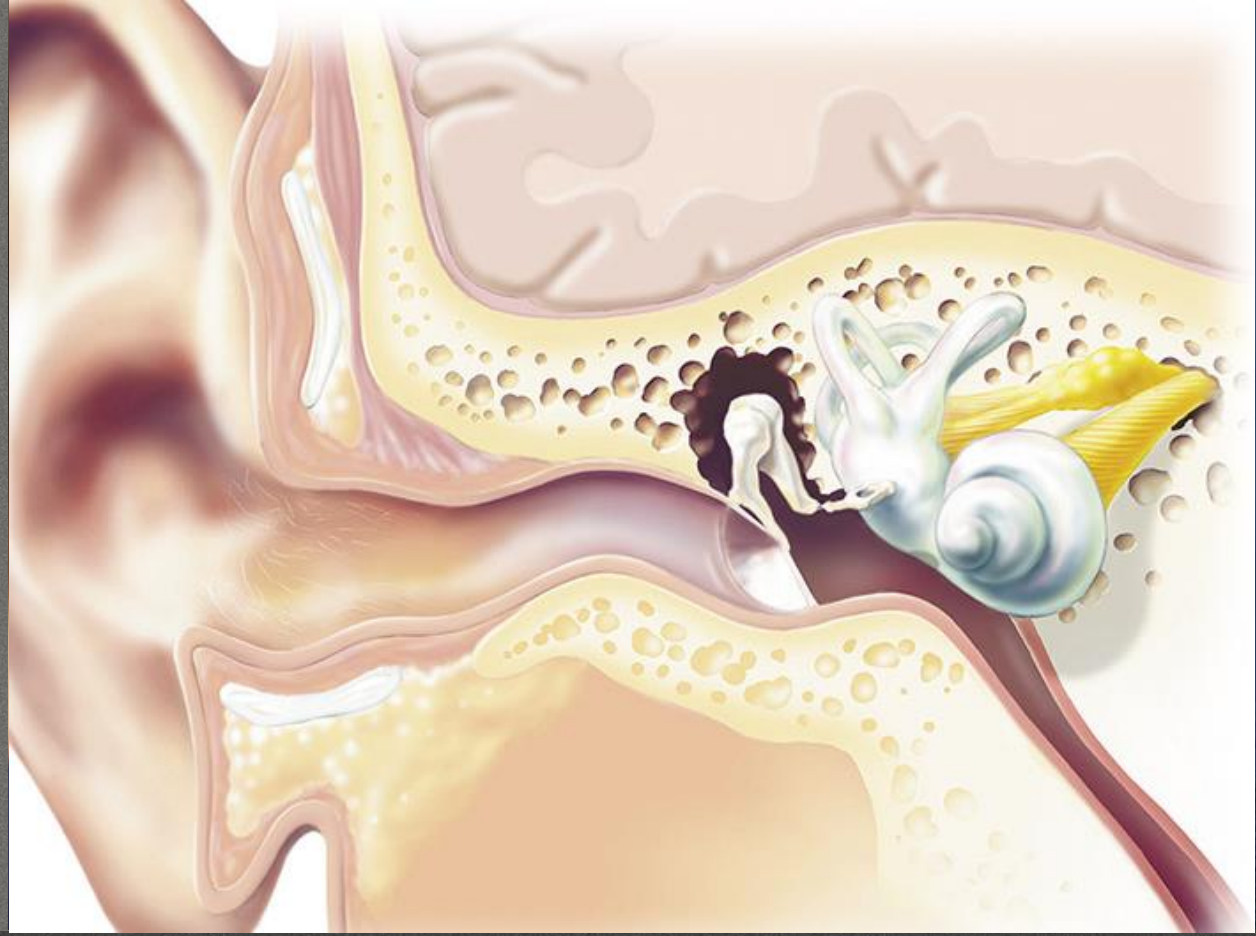
6 January 2020

Understanding the user group

Physiology and auditory performance



Johanne Rumley
Clinical Research Audiologist

oticon
PEOPLE FIRST

The next step in the Oticon legacy

Oticon has a long history of making high-quality power instruments.

2005	2010	2015	2019
Sumo DM	Chili/Safari SP	Dynamo/Sensei SP	Xceed/Xceed Play

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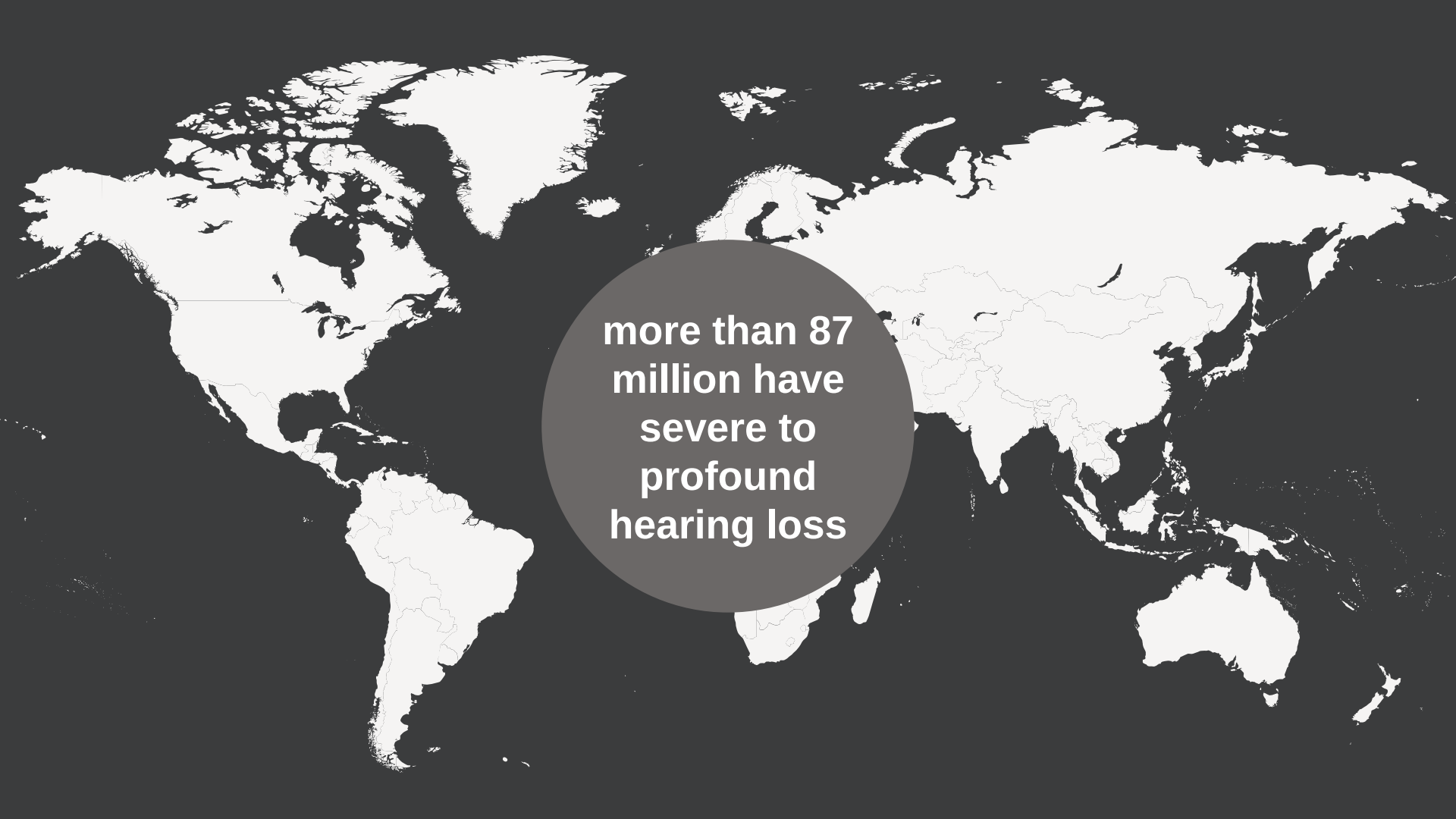
more than 87 million have severe to profound hearing loss

POWER users and their challenges

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How does your hearing loss make you feel?

How does it affect your everyday life?

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Primary challenges in severe-to-profound hearing loss

Limited access to high frequency sounds

Reliant on temporal cues

Souza, 2009

Completely dependent on hearing instruments and may be reluctant to change

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Physiology and auditory performance

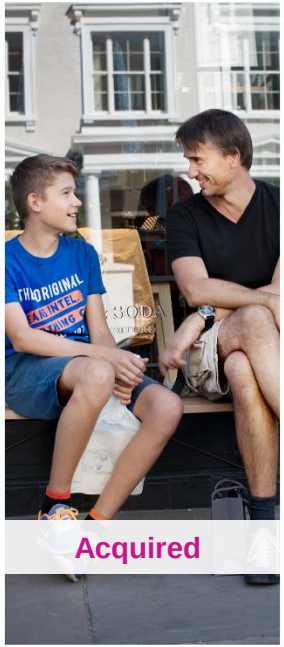
Adults with severe to profound hearing loss

A diverse group

Progressive

Congenital

Aging


Acquired

Trauma

Noise

Ototoxicity

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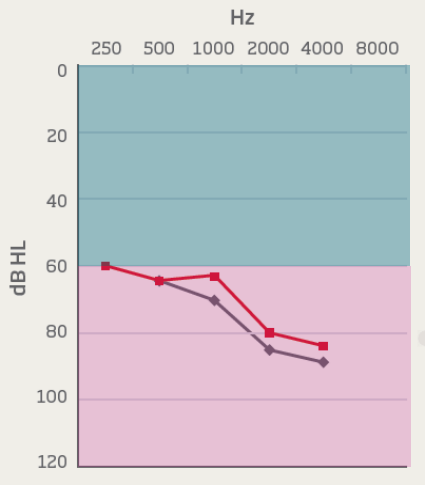
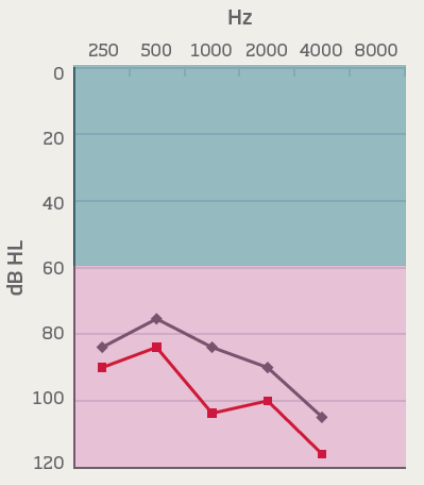
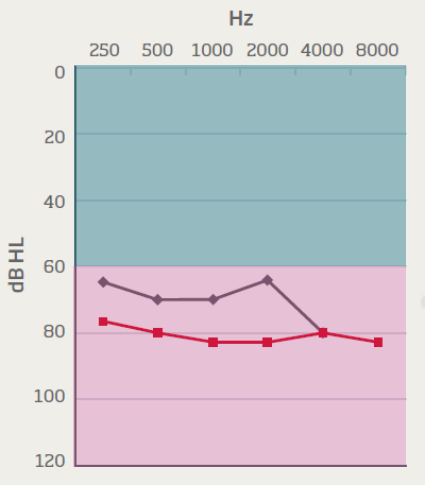
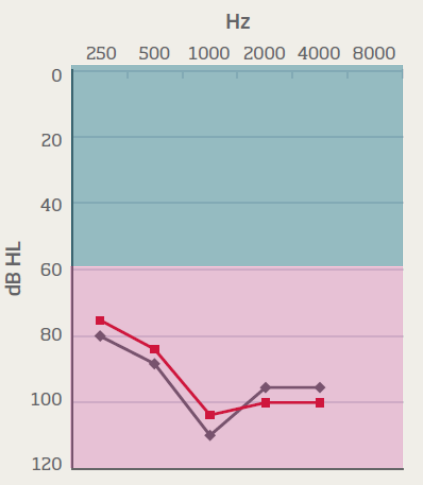
The audiogram

More than just a corner









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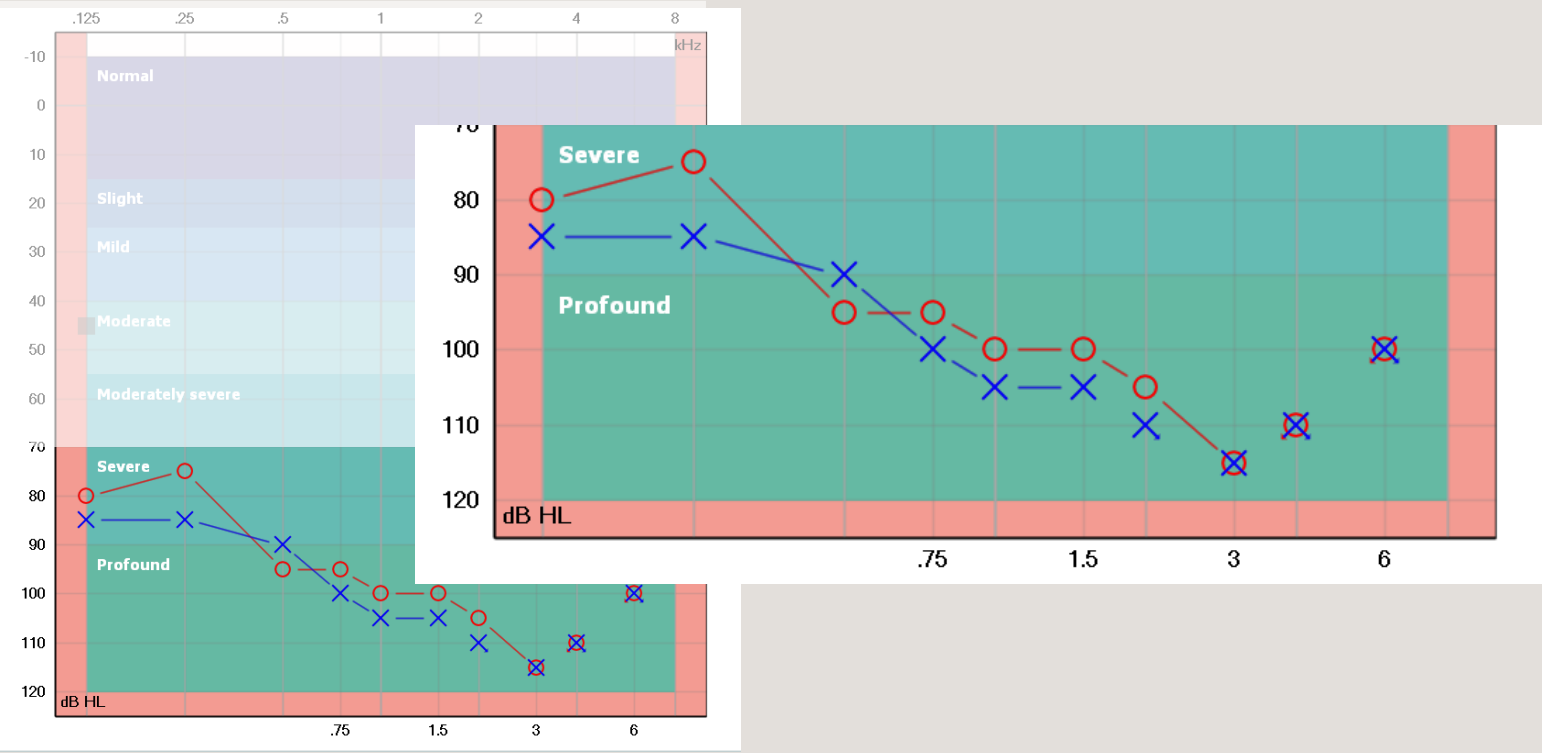
The audiogram

High-frequency sounds are not audible to the patient



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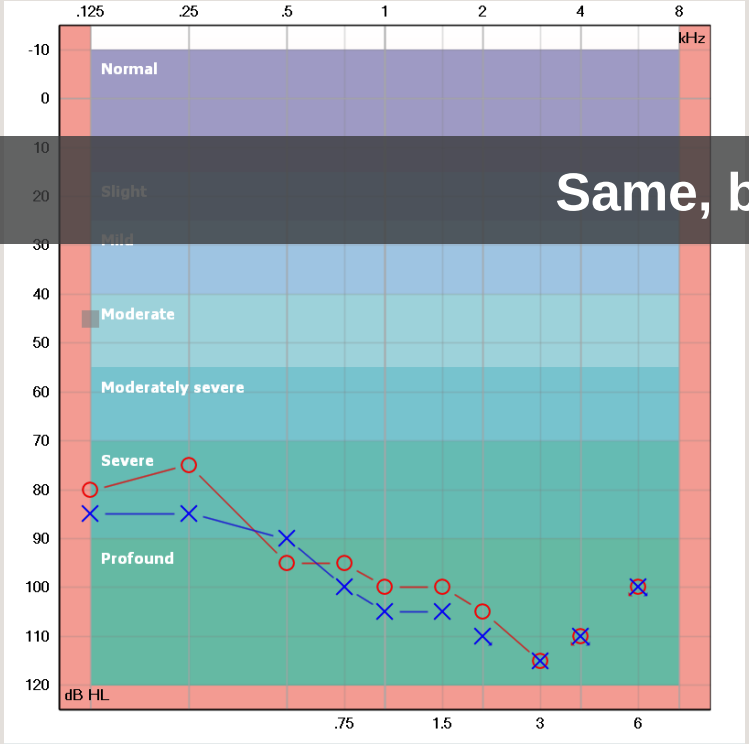
The audiogram

Thresholds do not predict performance with hearing aids



Same, but different

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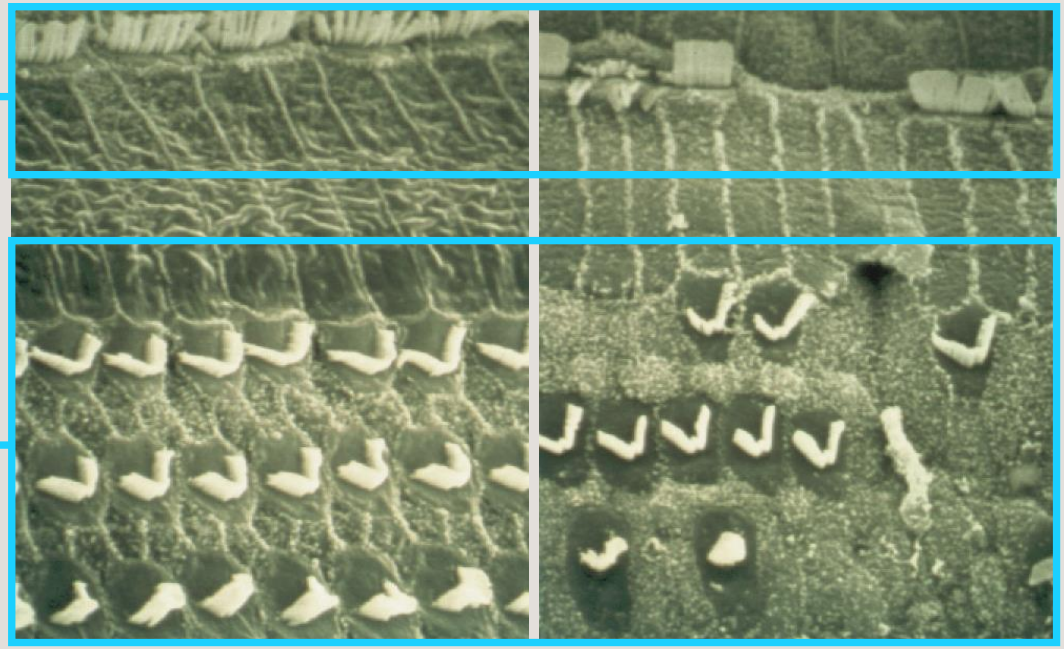
The physiology…

Damage to the hair cells

Intact cochlea | Damaged cochlea

Inner hair cells

Outer hair cells



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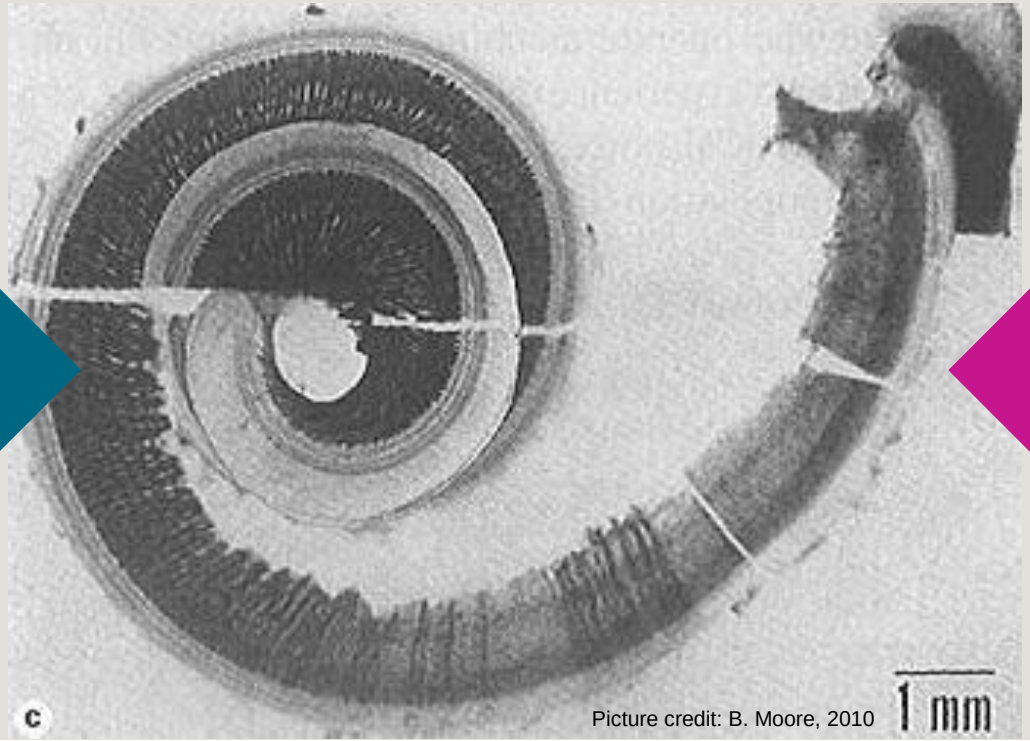
Cochlear dead regions

Areas with hair cells and neurons



Picture credit: B. Moore, 2010

Areas without hair cells and neurons

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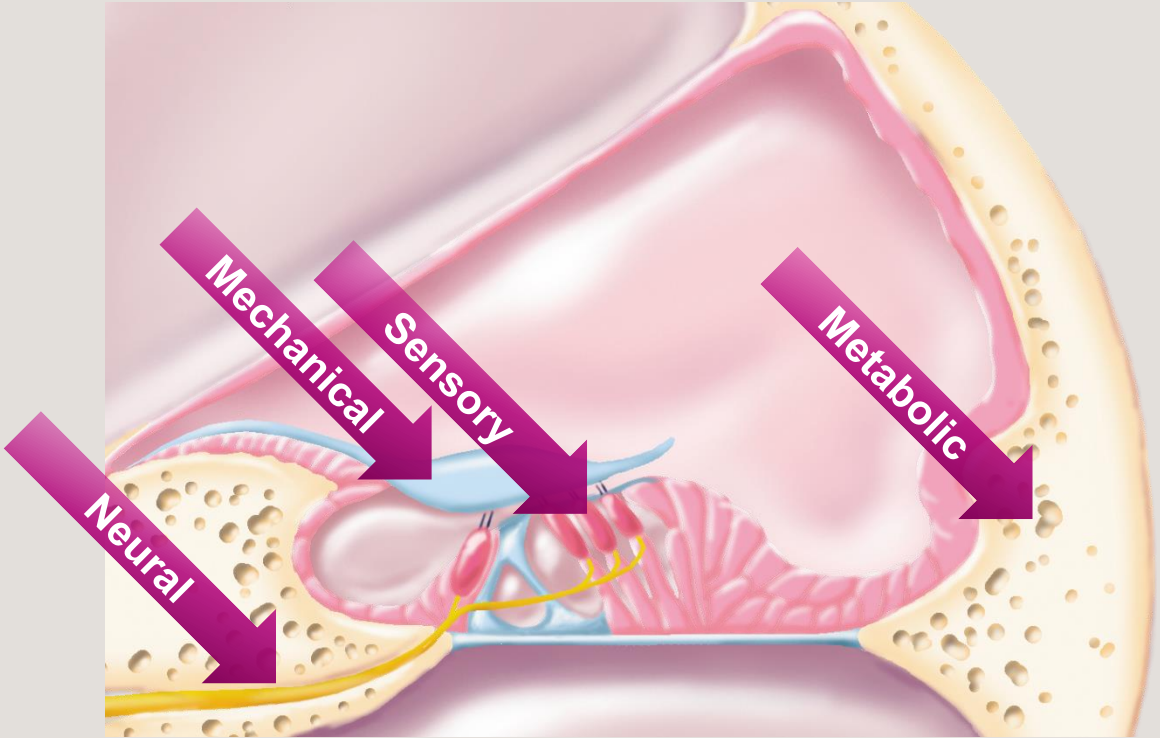
The physiology…

More than just hair cells

- Sensory
- Metabolic
- Mechanical
- Neural



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Issues with severe/profound hearing loss…

Altered Loudness Perception

Increased listening effort

Monitoring own voice

Audibility

Reduced dynamic range

Reduced temporal resolution

Reduced frequency resolution

Reduced speech recognition

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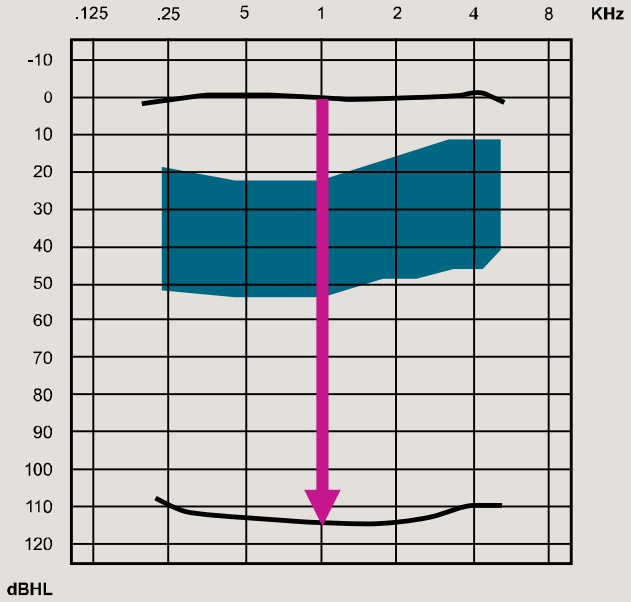
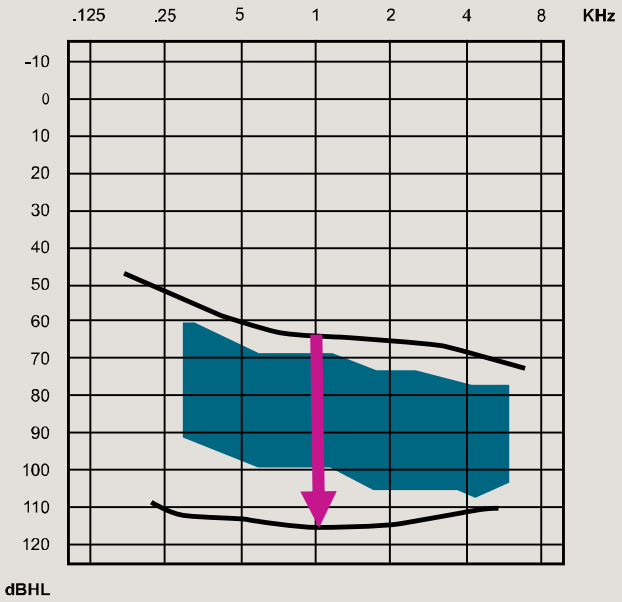
Reduced dynamic range

An example

Normal hearing



Hearing loss



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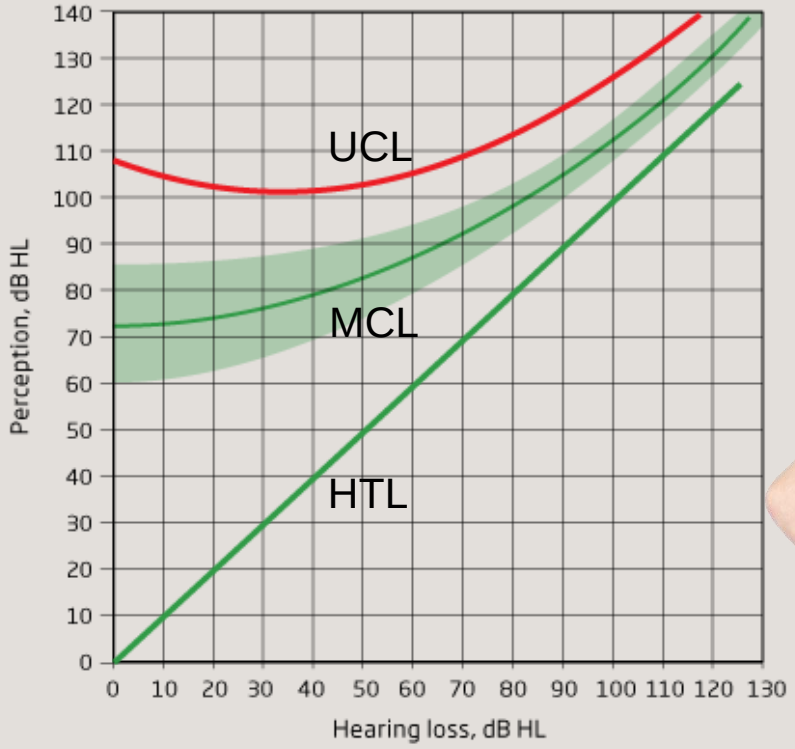
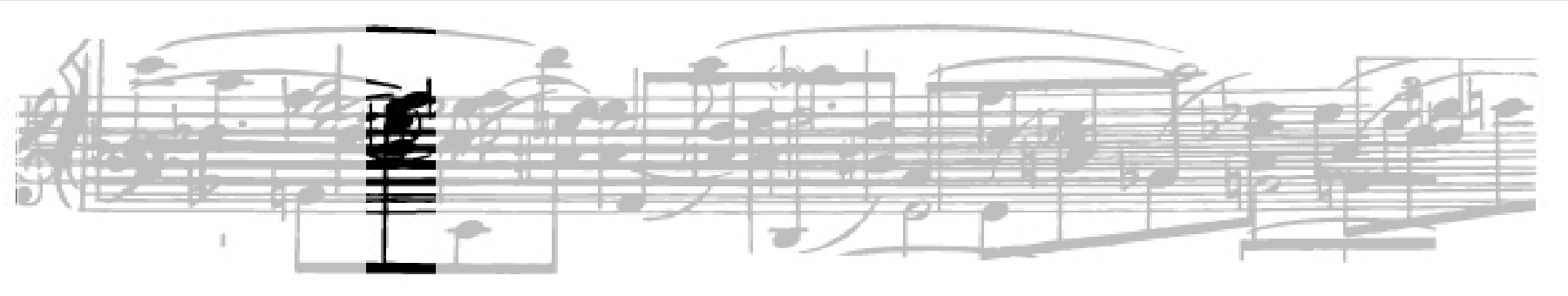
Altered loudness perception



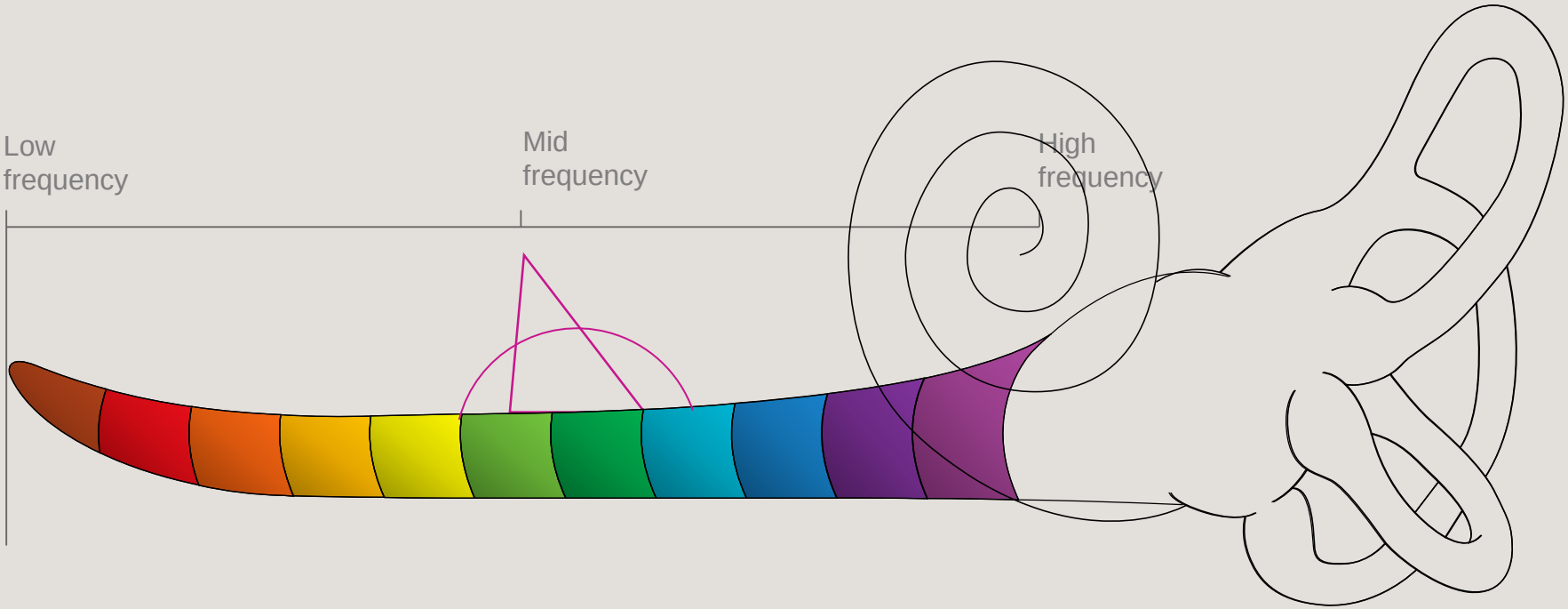
Frequency resolution

The ability to perceive multiple frequency components of a complex sound.



Reduced frequency resolution

Sounds are distorted, masked or absent



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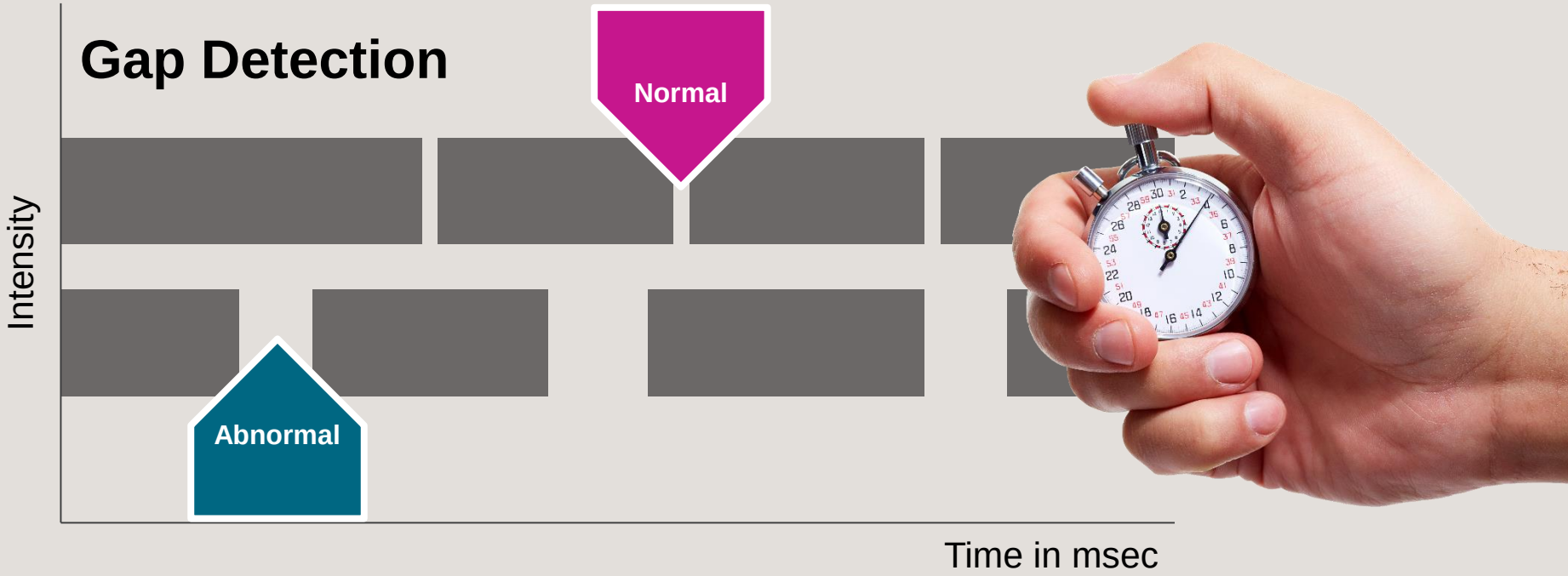
Temporal resolution

The detection of consecutive auditory events as separate.



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Temporal cues

What are they? Why are they important?

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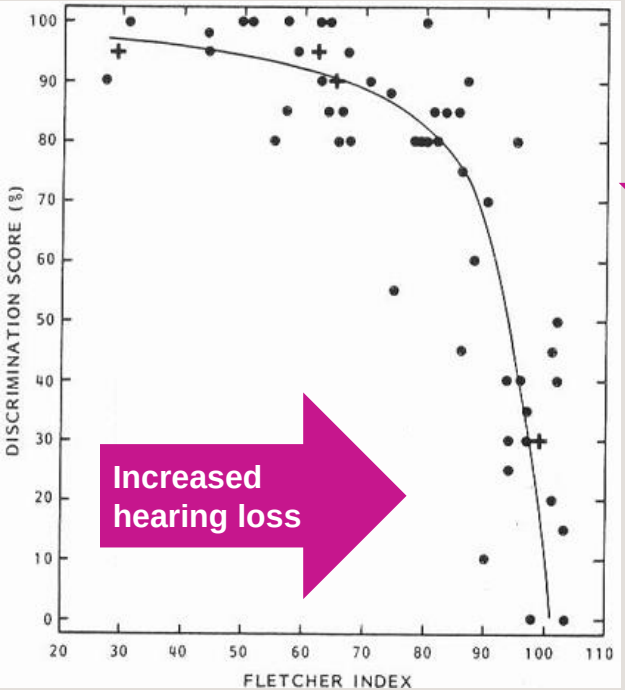
Reduced speech recognition

It sounds mumbled…



Lamore, Verweij and Brocaar, 1990

Decreased discrimination

Strawberry jam is sweet

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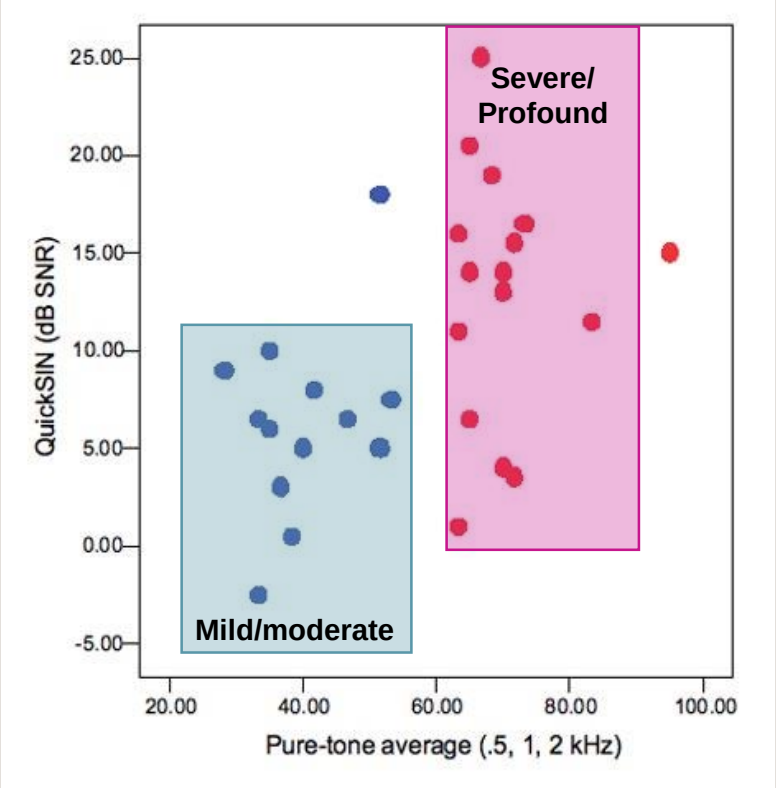
Reduced speech recognition

Speech understanding in noise…

Quick SIN (Speech in Noise)

- 6 Sentences with 5 key words highlighted in each
- Speech babble in background
- SNR is lowered for each sentence
- Scored on SNR for 50% correct



Souza, P. 2009

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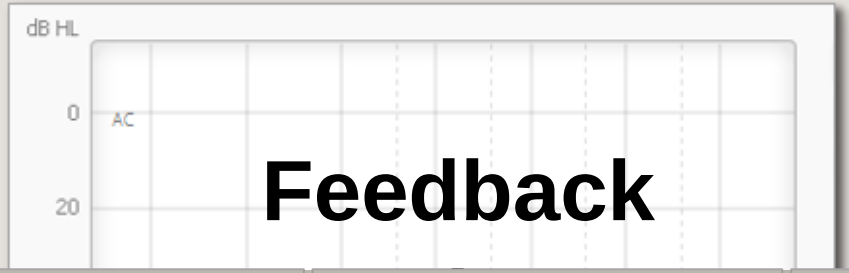
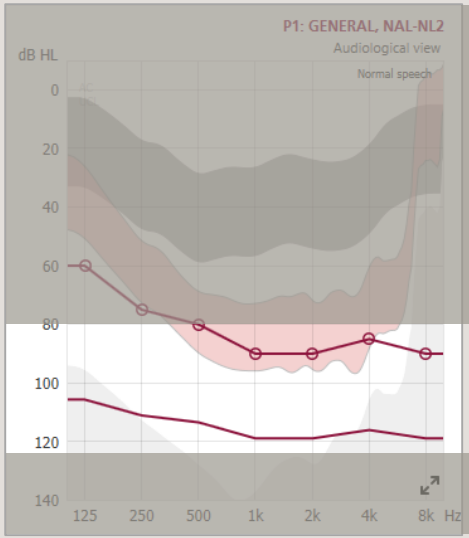
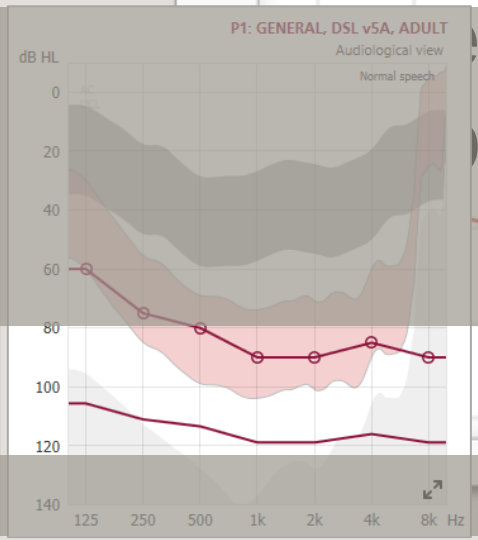
Audibility

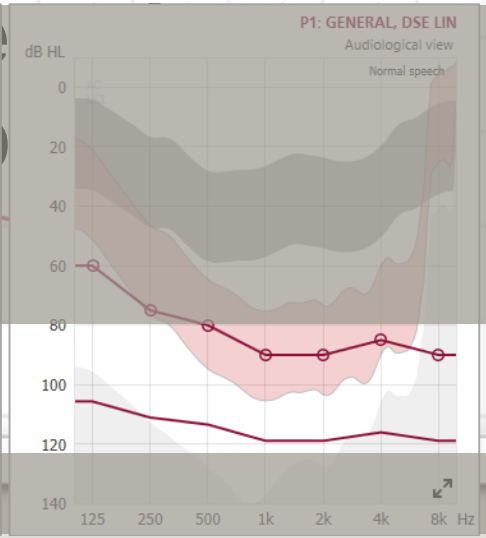
Is it possible to hear it all?

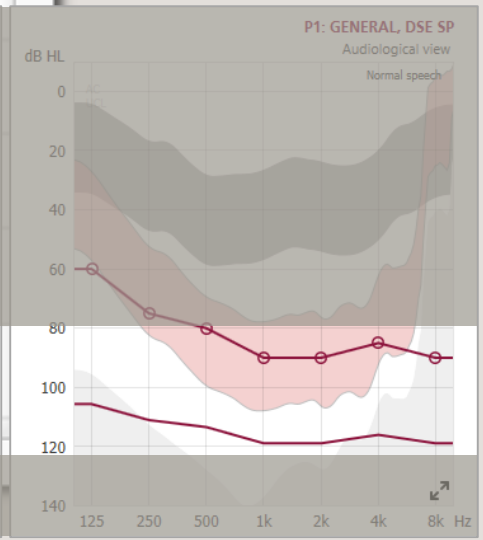


Feedback









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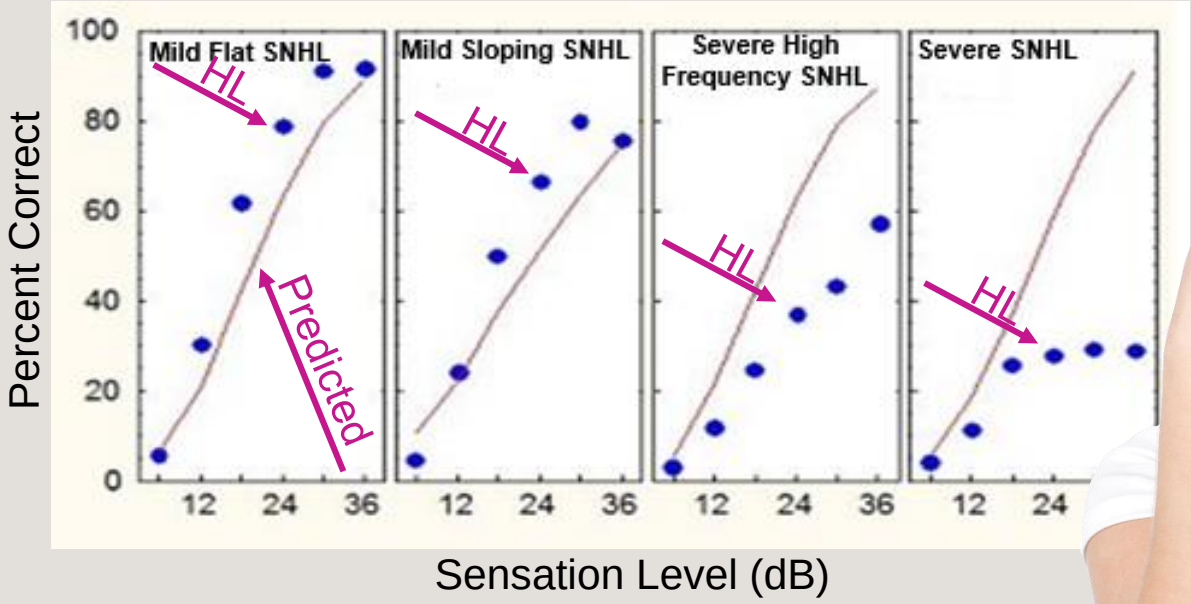
Audibility

I hear but I don’t understand!

1400 – 5200 Hz



Ching, Dillon & Byrne 1998

Audibility

I hear but I don’t understand!

Higher gain

Increases audibility

Distortion

Poorer discrimination

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Monitoring own voice

Here’s what they say…

“I didn’t sound like this with my old hearing aid…”

“I feel like my voice is booming…”

“What do you mean I’m SCREAMING?”

“I sound like I’m talking through my nose!”

“I’m whispering?”

“I feel like I am yelling!”

“I don’t like this at all!”

“Do I really sound like that???”

“My voice is scratchy”

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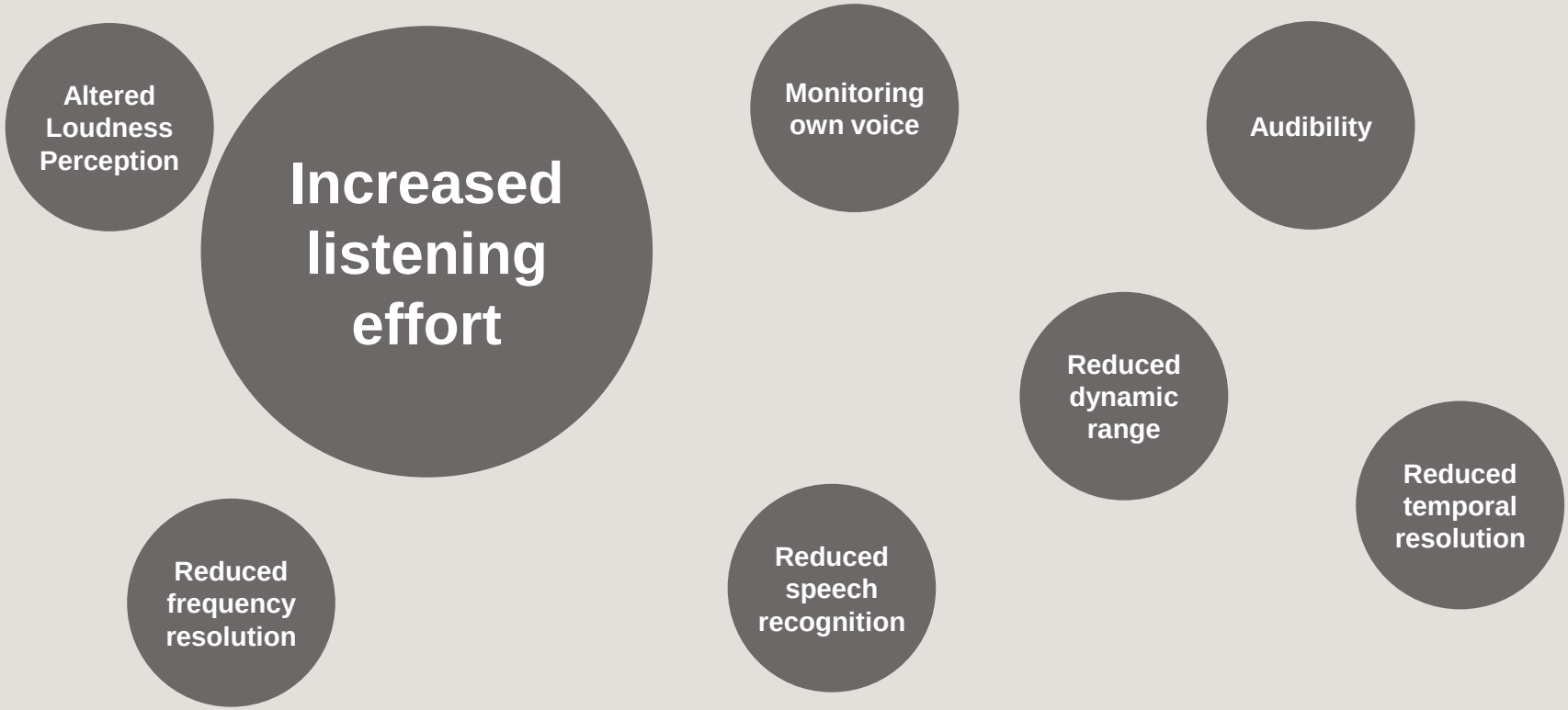
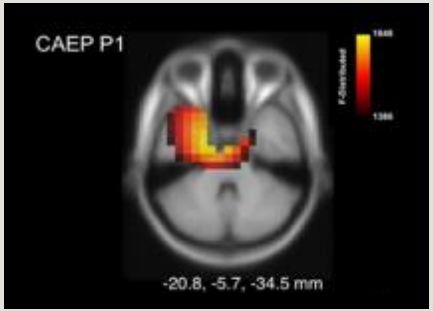

Altered Loudness Perception
Increased listening effort
Monitoring own voice
Audibility
Reduced dynamic range
Reduced temporal resolution
Reduced frequency resolution
Reduced speech recognition

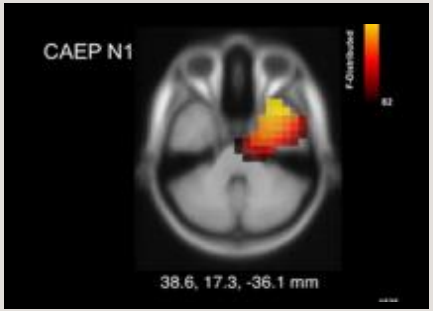
Increased listening effort

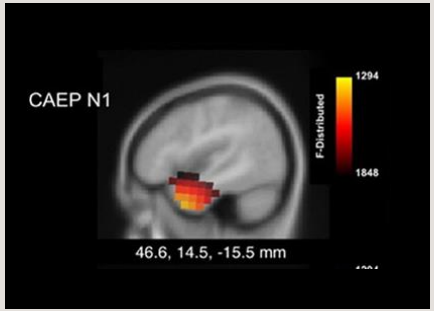
Re-assigning auditory processing

Auditory Cortex | **Frontal Lobe**

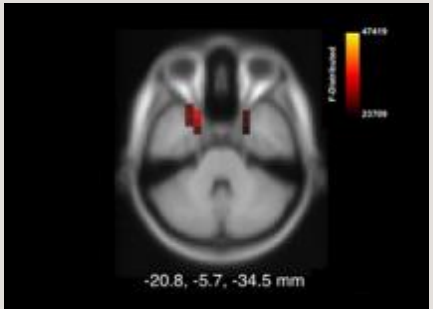
Normal hearing

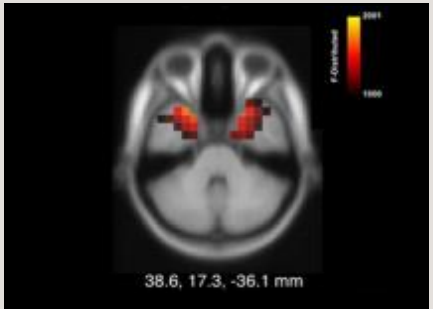


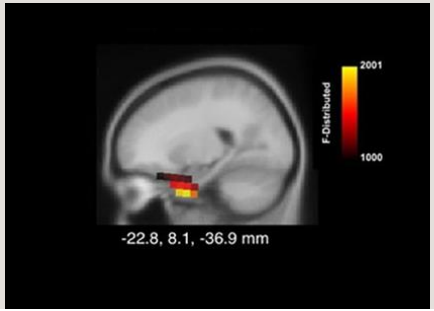




Hearing Loss







Campbell, S 2013

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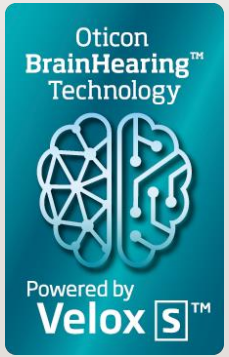
Technology needs

Meeting the needs with Oticon Xceed and Oticon Xceed Play

Audibility with reduced risk of feedback



Help in noise

Connectivity

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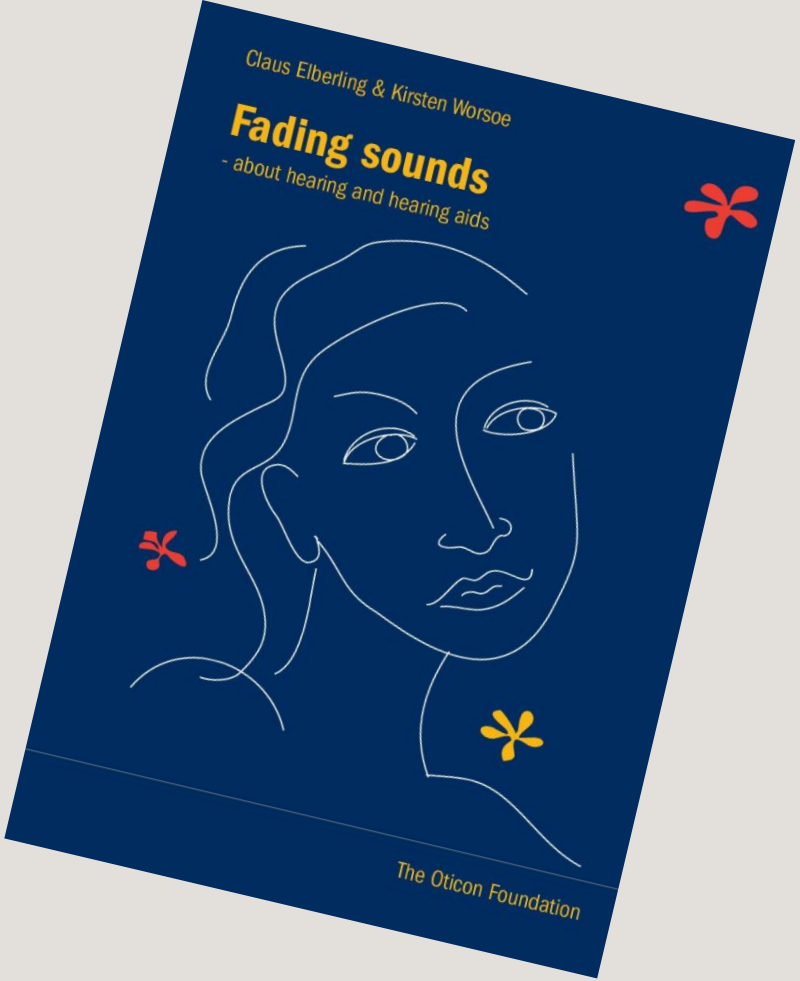
Read more…

- www.fadingsounds.com



Q&A