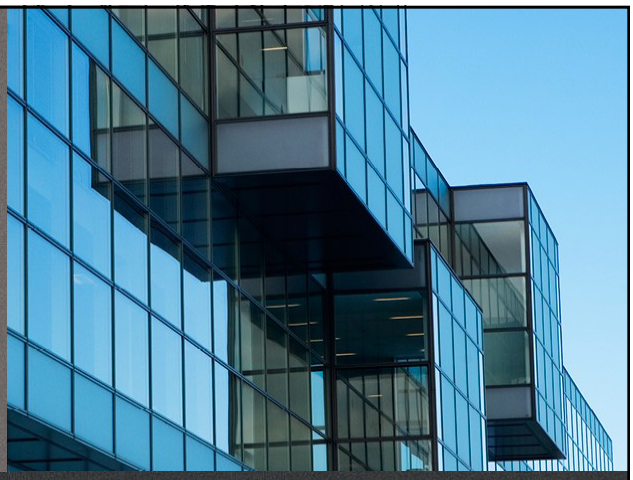
Oticon Technologies to Manage Complex Listening Environments



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VP, Audiology

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Learning Objectives:

1. … Identify the characteristics of realistic complex listening environments
2. … identify the principles that drive speech understanding in challenging situations
3. … recognize the characteristics of OpenSound Navigator and other Oticon technologies designed to mange complex environments

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Why?

Noise bad … Speech good

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Conventional Amplification

Improved Audibility & Improved S/N …

But …

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Explaining Speech Understanding

- Audible?
- Above the noise?
- Where does the noise come from?
- What constitutes the "noise"?
- Who is the talker?
- Support cues?
- How sensitive to noise? (distortional component)
- How good is the patient at piecing together a partial signal?
- How much effort is the listener investing?

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Complex Environments

Multiple talkers
Movement
Stable, non-speech sources
Unstable, non-speech sources
Distractions
Shifting focus
A little bit of everything

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Creating solutions for complex environments:

- Use the brain
- Preserve the good stuff
- Present the user with a cleaner, rebalanced signal
- Improve performance at the same time as preserving a natural listening experience

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Three Principles of Cue Preservation:

1: ***Where sound comes from matters***

2: The bandwidth of speech matters

3: The details of speech matter

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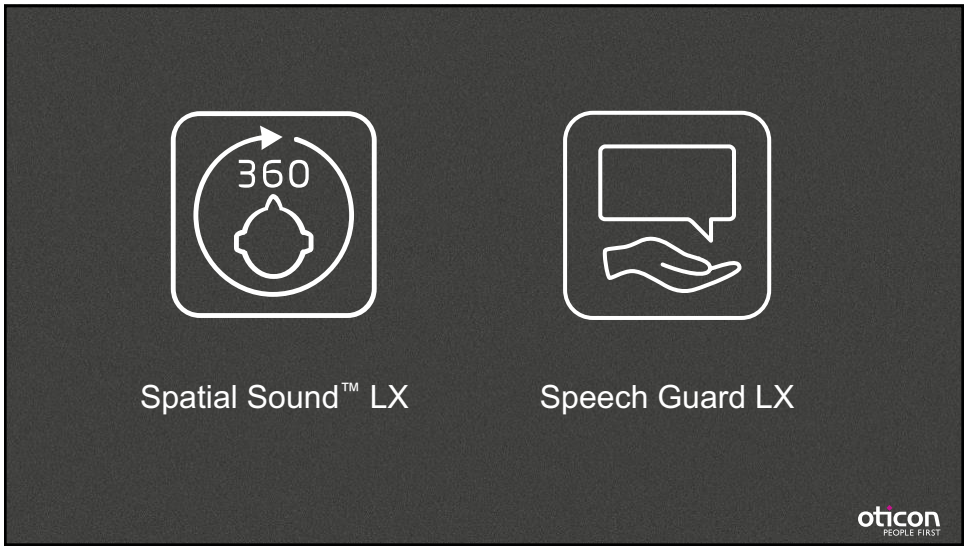

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Creating solutions for complex environments:

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Complex Environments

Multiple talkers
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A little bit of everything

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Speech in Noise Problem: Traditional Technologies

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In order to get rid of noise,

…you have to find & define noise

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- **Adaptive Directionality**
- **Noise Filtering – Long Term**

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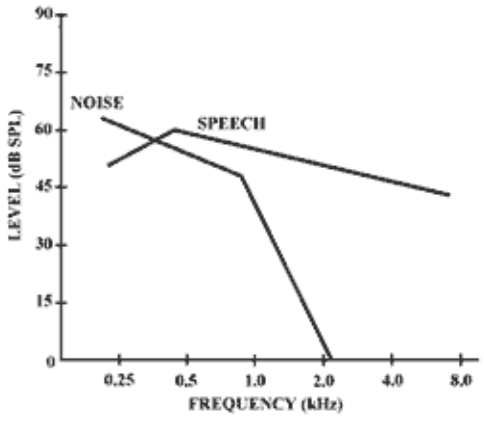

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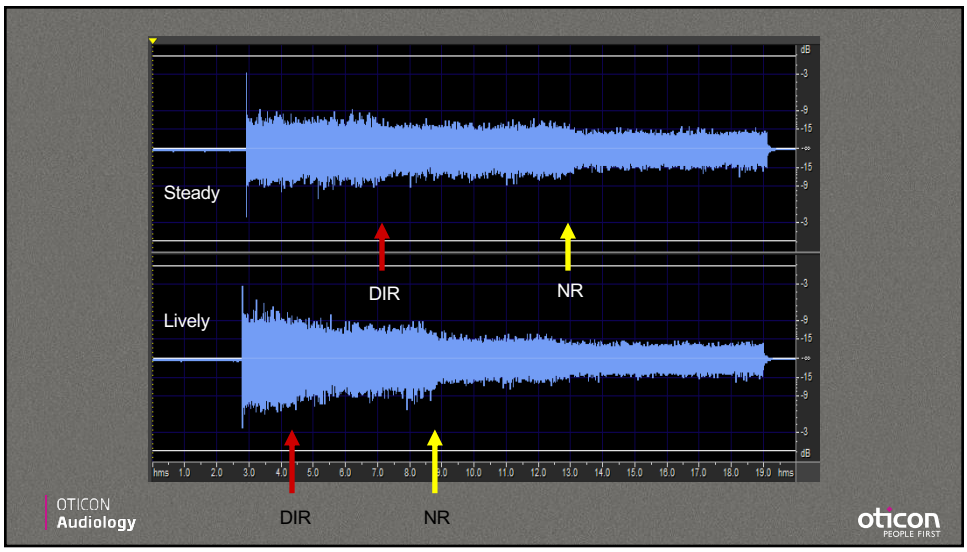

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Speech in Noise Problem: Industry Reaction?

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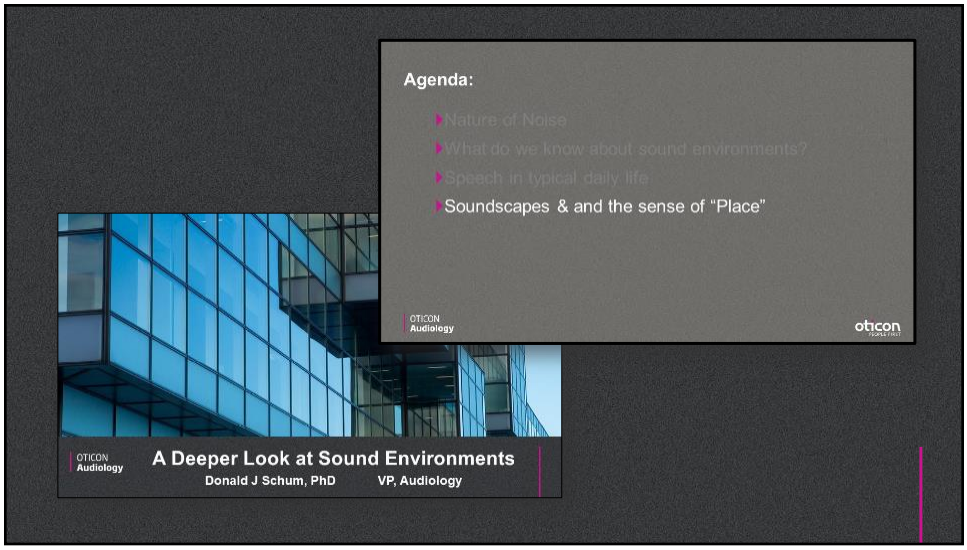
Agenda:
Nature of Noise
What do we know about sound environments?
Speech in typical daily life
Soundscapes & and the sense of "Place"
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A Deeper Look at Sound Environments
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OpenSound Navigator™
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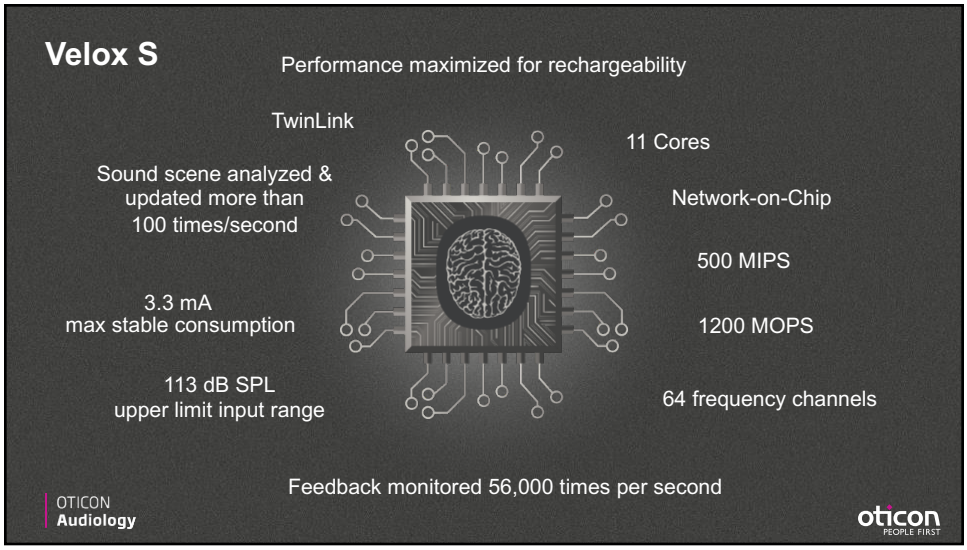
Velox S
Performance maximized for rechargeability
TwinLink
Sound scene analyzed & updated more than 100 times/second
3.3 mA max stable consumption
113 dB SPL upper limit input range
11 Cores
Network-on-Chip
500 MIPS
1200 MOPS
64 frequency channels
Feedback monitored 56,000 times per second
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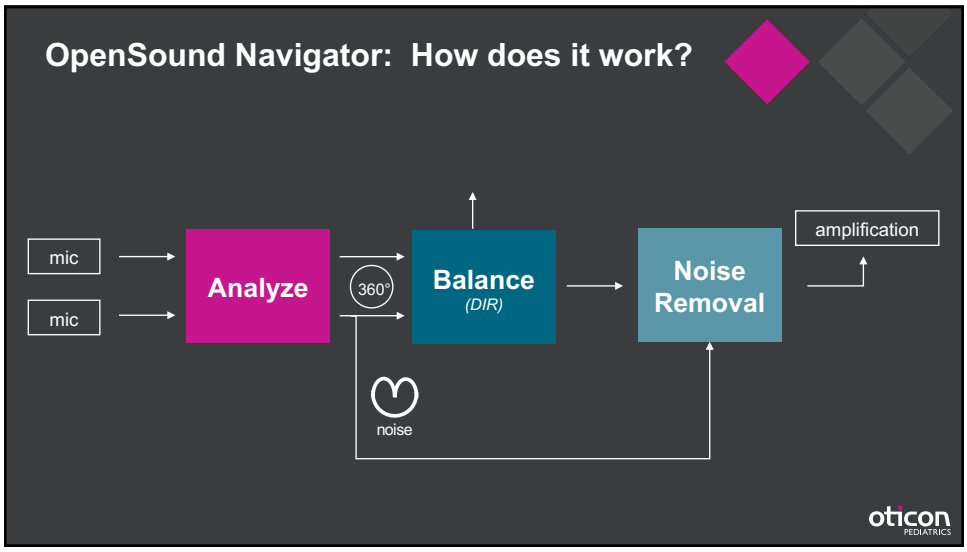
OpenSound Navigator: How does it work?
mic
mic
Analyze
360°
Balance (DIR)
Noise Removal
amplification
noise
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Data Captured

- Frequency (16 channels)
- Level
- Location
- Speech versus non-speech

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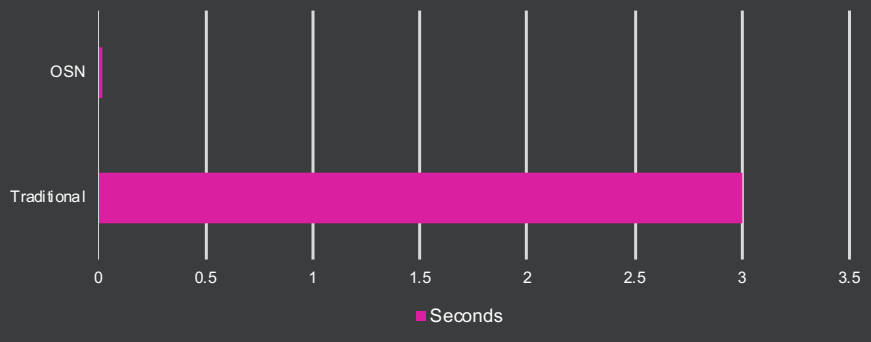
Update speed: 10 msec versus 3 sec



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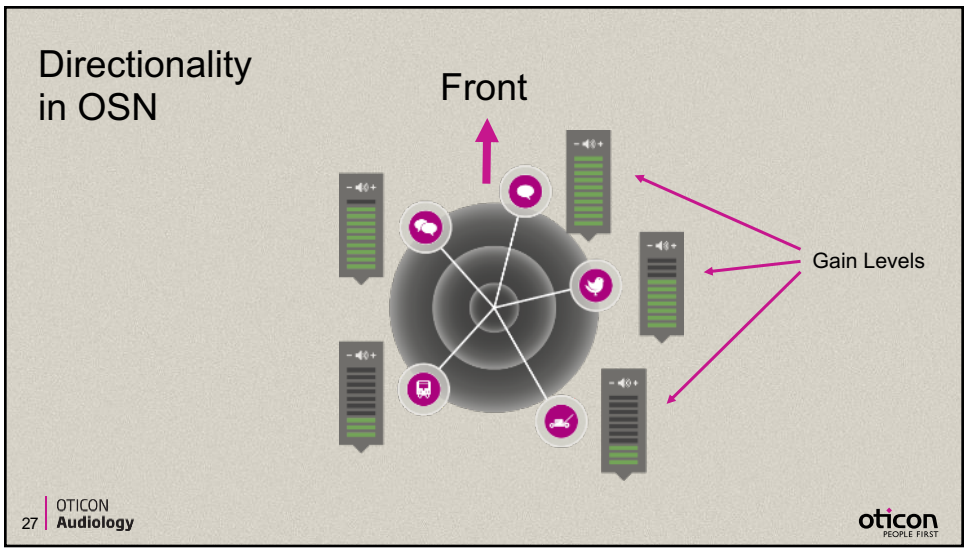
Directionality
in OSN
Front
Gain Levels
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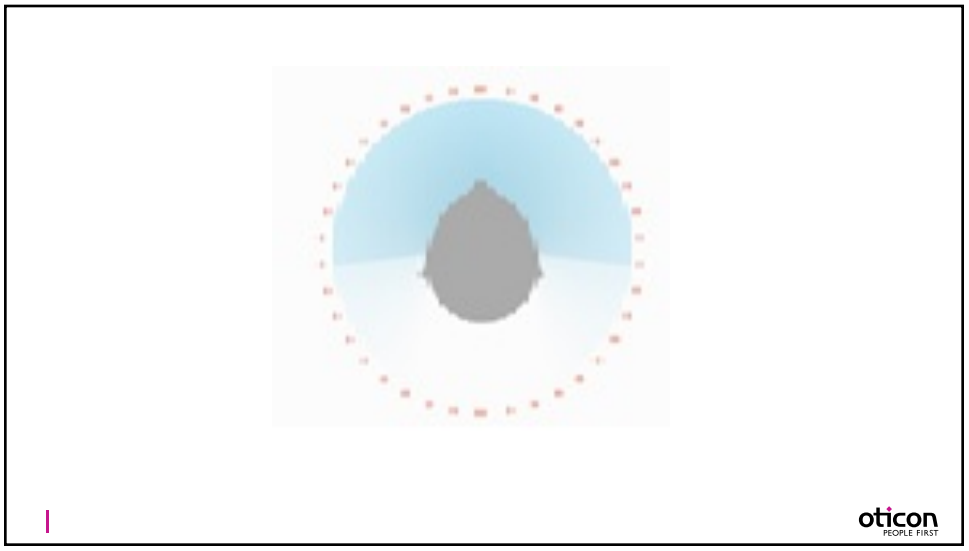
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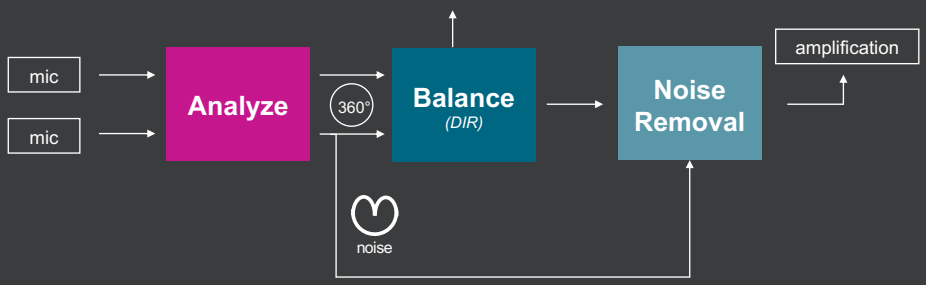
How does it work?



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OpenSound Navigator Compared to:

- Traditional DIR & NR:
  - Analysis Phase
  - Spatially-aware NR
  - Criteria for NR changes
  - Update Speed
- Beamforming:
  - Analysis Phase
  - Update Speed
  - Protection of clearly defined speech sources

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Recordings

- KEMAR recordings
  - Opn 1
  - Beam Former
  - Traditional DIR & NR
- Speech in Speech-shaped Noise (+5 dB S/N)
- Technical Analysis of effect on S/N

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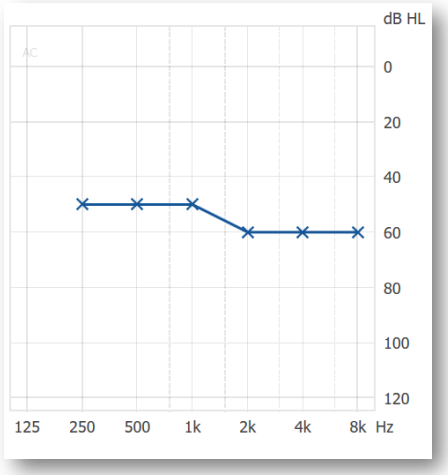
Audiometric configuration:



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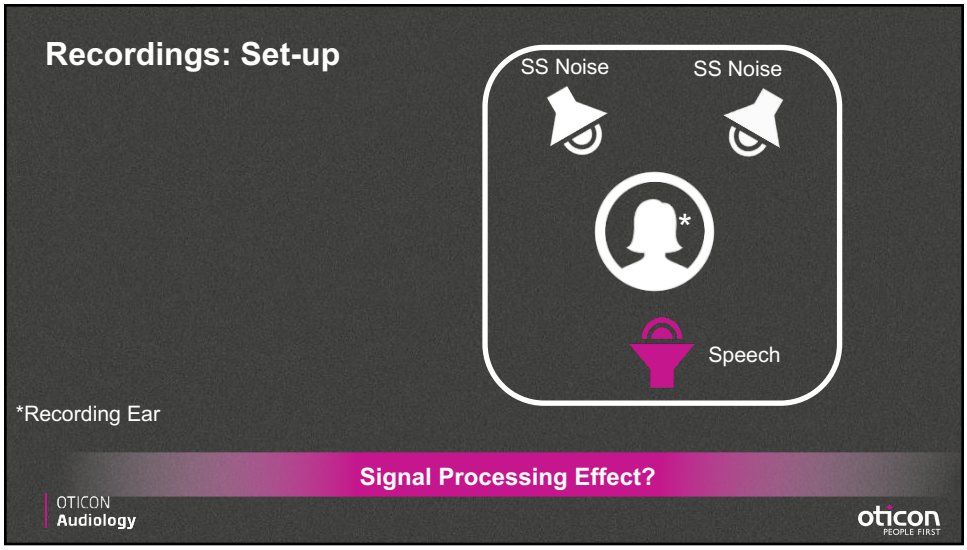
Recordings: Set-up
SS Noise
SS Noise
*
Speech
*Recording Ear
Signal Processing Effect?
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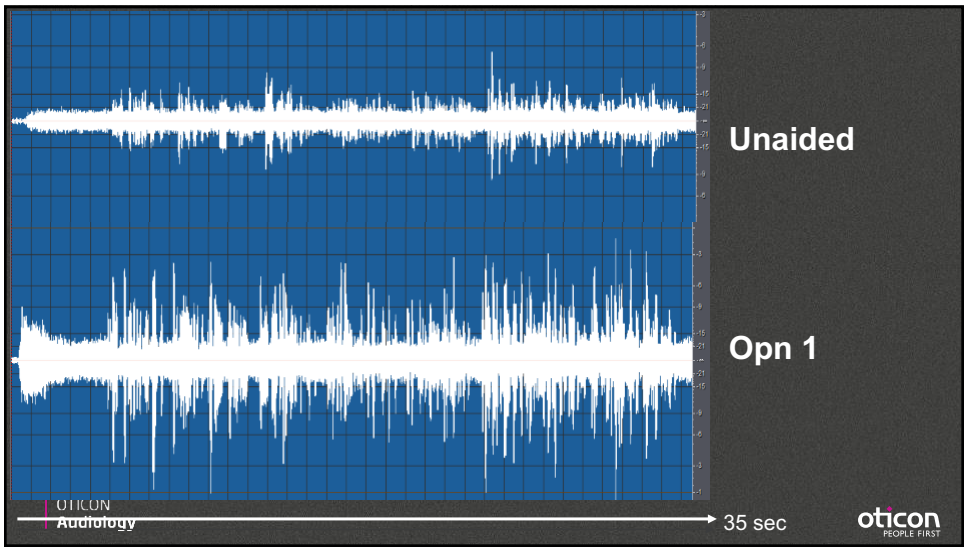
Unaided
Opn 1
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35 sec
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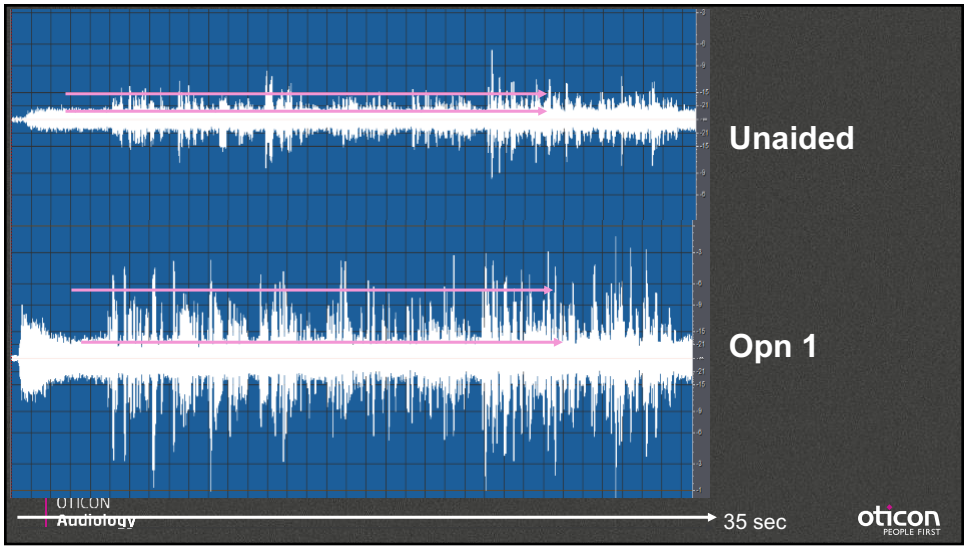
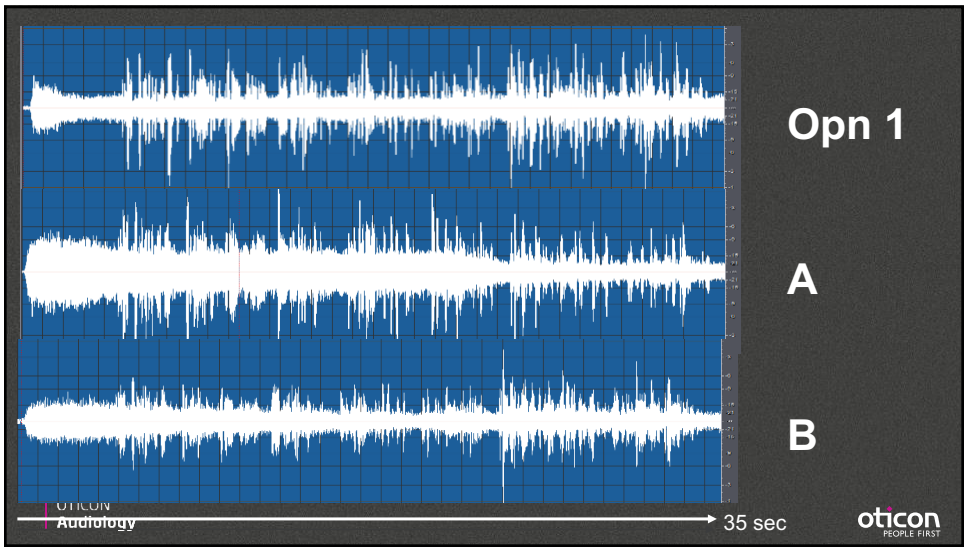

Unaided
Opn 1
35 sec
oticon
PEOPLE FIRST

35


Opn 1
A
B
35 sec
oticon
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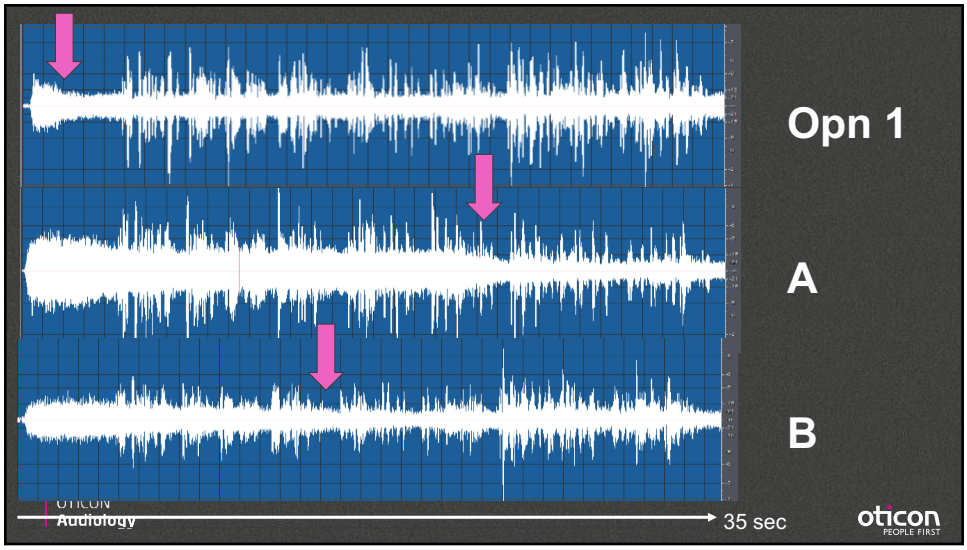
Opn 1
A
B
35 sec
oticon
PEOPLE FIRST

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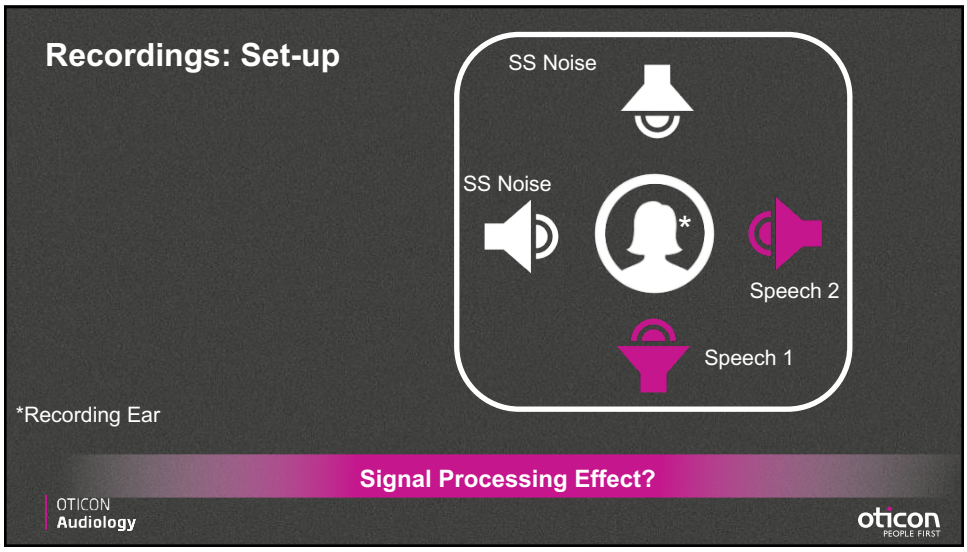
Recordings: Set-up
SS Noise
SS Noise
Speech 2
Speech 1
*Recording Ear
Signal Processing Effect?
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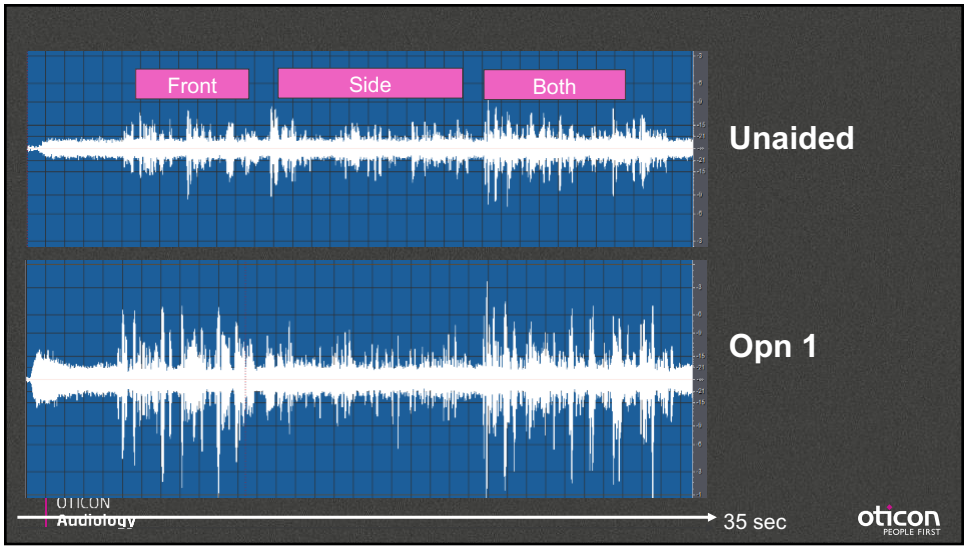
Front
Side
Both
Unaided
Opn 1
OTICON
Audiology
35 sec
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Front
Side
Both
Opn 1
C (BF)
OTICON
Audiology
35 sec
oticon
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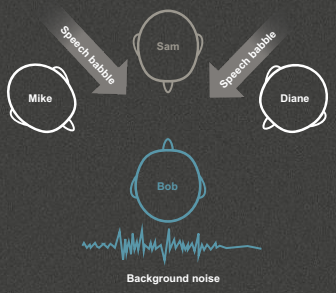
Study: Multiple talkers in noise

- Uncertainty of the target speaker location
- 24 participants
- 3 mRITE HAs with different technologies set to max NR



Traditional Directionality | Narrow directionality | OpenSound Navigator

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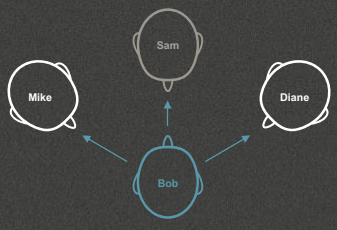
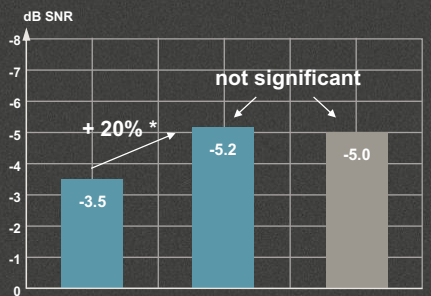
Results

Speech understanding of center speaker (Sam)





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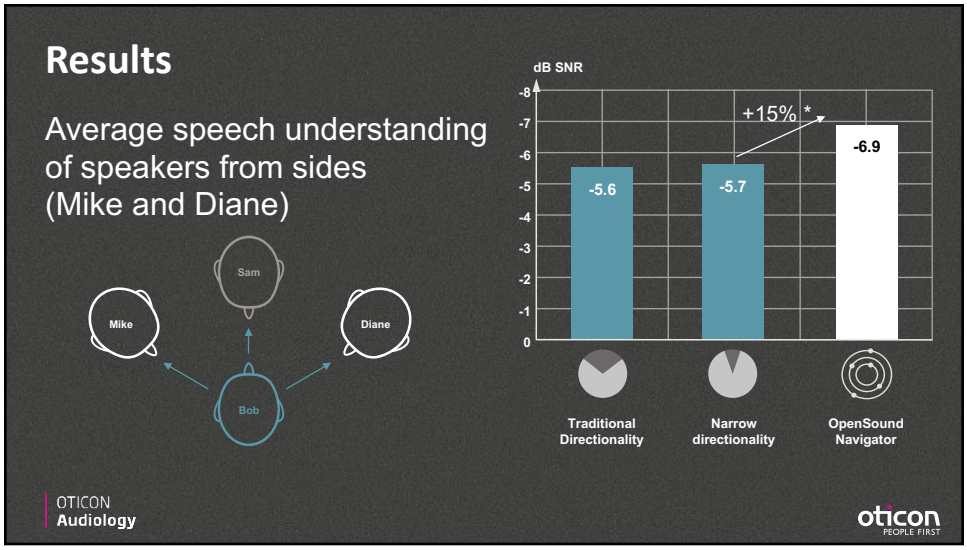
Results
Average speech understanding of speakers from sides (Mike and Diane)
Sam
Mike
Diane
Bob
dB SNR
-8
-7
-6
-5
-4
-3
-2
-1
0
-5.6
-5.7
-6.9
+15% *
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Narrow directionality
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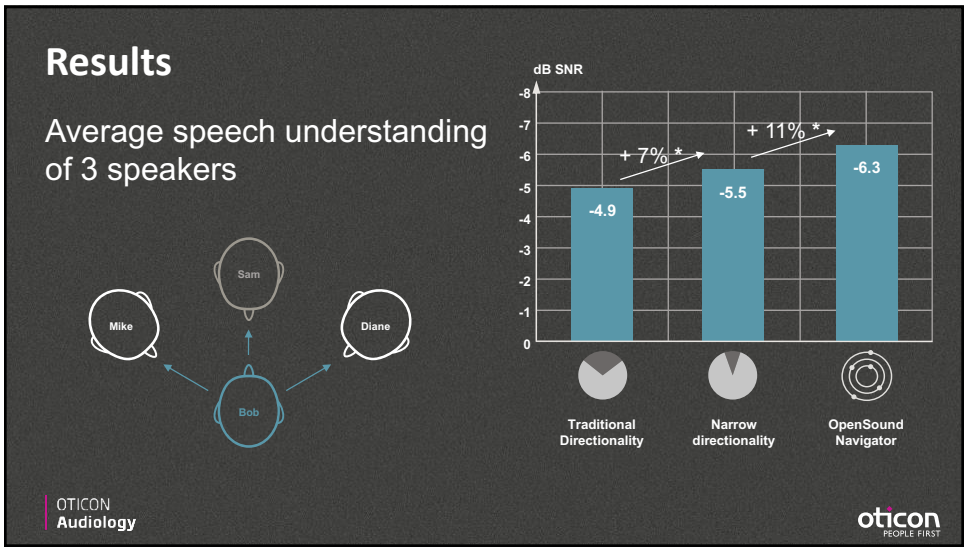
Results
Average speech understanding of 3 speakers
Sam
Mike
Diane
Bob
dB SNR
-8
-7
-6
-5
-4
-3
-2
-1
0
-4.9
-5.5
-6.3
+ 7% *
+ 11% *
Traditional Directionality
Narrow directionality
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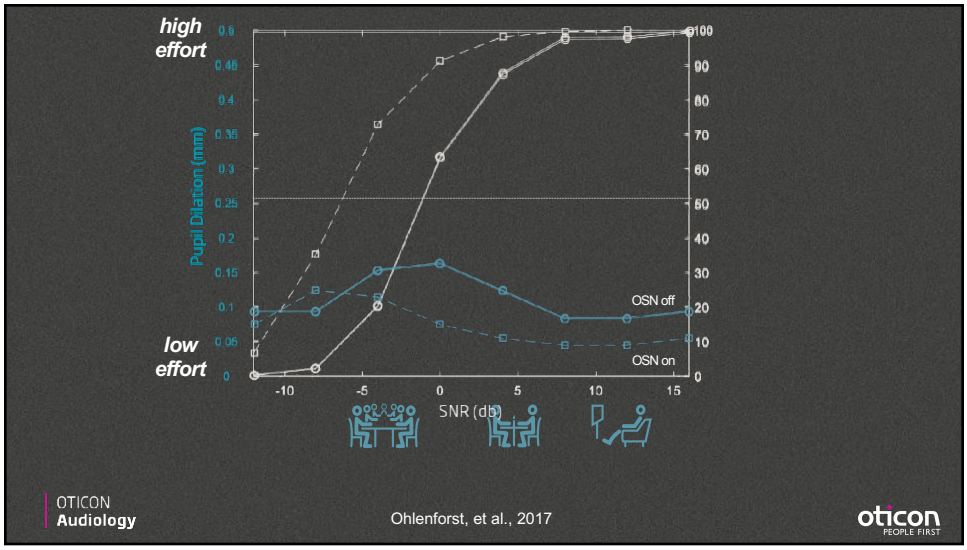

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Creating solutions for complex environments:

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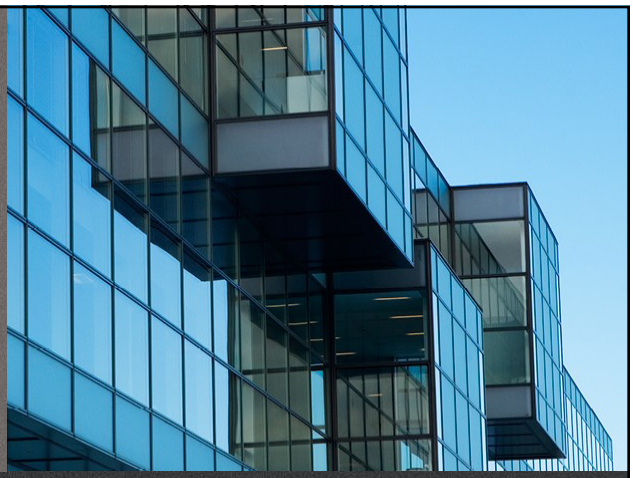

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