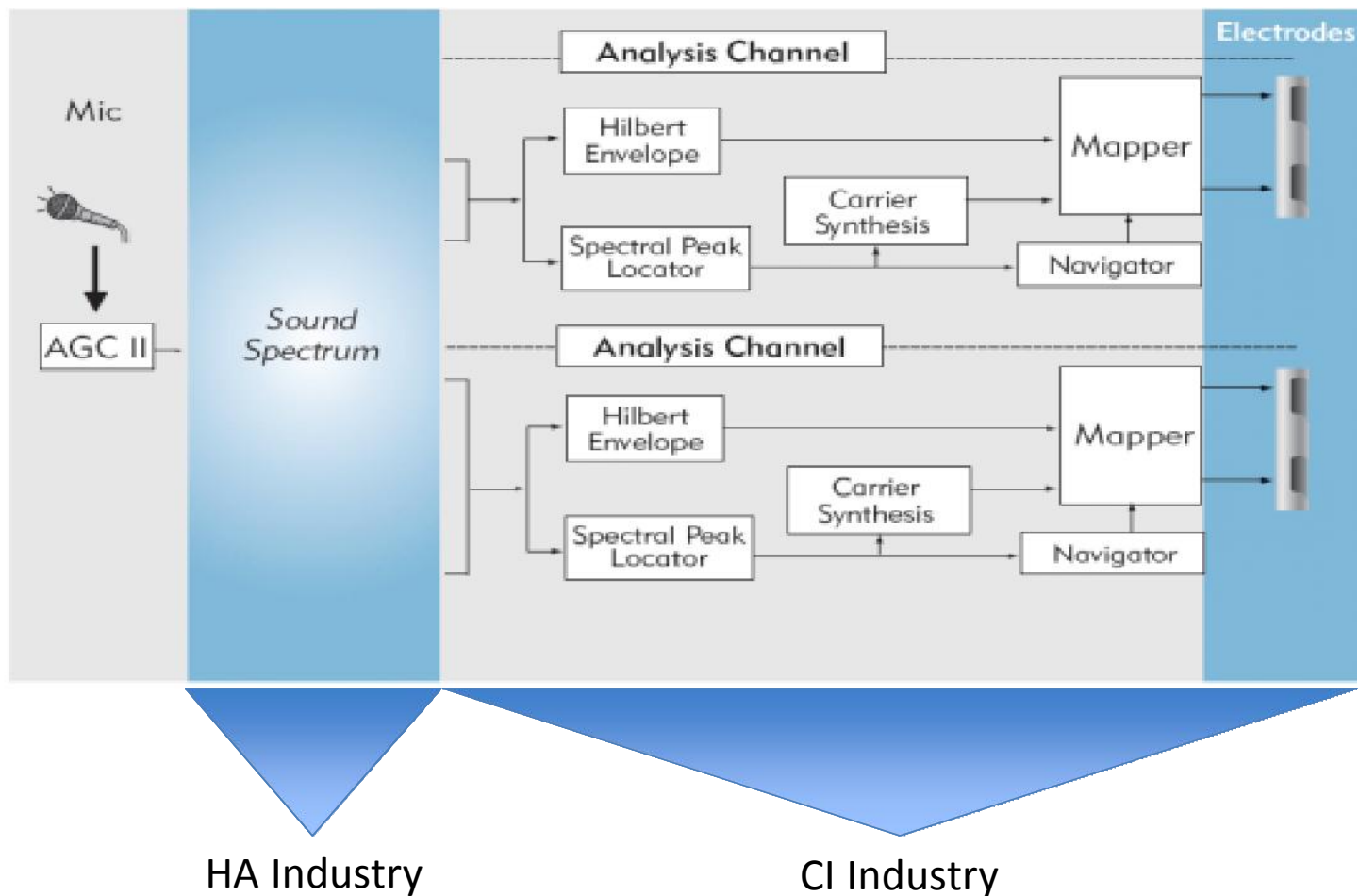
Hearing Performance with CI*



*Medical School Hannover, Buechner et al., 2011

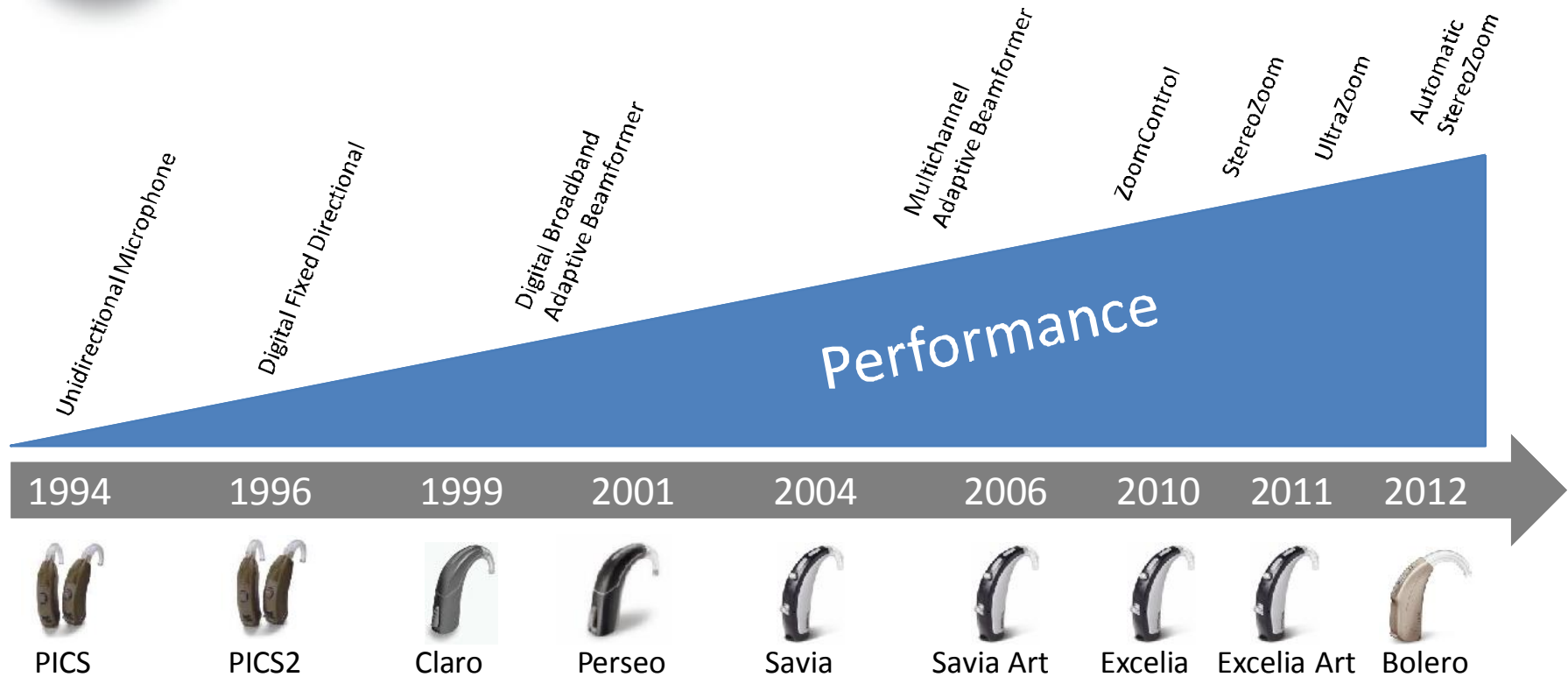


During the Last 15 Years





Phonak's Unique Expertise

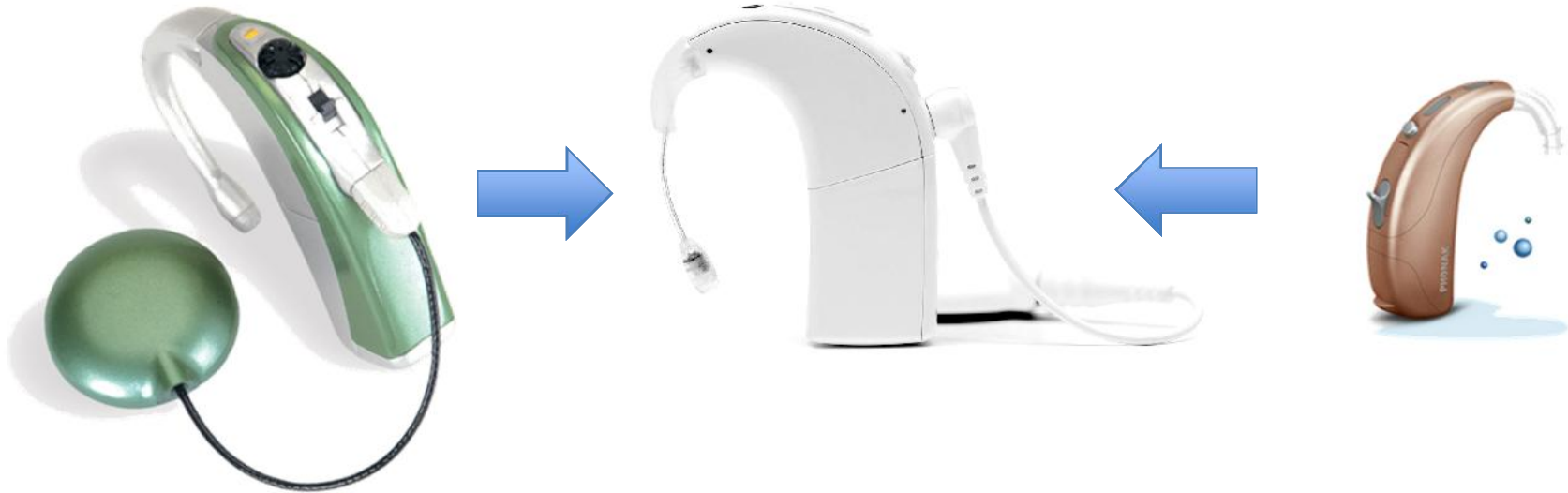


In the past 20 years Phonak has built up a unique design and manufacturing expertise, starting with invention of the dual-microphone technology in early 1990.



The Best of Two Worlds: Naída CI

The strongest value proposition for CI users and professionals



PHONAK

| Partners for Better Hearing

quantum leap *forward*

in performance & wireless connectivity
with a chic, modern instyle™ design



Naída CI Q70
By Advanced Bionics



What if I am in a Noisy Restaurant?





The Best of Two Worlds: Naída CI

Unique Selling Proposition (USPs)



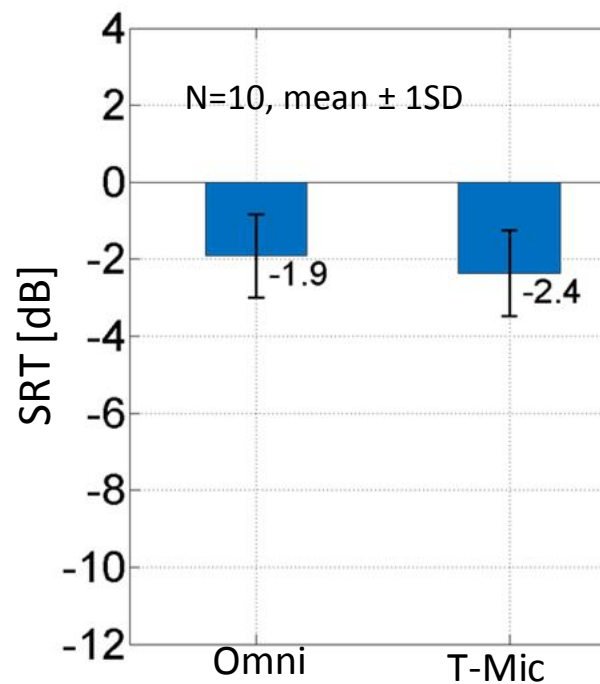
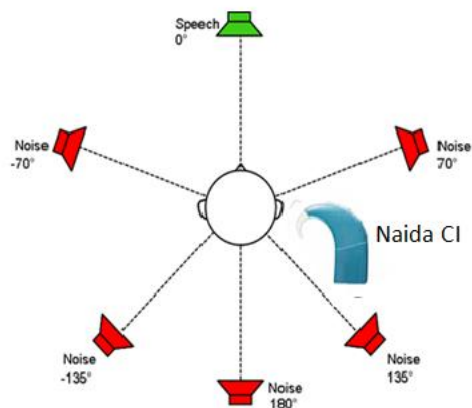
T-Mic™ 2
Natural Microphone
Placement



PHONAK



T-Mic™ – Clinical Results*



*In collaboration with MHH, Büchner et al., ESPCI 2013



PHONAK

Partners for Better Hearing



The Best of Two Worlds: Naída CI

Unique Selling Proposition (USPs)



T-Mic™ 2
Natural Microphone
Placement

UltraZoom
The Adaptive
Beamformer



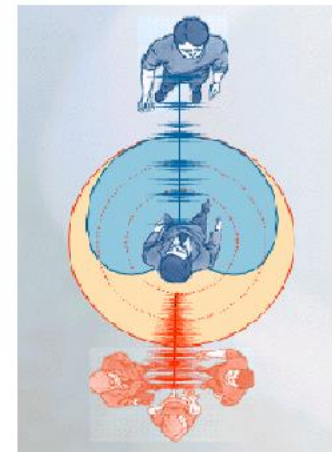
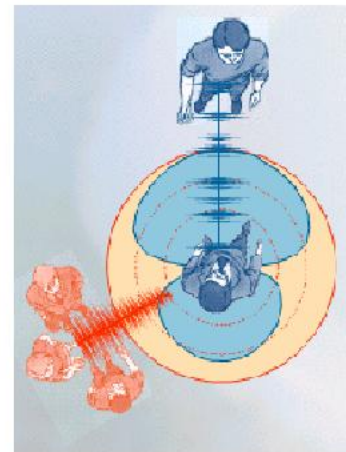
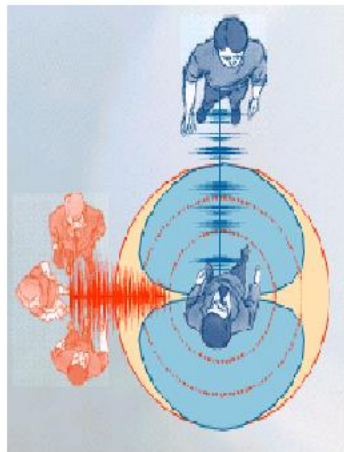
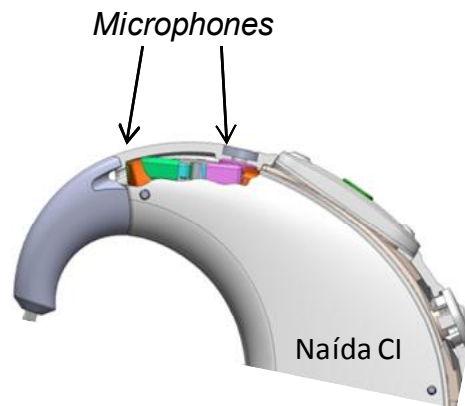
PHONAK



Phonak's Adaptive Directional Microphones

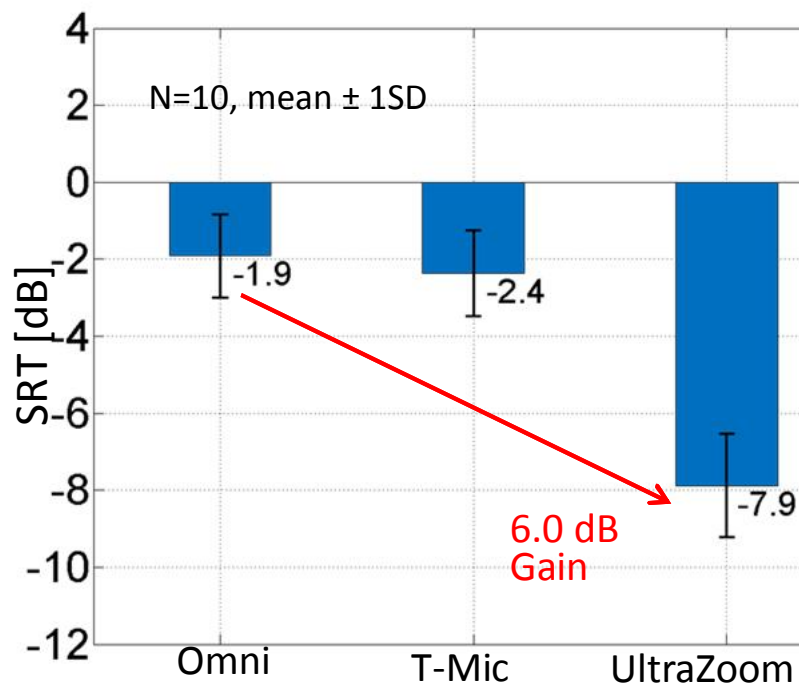
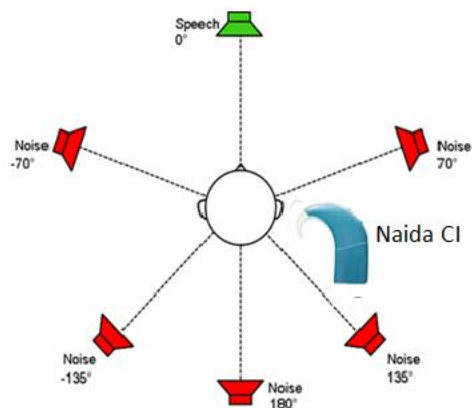
Adaptive directional microphones (Phonak UltraZoom) drastically improve speech in noise understanding for CI users.

- 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





UltraZoom – Clinical Results*



- 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



PHONAK

Partners for Better Hearing



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

UltraZoom
The Adaptive
Beamformer

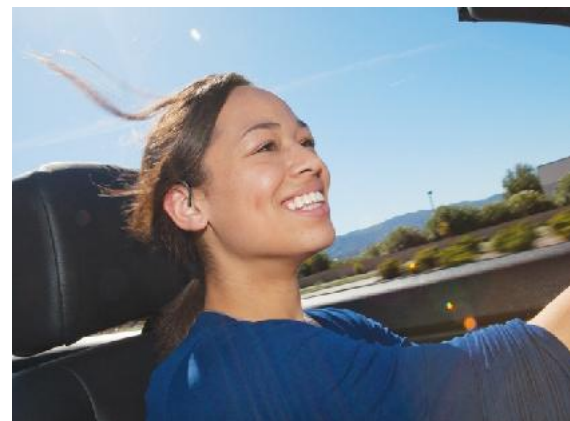
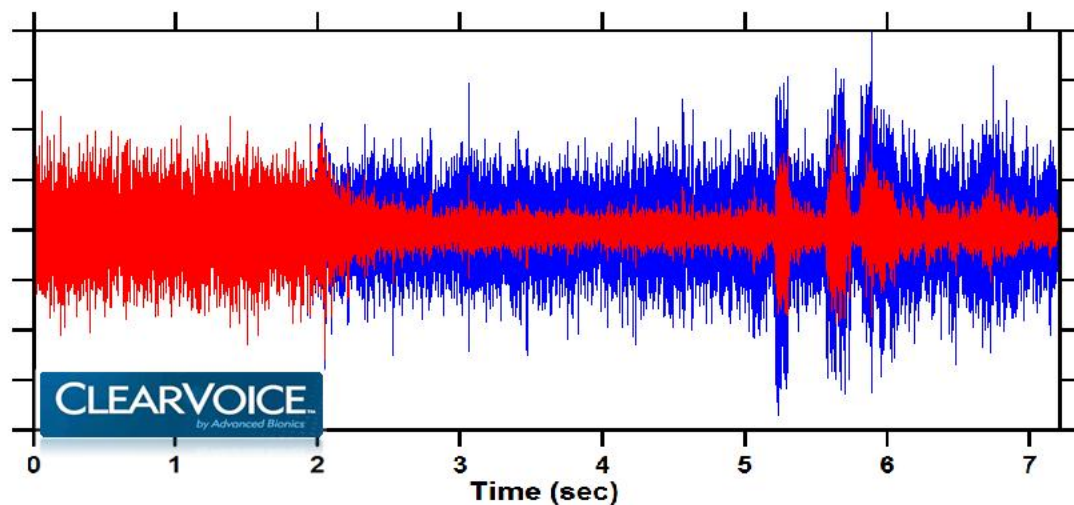


PHONAK



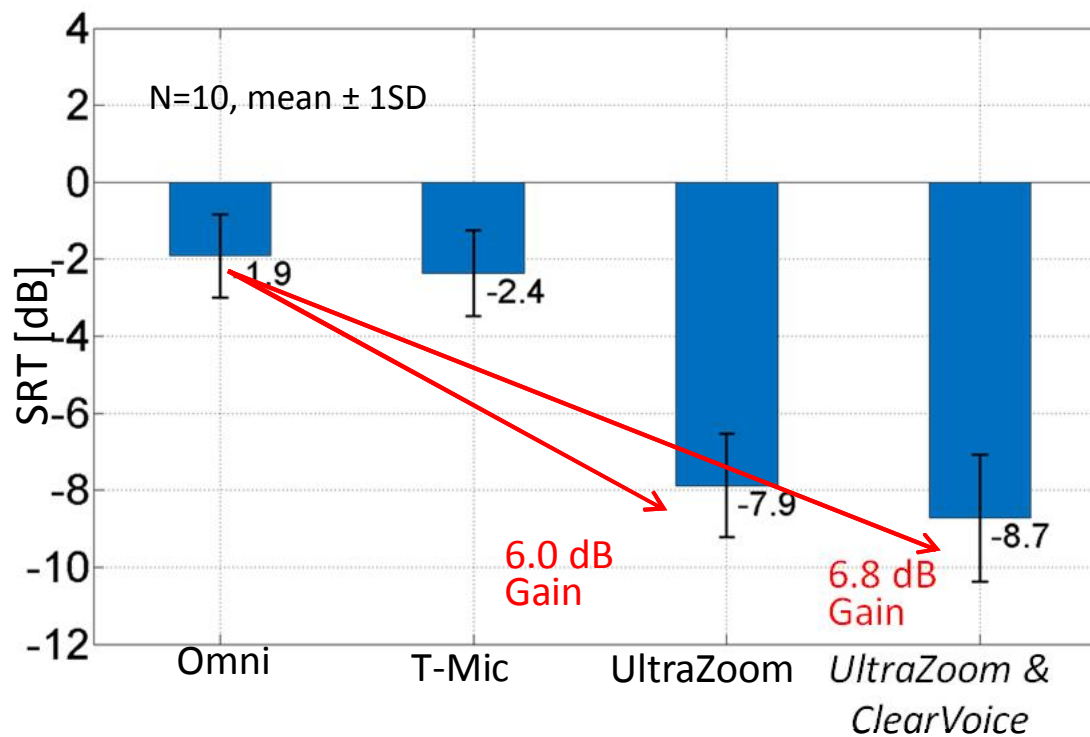
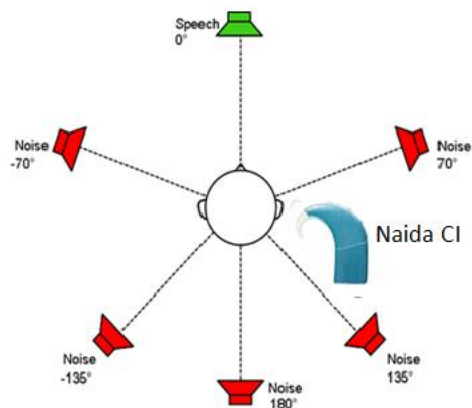
ClearVoice™ Sound Processing

- 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, everywhere¹
- 9 out of 10 recipients reported that listening in real-world settings is easier, less stressful, less tiring, and more enjoyable¹





UltraZoom + ClearVoice – Clinical Results*



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

*In collaboration with MHH, Büchner et al., ESPCI 2013



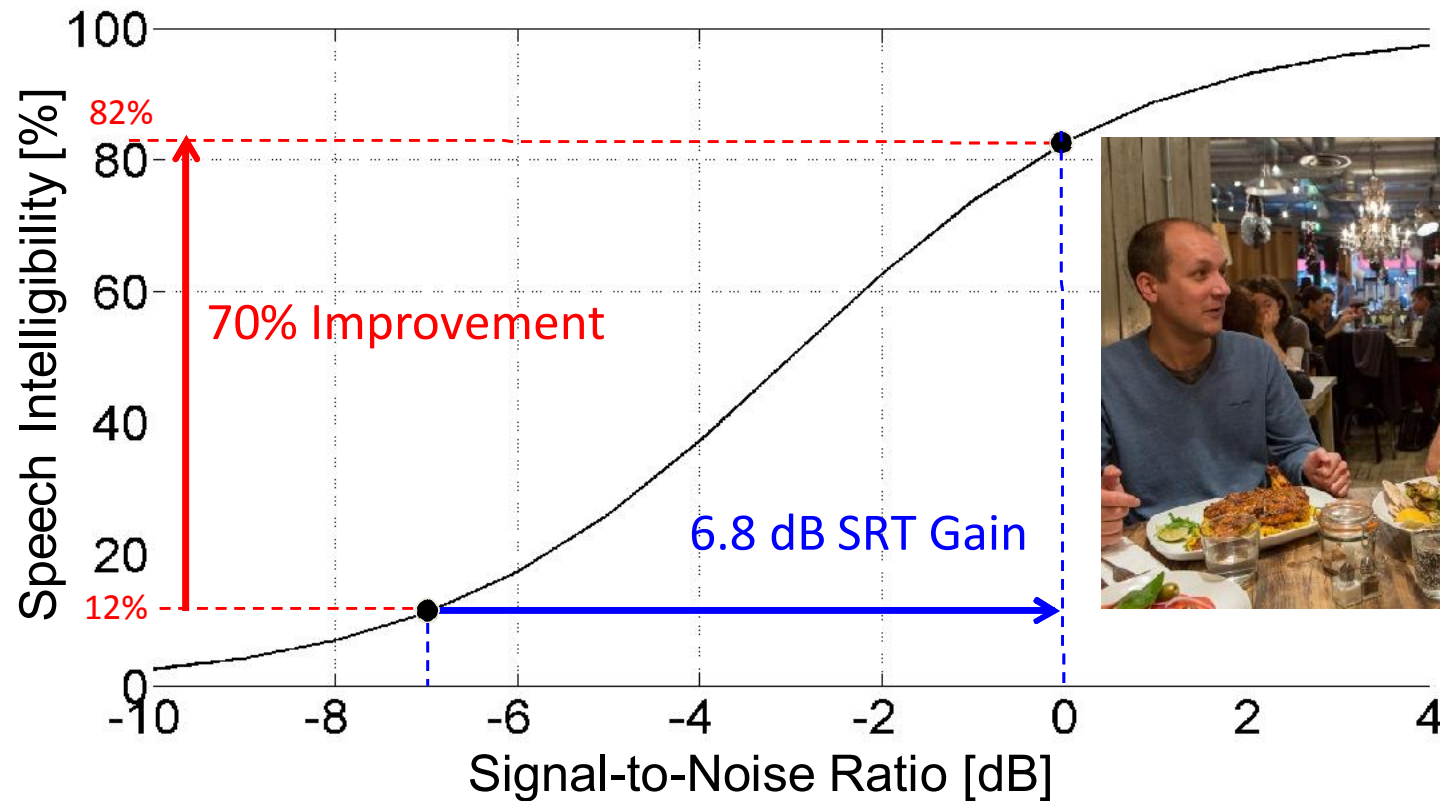
PHONAK

Partners for Better Hearing



What does +6.8 dB SNR mean?

Example





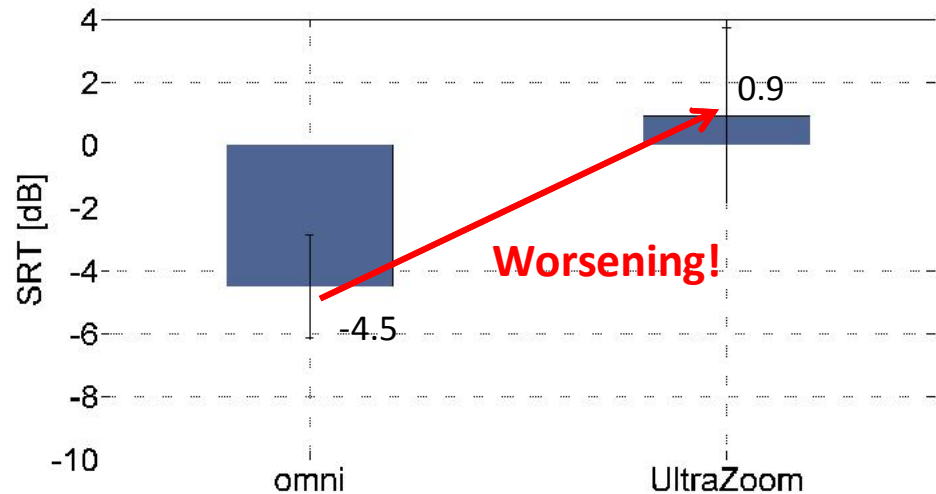
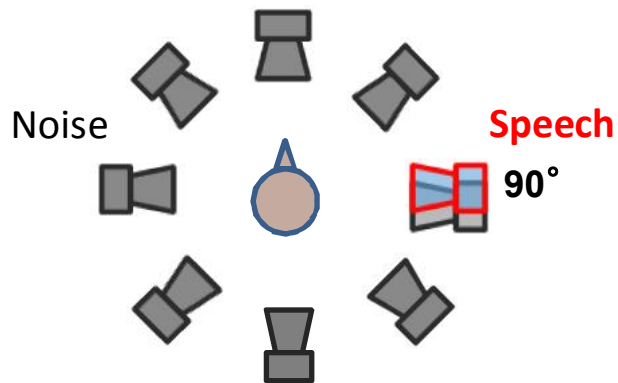
What if I am Driving a Car?





UltraZoom – Clinical Results*

What happens in situations with **speech from the side**, e.g. in a car?



*In collaboration with MHH, Geissler et al., 2013



The Best of Two Worlds: Naída CI

Unique Selling Proposition (USPs)



T-Mic™ 2

Natural Microphone
Placement



ClearVoice™

Unique Speech
Enhancement

UltraZoom

The Adaptive
Beamformer



ZoomControl

Dual-microphone
with VoiceStream



PHONAK

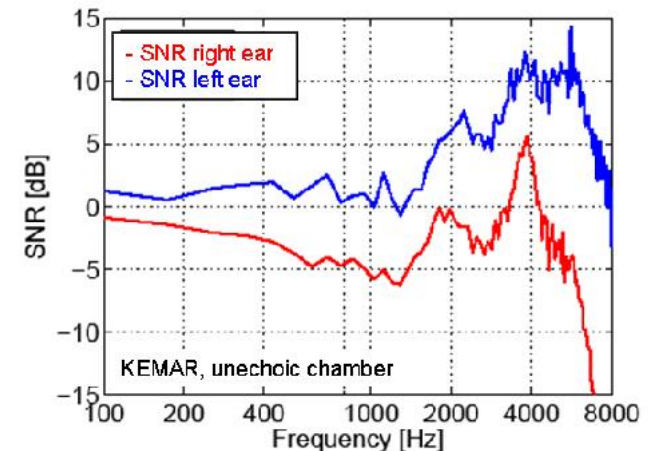


ZoomControl – Basic Principle



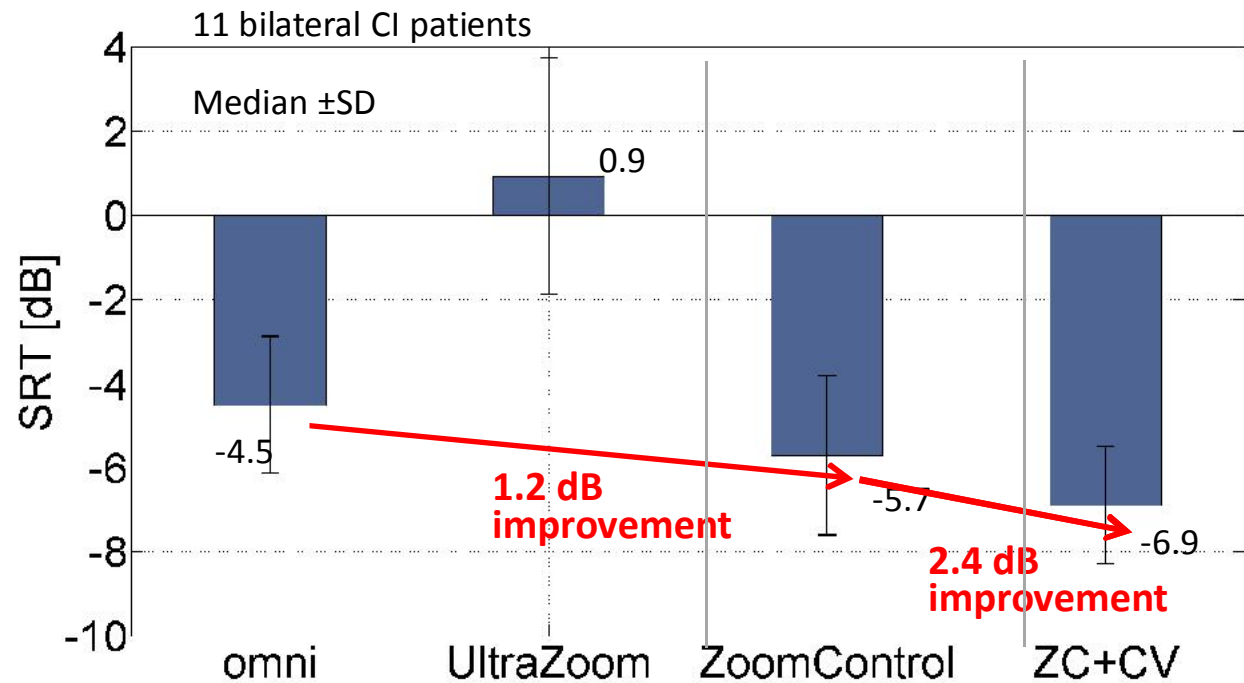
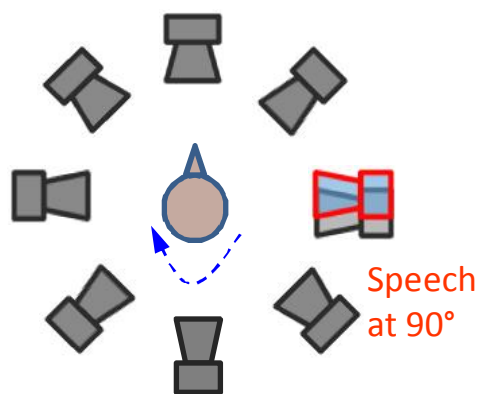
- Streaming of the speech signal to the contralateral side, which is acoustically shaded by the head (~6 dB loss!)
- Attenuation of the „noisy“ contralateral microphone signal
- Both ears get the „better signal“, especially useful for asymmetric hearing capabilities

Headshadow Effect





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

PHONAK Binaural VoiceStream Technology™



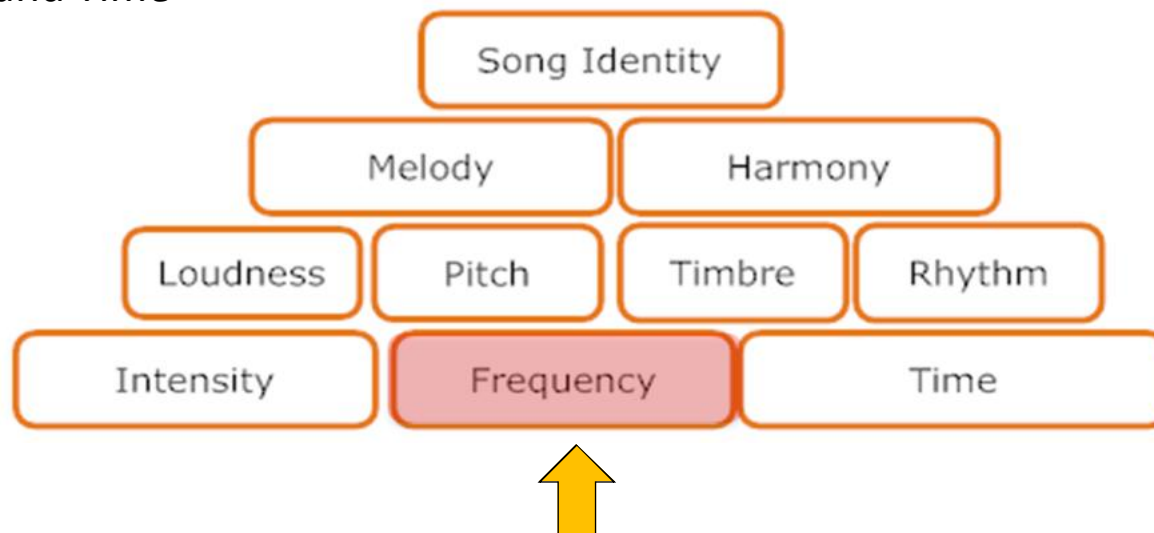
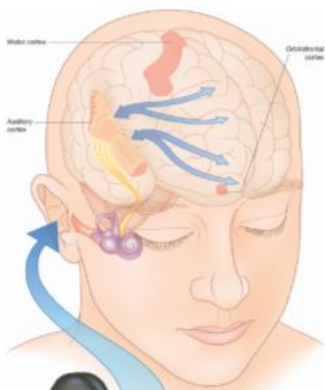
What if I like Music?



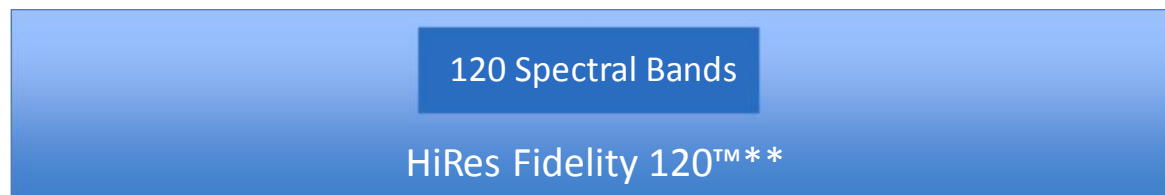


Music Perception with CI

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



Naída CI



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

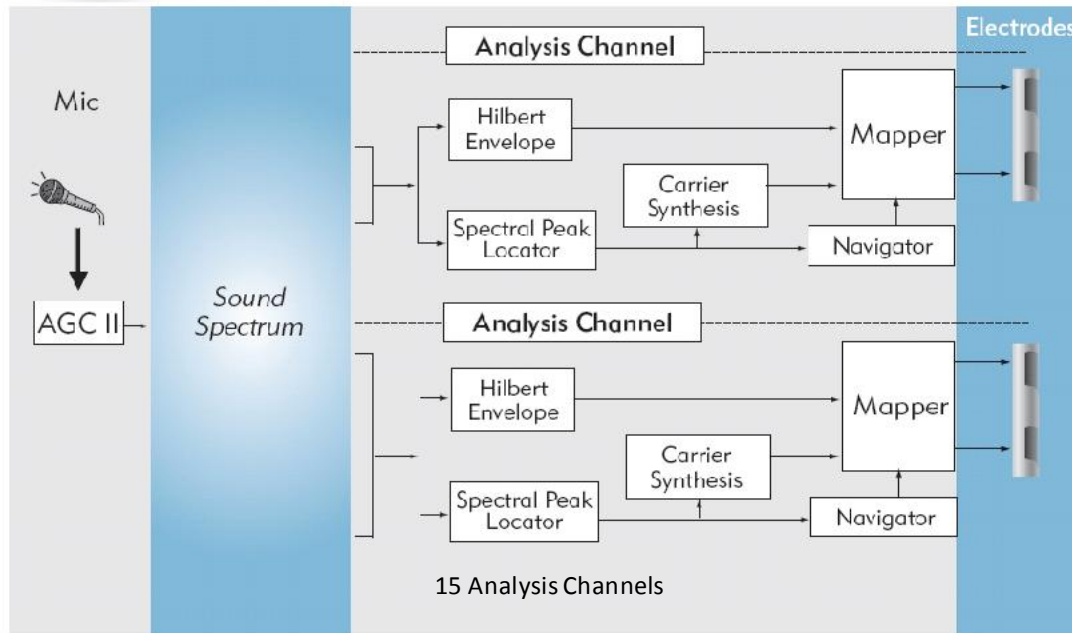
Dual-microphone with VoiceStream



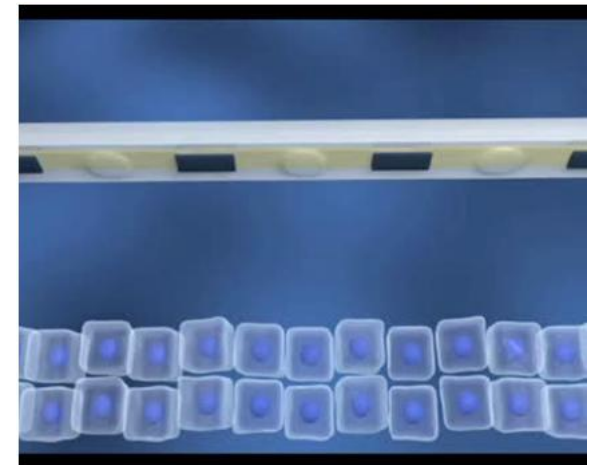
PHONAK



HiRes Fidelity 120™ Stimulation Strategy



Current steering
video illustration



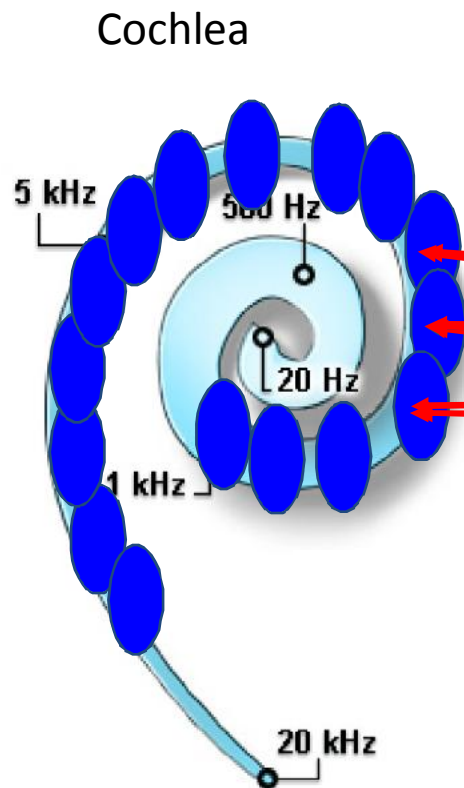
Current steering technology:

- 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 Stimulation Strategy

Conventional frequency coding



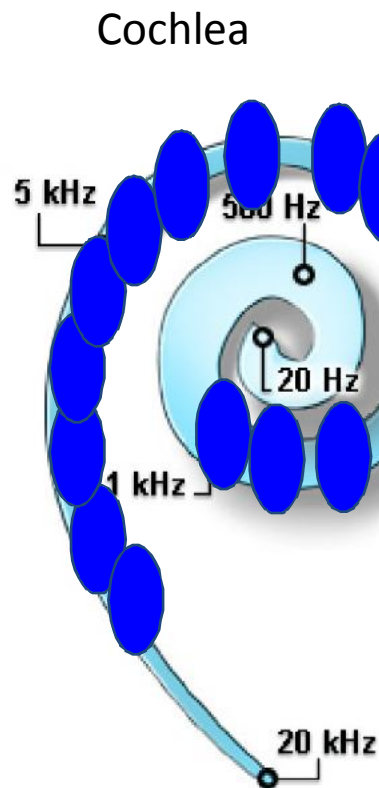
16	65.406	C ₁
17	69.269	D ₁
18	73.416	E ₁
19	77.782	F ₁
20	82.407	G ₁
21	87.307	A ₁
22	92.499	B ₁
23	97.999	C ₂
24	103.83	D ₂
25	110.00	E ₂
26	116.54	F ₂
27	123.47	G ₂
28	130.81	A ₂
29	138.59	B ₂
30	146.83	C ₃
31	155.56	D ₃
32	164.81	E ₃
33	174.61	F ₃
34	185.00	G ₃
35	196.00	A ₃
36	207.65	B ₃
37	220.00	C ₄
38	233.08	D ₄
39	246.94	E ₄
40	261.63	F ₄
41	277.18	G ₄
42	293.66	A ₄
43	311.13	B ₄
44	329.63	C ₅
45	349.23	D ₅
46	369.99	E ₅
47	392.00	F ₅
48	415.30	G ₅
49	440.00	A ₅
50	466.16	B ₅
51	493.88	C ₆
52	523.25	D ₆
53	554.37	E ₆
54	587.33	F ₆
55	622.25	G ₆
56	659.26	A ₆
57	698.46	B ₆
58	739.99	C ₇
59	783.99	D ₇
60	830.61	E ₇
61	880.00	F ₇
62	932.33	G ₇
63	987.77	A ₇
64	1046.5	B ₇
65	1108.7	C ₈
66	1174.7	D ₈
67	1244.5	E ₈
68	1318.5	F ₈
69	1396.9	G ₈
70	1480.0	A ₈
71	1568.0	B ₈
72	1661.2	C ₉
73	1760.0	D ₉
74	1864.7	E ₉
75	1975.5	F ₉

Piano



HiRes Fidelity 120™ Frequency Resolution

Frequency coding with current steering



16	18	20	21	23	25	27	28	30	32	33	35	37	39	40	42	44	45	47	49	5	52	53	55	57	59	61	63	64	66	68	69	71	73	75																									
C ₁	D ₁	E ₁	F ₁	G ₁	A ₁	B ₁	C ₂	D ₂	E ₂	F ₂	G ₂	A ₂	B ₂	C ₃	D ₃	E ₃	F ₃	G ₃	A ₃	B ₃	C ₄	D ₄	E ₄	F ₄	G ₄	A ₄	B ₄	C ₅	D ₅	E ₅	F ₅	G ₅	A ₅	B ₅																									
65.406	69.269	73.416	77.782	82.407	87.307	92.499	97.999	103.83	110.00	116.54	123.47	130.81	138.59	146.83	155.56	164.81	174.61	185.00	196.00	207.65	220.00	233.08	246.94	261.63	277.18	293.66	311.13	329.63	349.23	369.99	392.00	415.30	440.00	466.16	493.88	523.25	554.37	587.33	622.25	659.26	698.46	739.99	783.99	830.61	880.00	932.33	987.77	1046.5	1108.7	1174.7	1244.5	1318.5	1396.9	1480.0	1568.0	1661.2	1760.0	1864.7	1975.5

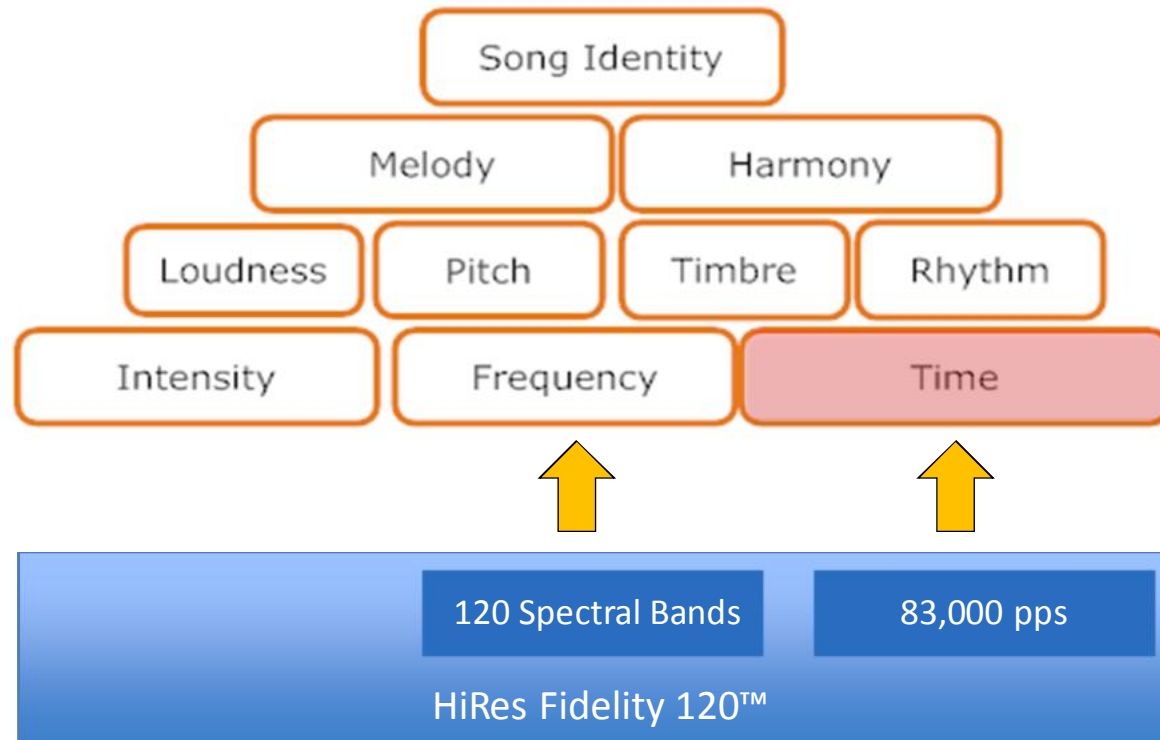
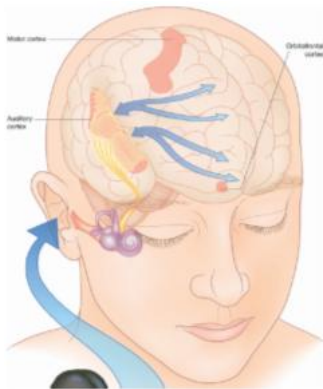
Piano

Creation of intermediate pitch percepts between electrode contacts



Music Perception with CI

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



Naída CI

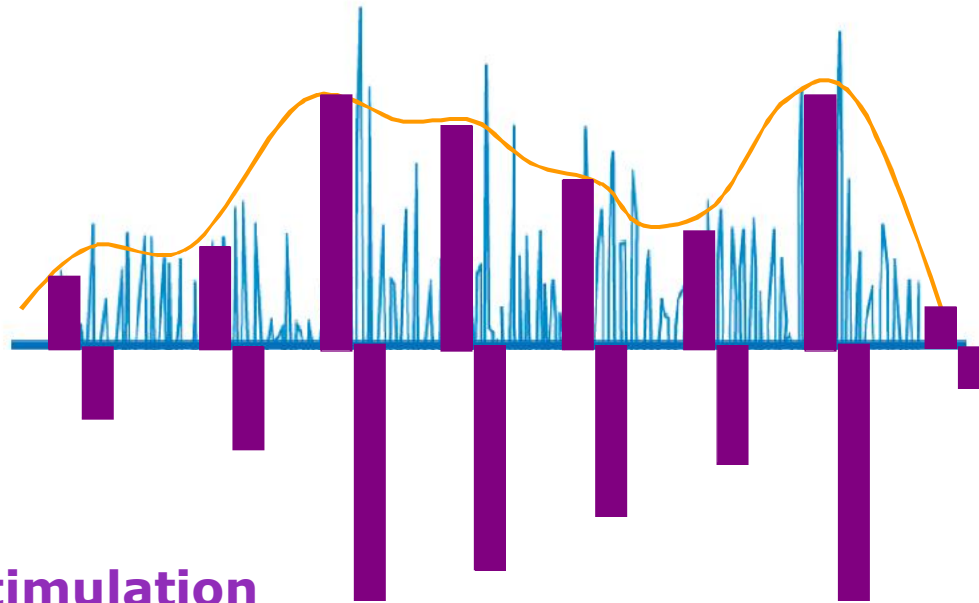
AB offers a unique feature set to support music perception with CI

*from «This is your brain on music», D. Levitin



Temporal Coding and Rhythm

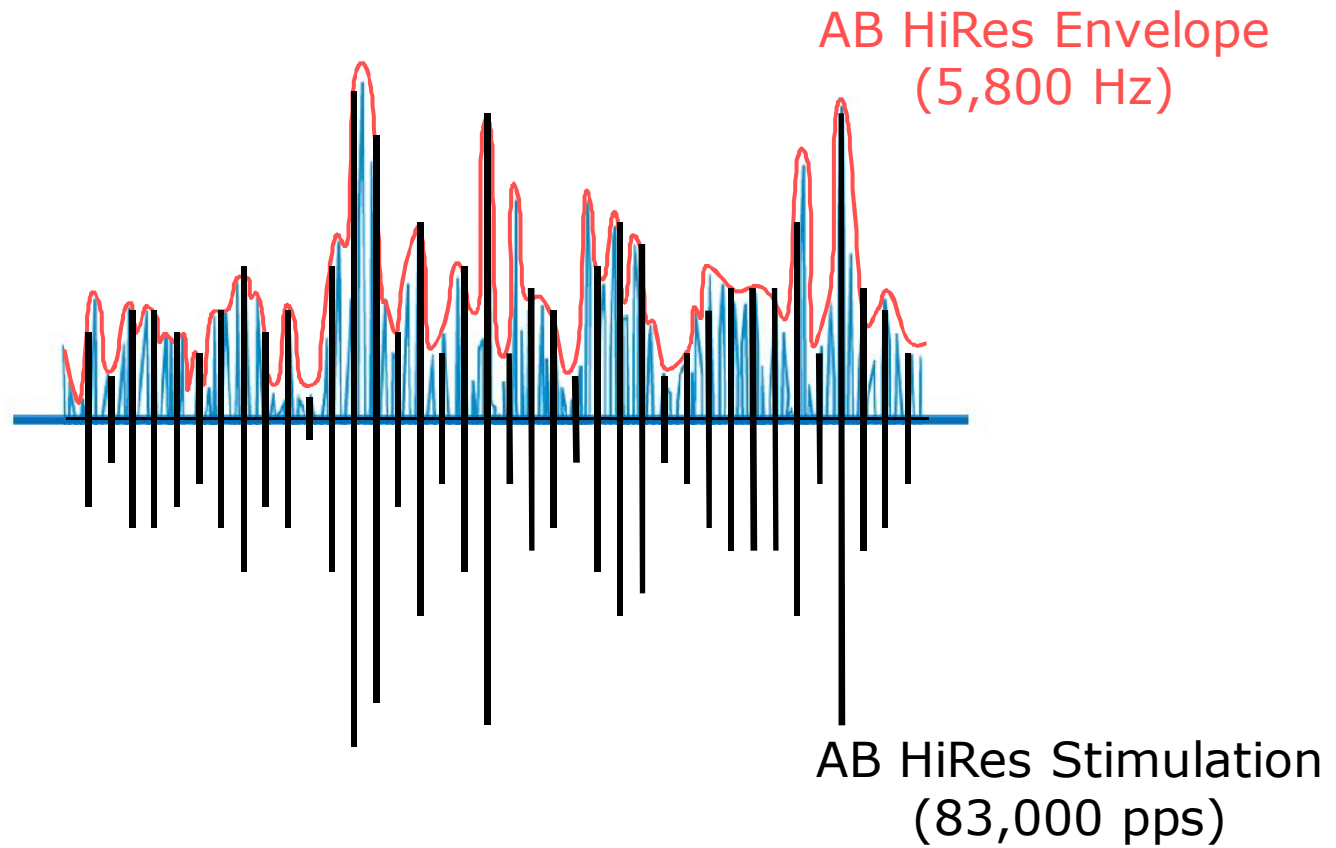
CIS Envelope
(400 Hz)



Low Rate Stimulation
(10,000 pps)



Temporal Coding and Rhythm





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

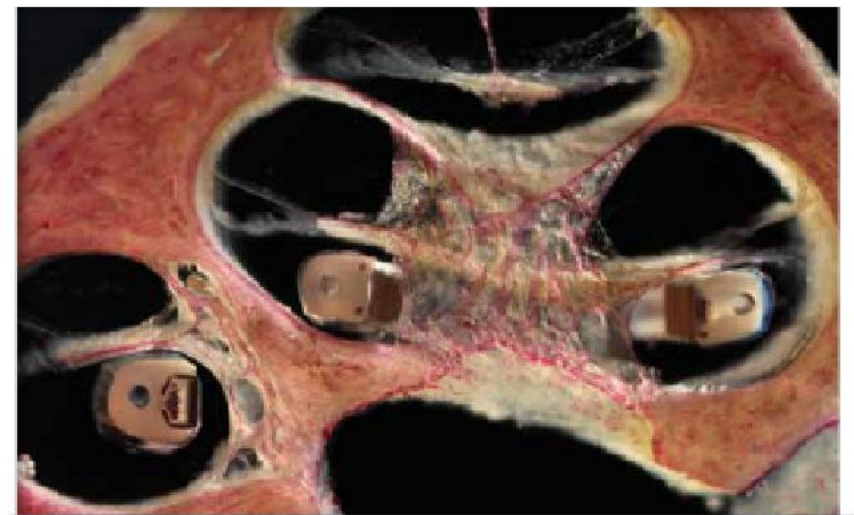
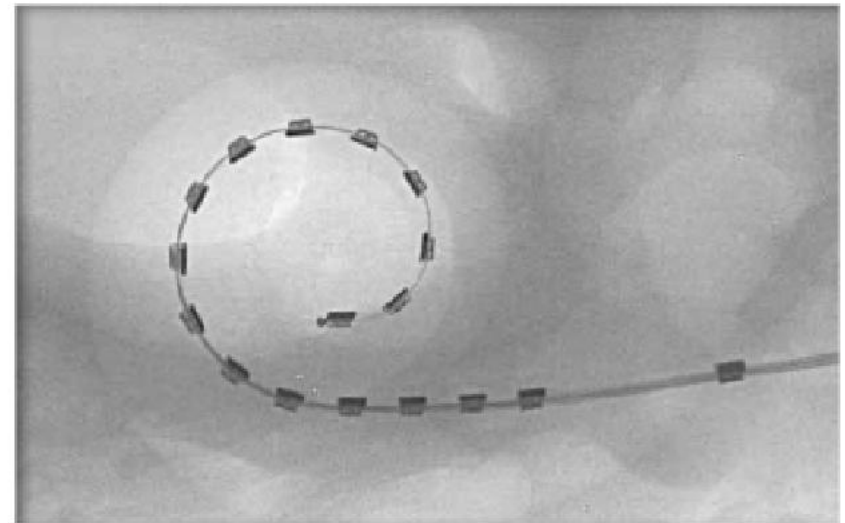
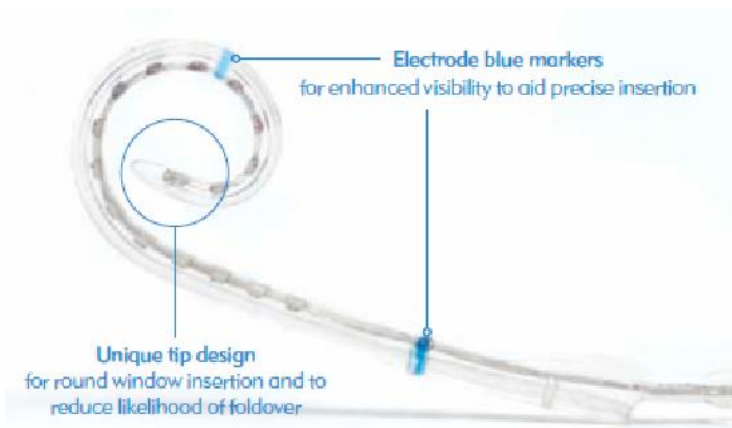


PHONAK



HiFocus™ Mid-Scala Electrode

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



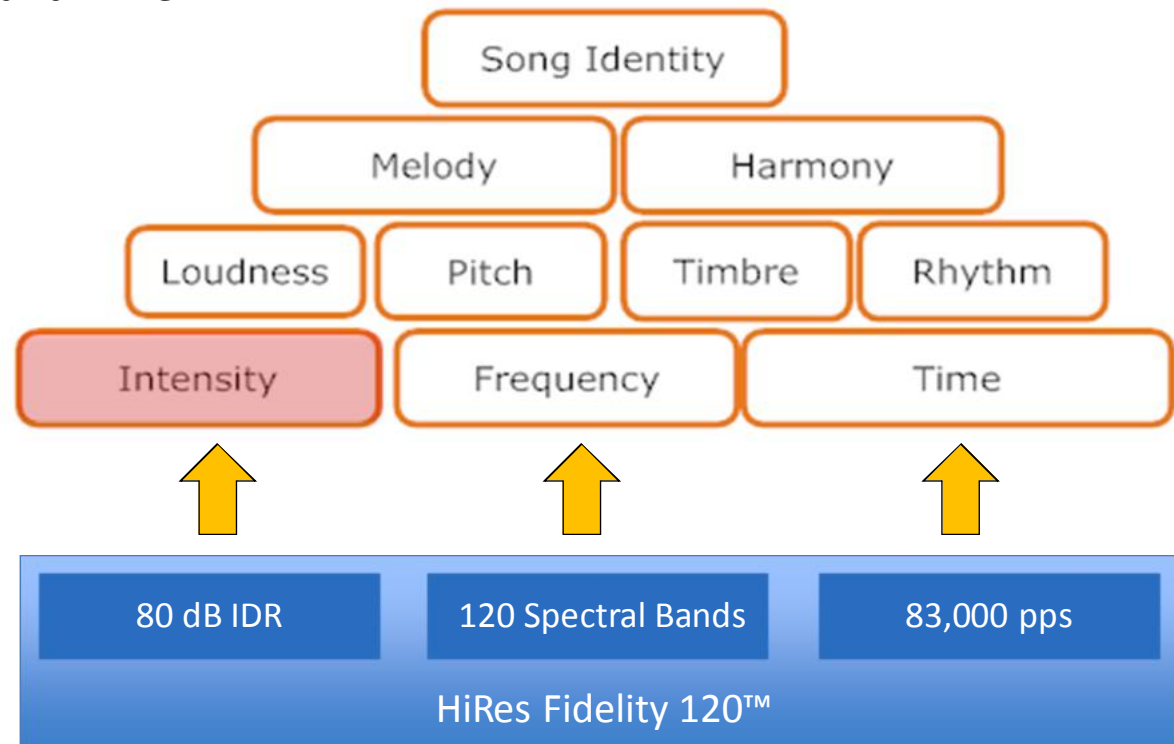
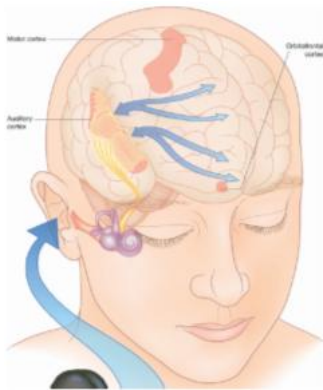
*Frijns et al, 2009

** Holden, Finley et al, 2013



Music Perception with CI

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



Naída CI

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

*from «This is your brain on music», D. Levitin



Loudness and Dynamic of Music



70 dB



80 dB



105 dB



Pianissimo 40 dB
Fortissimo 100 dB

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



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 (80 dB) Dynamic Range

UltraZoom

The Adaptive Beamformer



ZoomControl

Dual-microphone with VoiceStream

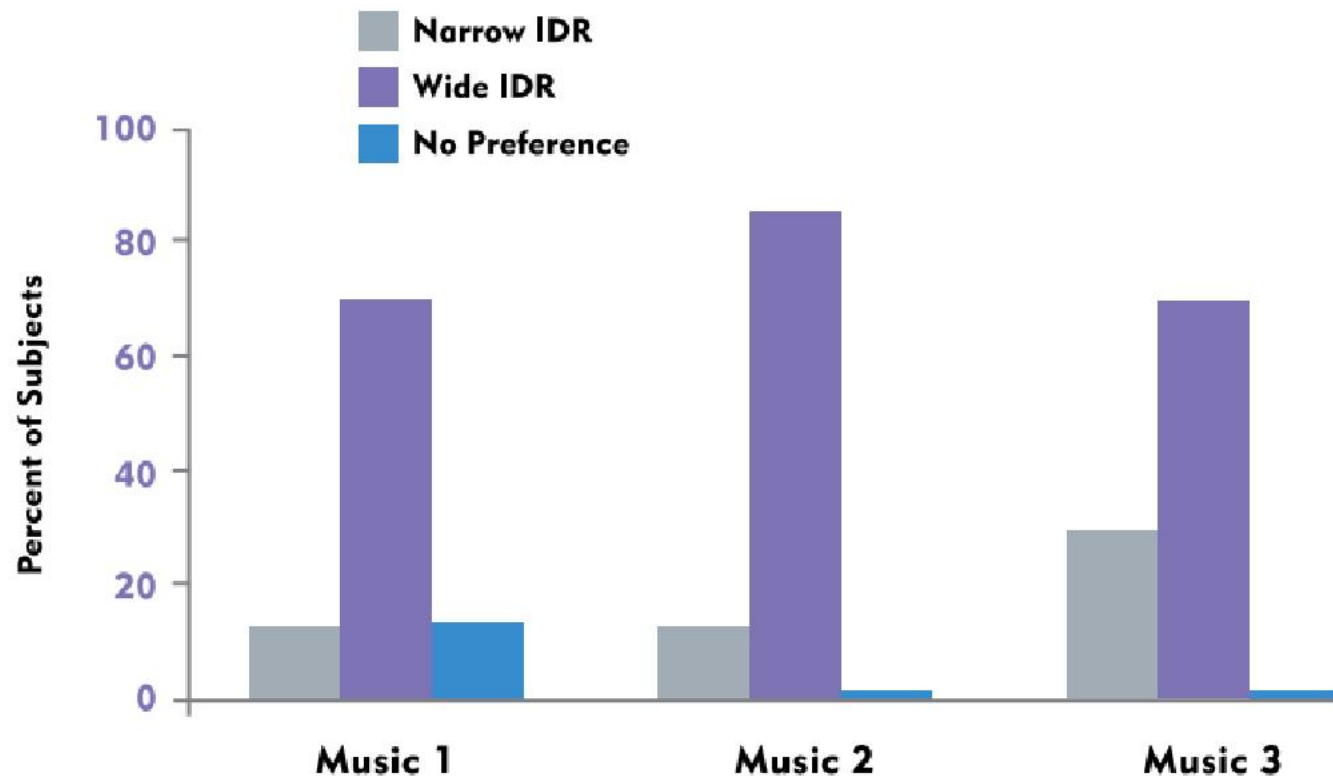


PHONAK



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

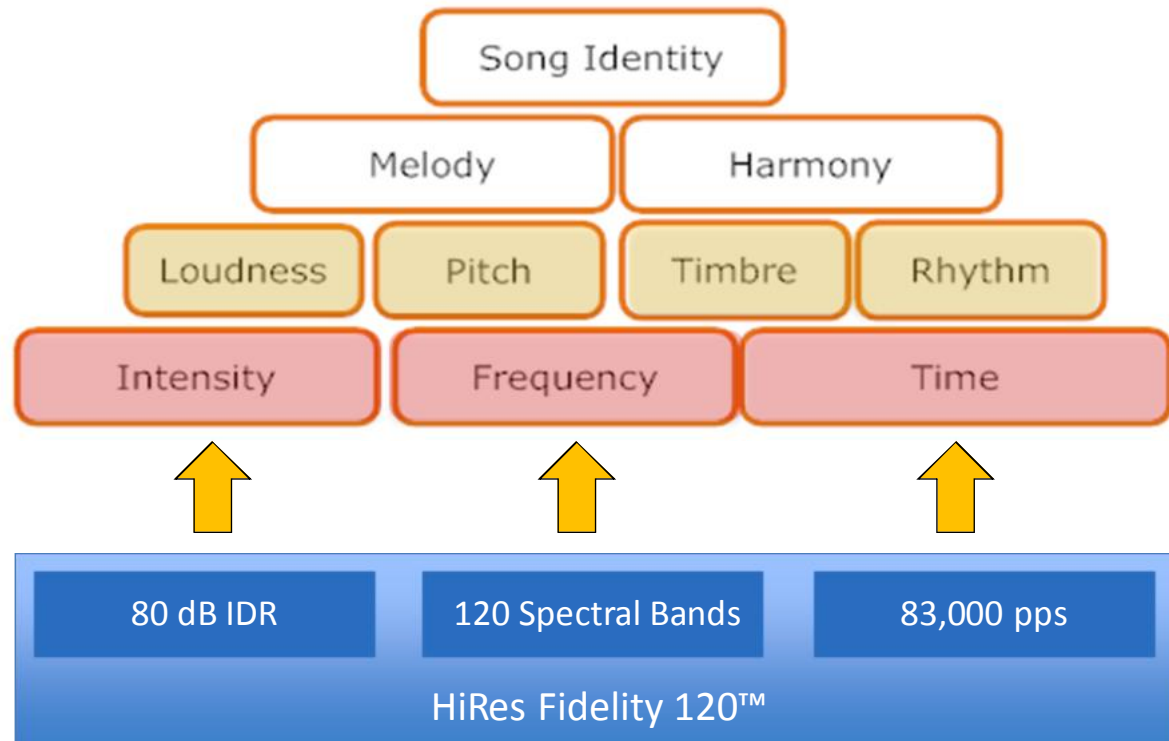
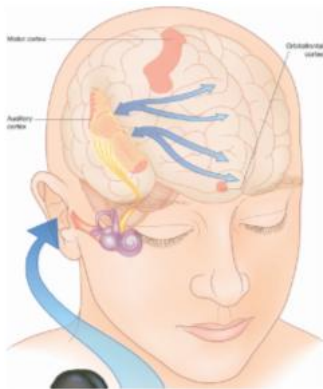


*Wolfe J, Mears A. Effect of Input Dynamic Range on Speech Recognition and Music Enjoyment. Poster presentation at the 10th International Conference on Cochlear Implants and Other Implantable Auditory Technologies, San Diego, CA, April 10–12, 2008



Music Perception with CI

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



Naída CI

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

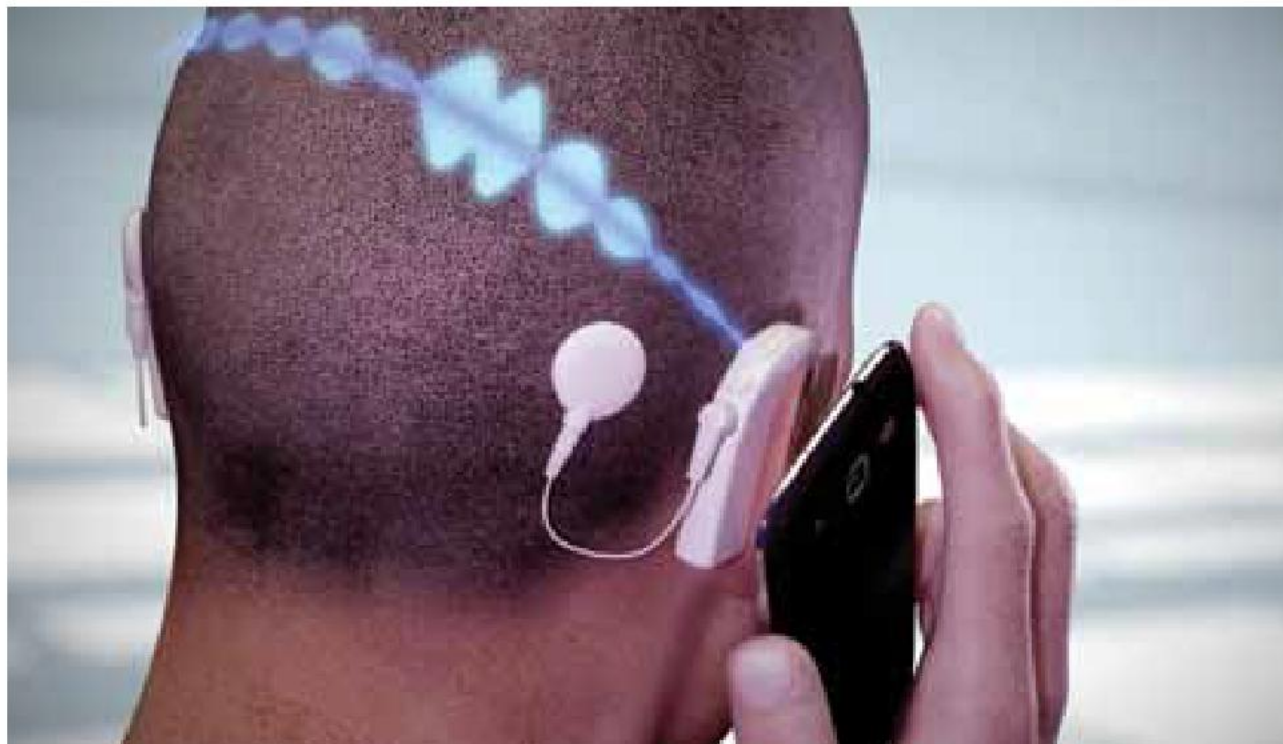
Phone call streaming to both ears



PHONAK



Phonak Binaural VoiceStream Technology™



PHONAK Binaural VoiceStream Technology™



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



ComPilot

Wireless streaming with Bimodal



PHONAK



Phonak ComPilot Accessory



PHONAK | Partners for Better Hearing

 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.



small size **big performance**

Naída CI Q70
By Advanced Bionics



What if I Need to Hear over a Distance?





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



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ComPilot

Wireless streaming with Bimodal



RemoteMic

Wireless solution for noisy places



PHONAK



What if I Need to Hear in School?





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ClearVoice™

Unique Speech Enhancement



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Roger

Design-Integrated DM



PHONAK



Design-Integrated DM Link



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What if the Vol. of my TV is Annoying Others?





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RemoteMic

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Roger

Design Integrated DM



TVLink

Wireless solution for TV



PHONAK



Phonak TVLink



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What if I Want to Hear in and under Water?





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



PHONAK

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RemoteMic
Wireless solution
for noisy places



TVLink
Wireless
solution for TV



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Design-Integrated DM



*available soon



AquaMic Waterproof Headpiece





What if I Desire a Smaller Processor?





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



PHONAK

UltraZoom
The Adaptive
Beamformer



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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



PHONAK

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Roger

Design-Integrated DM

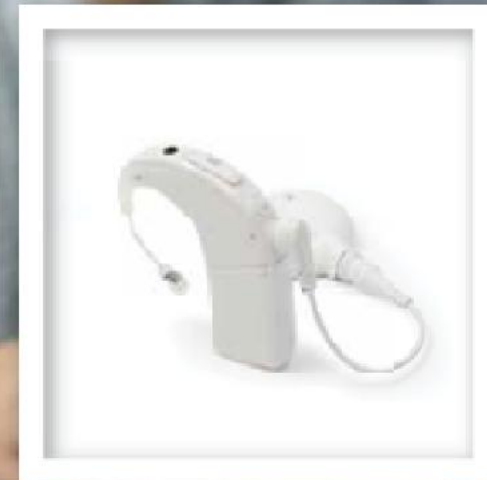


Naída CI

quantum leap *forward*

in performance & wireless connectivity

with a chic, modern instyle™ design



Naída CI **Q70**
By Advanced Bionics



This is just the Beginning!

Phonak features

Understanding everywhere

**Speech in Wind**

Allows enjoyment of conversations even on a windy day.

**auto StereoZoom**

Zooms in on a single voice in a noisy environment, automatically.

**auto ZoomControl**

Automatic focus wherever the loudest speech comes from.

**StereoZoom**

Focuses on a single voice in a noisy crowd.

**ZoomControl**

The ability to choose the hearing focus direction.

**DuoPhone**

Hear the phone conversation in both ears while also reducing surrounding noise.

Understanding everything

**SoundRecover**

Makes high-pitched sounds easier to hear in all situations.

**UltraZoom**

Directional microphone technology reinvented.

**SoundFlow**

Instantly and seamlessly blends the best combination of features and programs to create a unique program, specially suited to each situation.

**Everyday Automatic**

Automatically adjusts the hearing system to provide better understanding in noise.

**FlexControl**

Personalizes the volume control, making sounds clearer or more comfortable, not just louder or softer.

**FlexVolume**

Adjusts loudness based on the individual hearing loss by shaping the gain curve in a frequency dependent manner.

**Real Ear Sound**

Maintains the ability to tell from which direction sounds are coming.

**QuickSync**

Allows hearing aid wearers to control both hearing instruments with just one touch.

Understanding with comfort

**auto Acclimatization**

The right amplification level at the right time, automatically.

**WindBlock**

Suppresses wind noise so hearing aid wearers can enjoy spending time outdoors.

**SoundRelax**

Cushions sudden loud or unpleasant impulse sounds such as clanging dishes or slamming doors.

**WhistleBlock**

Adjusts feedback suppression levels adaptively and continuously applying just the right amount for each specific situation.

**NoiseBlock**

Measures the signal-to noise ratio in each channel and decreases the gain without delay only in the channels with a poor SNR.

**EchoBlock**

Instantly removes disturbing reflections of the reverberant signal, while sounds remain natural and undistorted.



PHONAK | Partners for Better Hearing



Focused Innovation



1) Hearing Preservation



2) Reduce Power Consumption



3) Reduce Size



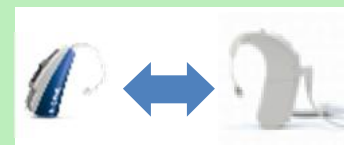
PHONAK



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



PHONAK | Partners for Better Hearing



Sustainable Technological Advantage

bimodal technology

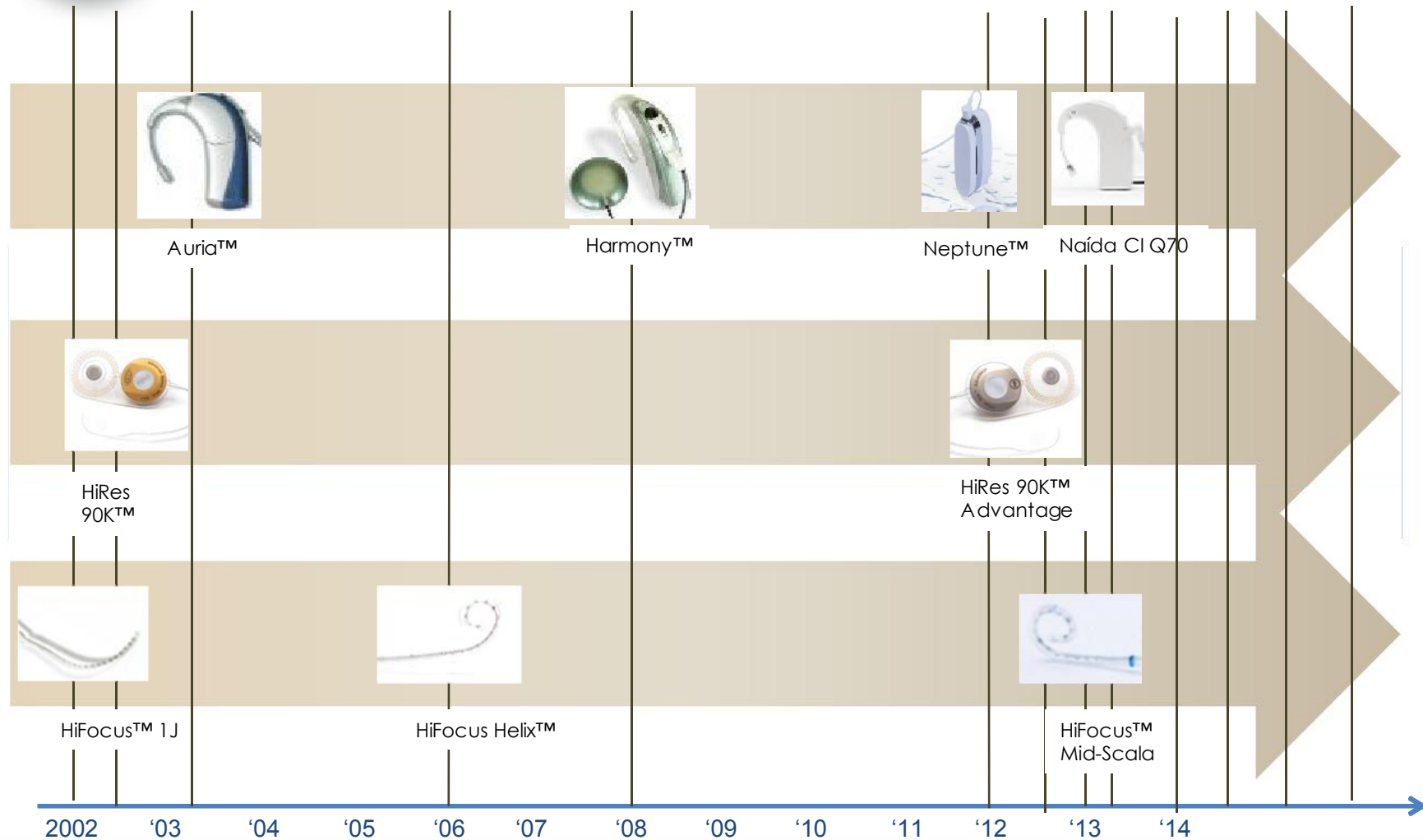
stream media simultaneously to a Phonak hearing aid and AB sound processor



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Accelerating Innovation Rate



Naída CI

By Advanced Bionics

