

Advanced Directionality with Single Microphone Hearing Aids

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WS Audiology

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Learning Outcomes

- 1) After this course, participants will be able to discuss the impact of noise on speech intelligibility for those with hearing loss.
- 2) After this course, participants will be able to discuss the limitations of single microphone hearing aids for directionality.
- 3) After this course, participants will be able to discuss the benefits of one-mic directionality for improved speech intelligibility in noise.



Advanced Directionality with Single Microphone Hearing Aids



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February 5, 2026
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Satisfaction with noise

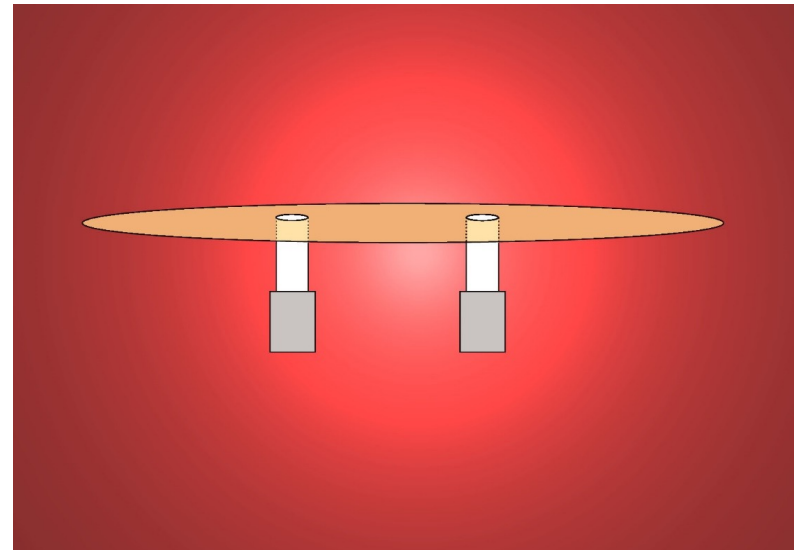
- Noise is consistently a challenge for those with hearing loss¹
- Conversations in noise have lowest satisfaction, followed by conversations in large groups
- Other noise categories are not far behind

		All Non-owners (n = 1,840)	
When following conversations in the presence of noise		25%	
In conversations with large groups		27%	
In conversations with small groups		38%	
When watching TV with others		39%	
At home with family members		44%	
In the workplace		44%	
In a larger lecture hall		34%	
In a store, when shopping		41%	
In school or a classroom		34%	
When talking to children		41%	
When talking on a cell phone		47%	
When riding in a car		45%	
In conversations with 1 person		52%	
Outdoors		47%	
When talking on a traditional telephone		46%	
During leisure activities		49%	
When listening to music		57%	
At a movie theater		49%	
Overall, across all listening situations^a		36%	

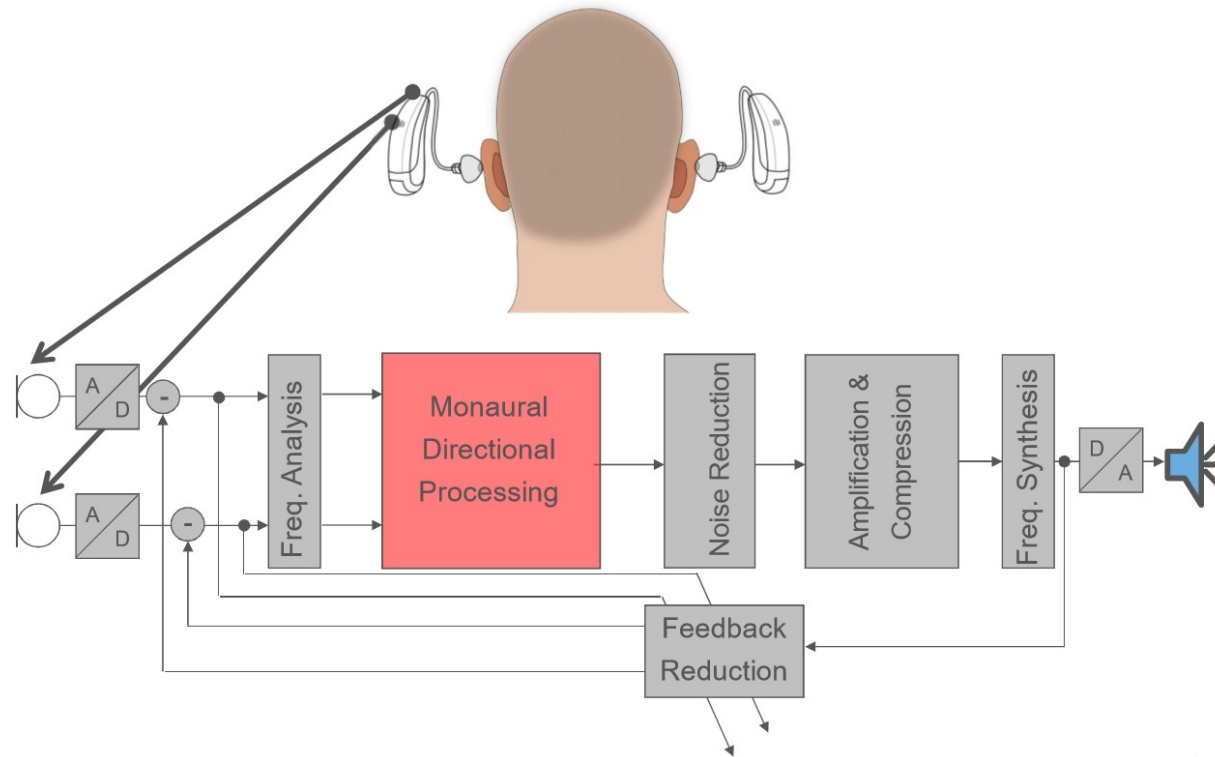


Directional technology

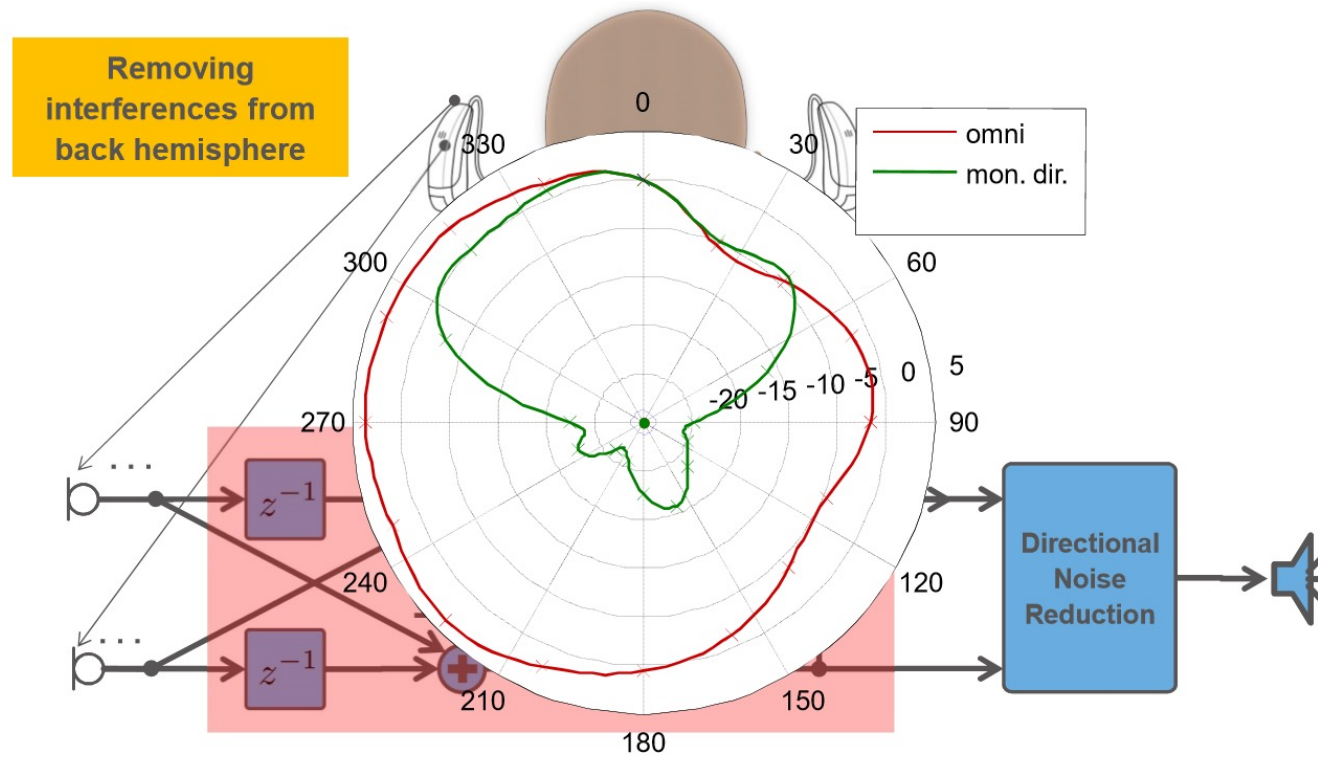
- Two separate omni mics
- Calculate directional effect using external factors (time to travel between mics) and internal timing factors (electronic delay)
- We refer to this as beamforming



Monaural directional processing: quick overview

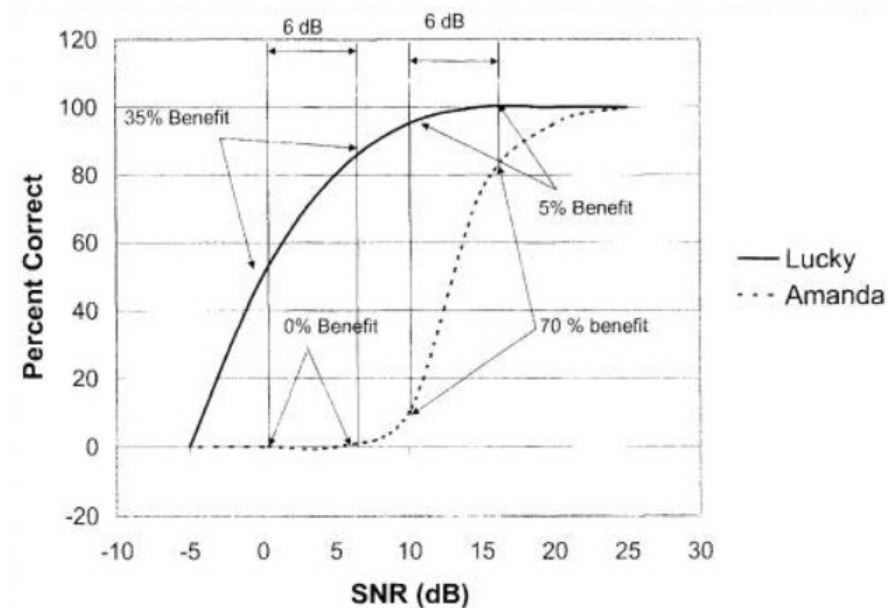


Monaural directional processing: directivity pattern



Directional benefit

- Directional mics improve the SNR, which in turn can improve speech intelligibility
- Improvement can vary with each patient
- Two popular tests for measuring directional improvement in noise
 - American English Matrix Test (reported slope of $13.3\%/dB$)²
 - Hearing in Noise Test (reported slope of $10.6\%/dB$)³



Adapted from Ricketts, 2001



Satisfaction with noise

- We do see marked improvements with hearing aid use¹
- These improvements can be larger increases over other situations
- Noticeable difference in SNR is about 3 dB⁴

	HA Owners (n = 1,061)	All Non-owners (n = 1,840)	Difference between HA users and non-owners
When following conversations in the presence of noise	72%	25%	47%
In conversations with large groups	72%	27%	45%
In conversations with small groups	78%	38%	40%
When watching TV with others	78%	39%	39%
At home with family members	83%	44%	39%
In the workplace	82%	44%	38%
In a larger lecture hall	72%	34%	38%
In a store, when shopping	77%	41%	36%
In school or a classroom	70%	34%	36%
When talking to children	74%	41%	33%
When talking on a cell phone	78%	47%	31%
When riding in a car	76%	45%	31%
In conversations with 1 person	83%	52%	31%
Outdoors	77%	47%	30%
When talking on a traditional telephone	75%	46%	29%
During leisure activities	76%	49%	27%
When listening to music	78%	57%	21%
At a movie theater	70%	49%	21%
Overall, across all listening situations^a	78%	36%	42%

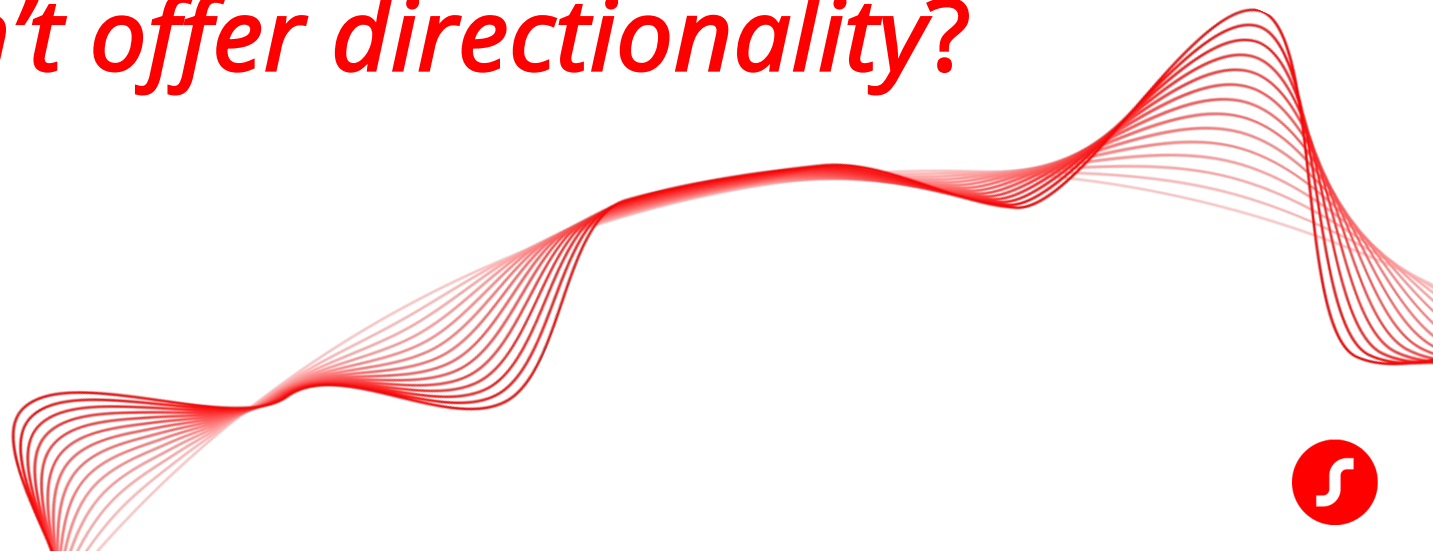


Stigma

- For older adults with hearing loss, there is perceived stigma associated with both hearing loss and use of hearing aids⁵
- Association with ageism and perceptions of disability⁵
- May be seeing improvement with smaller devices being more mainstream⁶

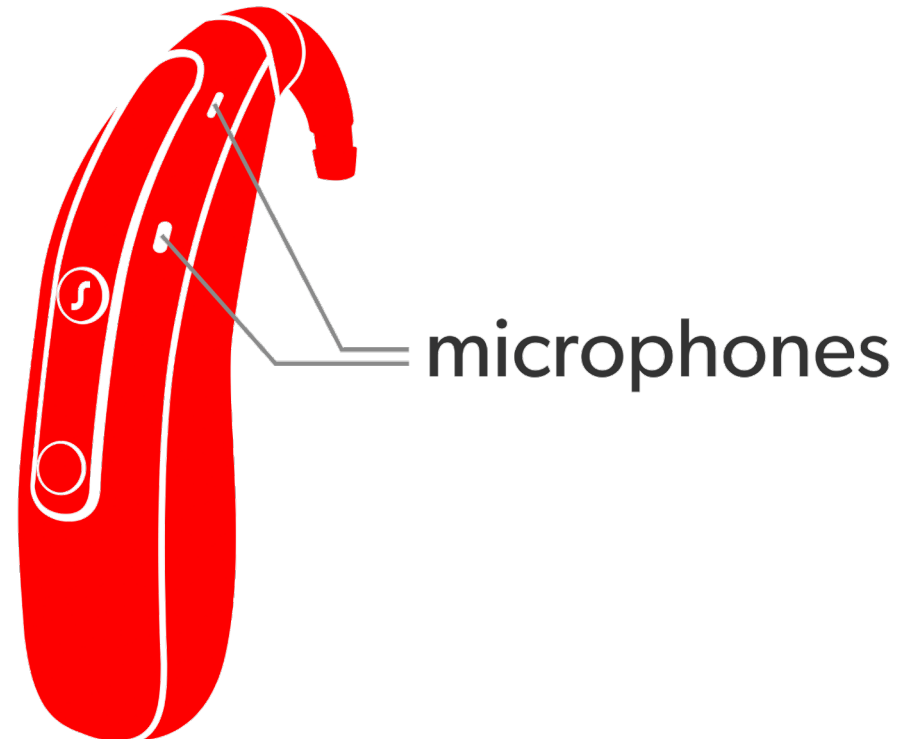


*But one microphone devices
can't offer directionality?*

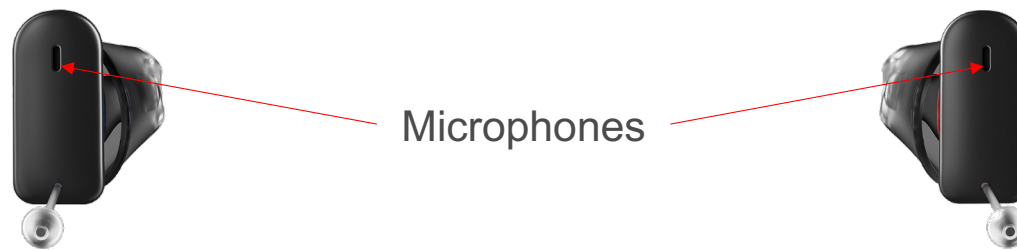


Why that's usually the case

- Directionality relies on spatial cues obtained from two separate microphones
- Comparing signals from two microphones to identify the direction of speech and background noise
- CIC devices only have one microphone on each device so can't usually deliver directionality



Only Signia can offer one-microphone directionality



Made possible by Signia's ultra-fast, wide bandwidth binaural communication, **e2e Wireless 4.0**.

We can compare the timing and intensity differences in the sound arriving to the microphone on each hearing aid to create a directional beam.



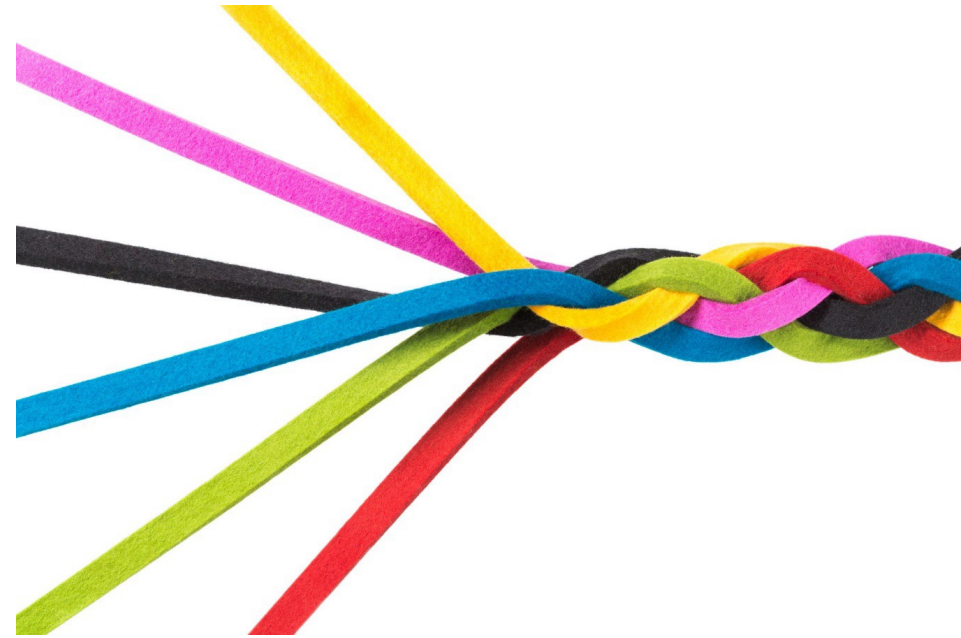
Near field magnetic induction

- Near-Field Magnetic Induction (NFMI) is a short range wireless physical layer that communicates by coupling a tight, low-power, non-propagating magnetic field between devices
- The concept is for a transmitter coil in one device to modulate a magnetic field which is measured by means of a receiver coil in another device
- Short range – less than 2 meters
- Examples of carrier frequencies are 13.56 Mhz and 3.27 Mhz
- Introduced to hearing aids in 2004

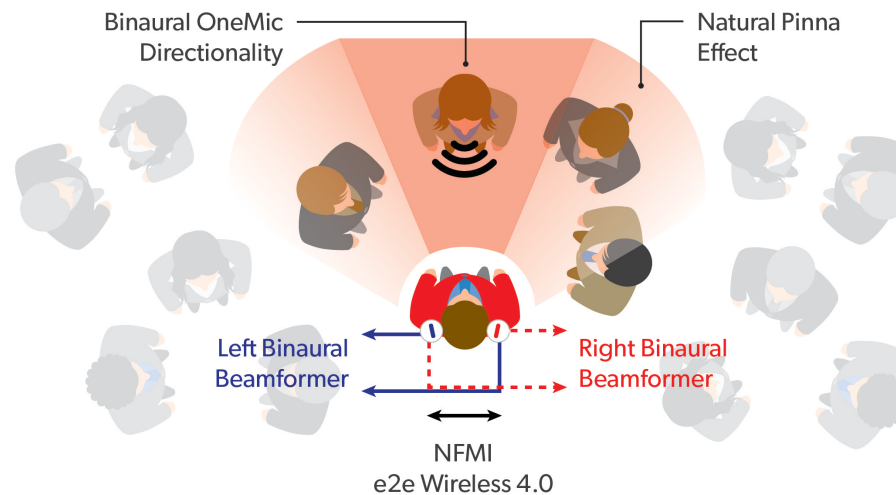


Near field magnetic induction

- Due to short transmission range, used mainly for instrument-to-instrument communication
- Drives bilateral synchronization between devices
- Provides high quality signal transfer between devices
- Each device can process data from both devices



Only Signia can offer one-microphone directionality

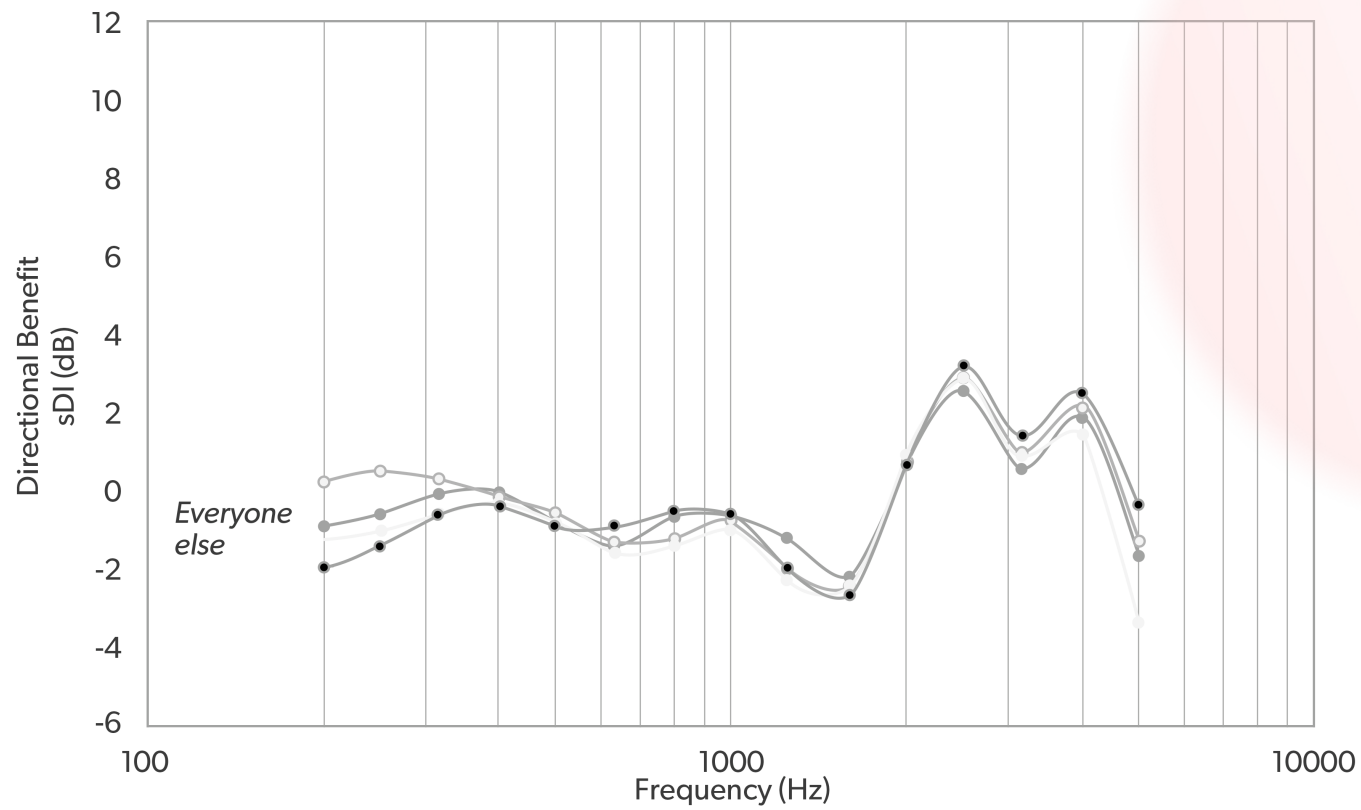


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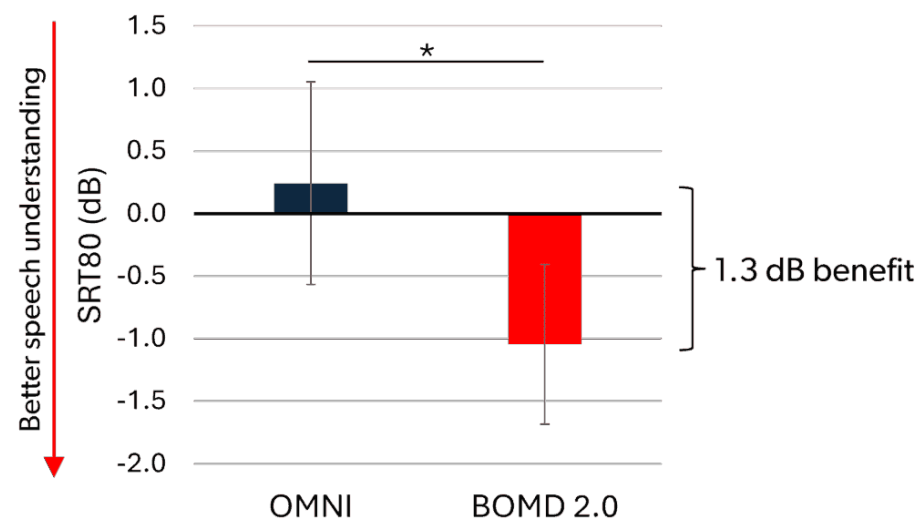


5x the speech enhancement in noise⁷



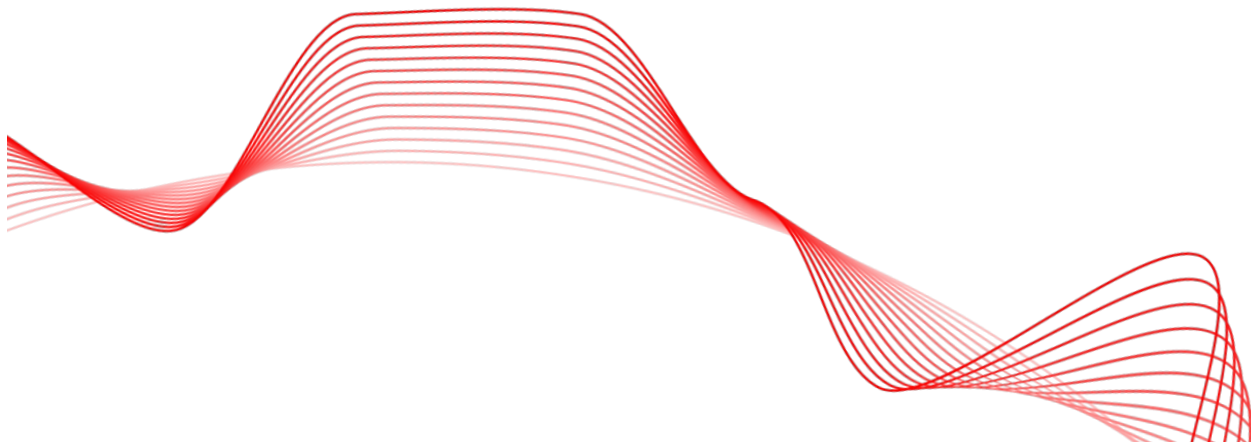
Speech intelligibility in noise⁸

- 17 participants average age 69 years, 10 females and 7 males with SNHL, mean 4-frequency PTA 44 dB HL
- Binaural Signia Silk Charge&Go IX with BOMD 2.0 technology and power sleeves fitted to NAL-NL2
- Programming: 2 test programs with identical gain
 - P1, BOMD 2.0 activated
 - P2, BOMD 2.0 deactivated
- American English Matrix test in a sound-treated room.
- Target sentences from a loudspeaker in front of the participant
- Babble noise was presented from 45°, 135°, 225° and 315° azimuth at 67 dBA
- Results showed significant 1.3 dB benefit for SRT80 with BOMD 2.0



For discreet comfortable all-day enhancement

- The world's first ready-to-wear rechargeable, completely in the canal (CIC) hearing aid, Silk Charge&Go IX - **With 5x the directional speech enhancement in noise compared to competitors⁷**
 - No impressions necessary – assess and fit on the same day
 - The world's smallest ready to wear CIC for the ultimate in discretion
 - The only ready to wear CIC device able to offer directional speech enhancement in noise
 - The world's longest runtime in a rechargeable ready to wear CIC



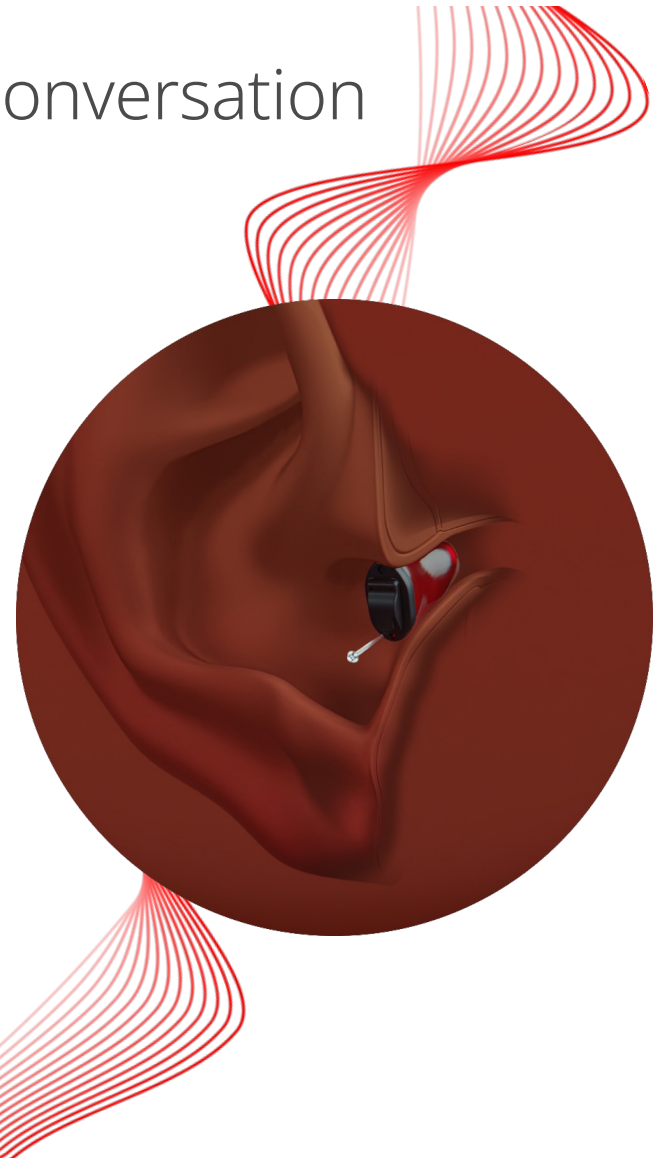
For discreet comfortable all-day enhancement

Proven with millions fitted worldwide



Insio IX IIC/CIC... Engineered for the conversation

- Engineered for discretion and comfort
- An array of design and processing improvements
- Bespoke, comfortable fit
- The only custom one-microphone device with directionality
- Unleash the power of conversation with Insio IX



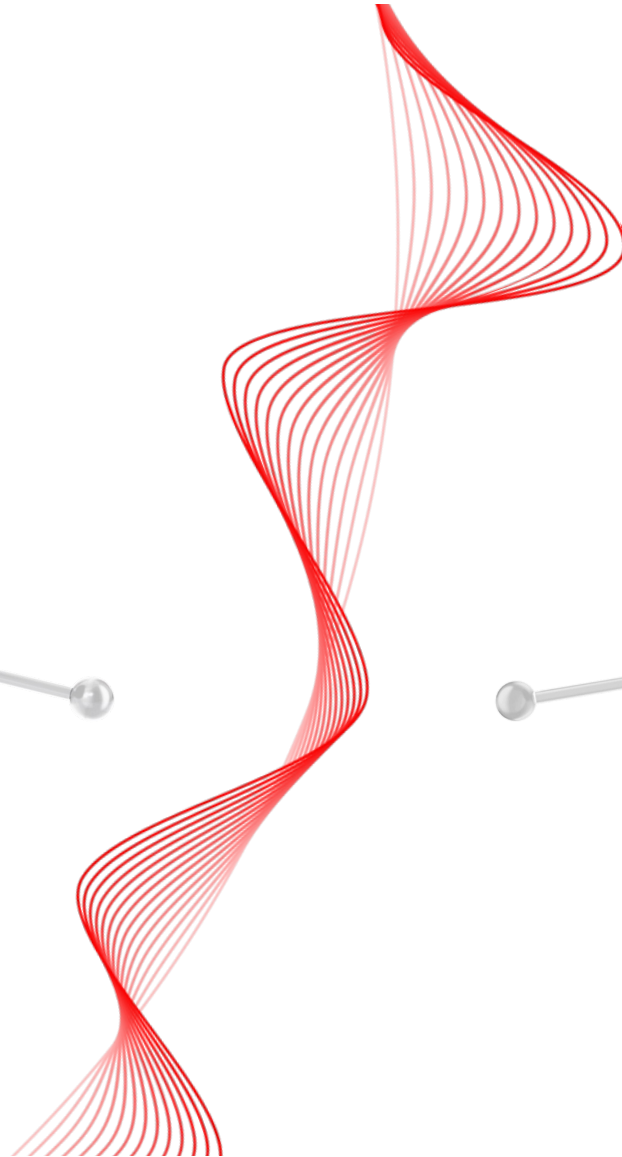
Insio IX



Insio IX CIC



Insio IX IIC



Summary

- Speech understanding in noise continues to be a challenge for those with hearing loss
- Hearing aid features such as directional microphones help improve speech intelligibility in noise
- Stigma regarding hearing aids is still a challenge to patient uptake
- Miniaturization with advanced directional technology can help address the needs of hearing aid wearers



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