

Optimizing fittings for older adults

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PHONAK
life is on

Optimizing fittings for older adults.

A part of the ECHHO program

A solid green semi-circle is located on the left side of the slide.

Financial disclosure: Speaker is employed by Phonak US

Non-financial discloser: None

Risks/Benefits

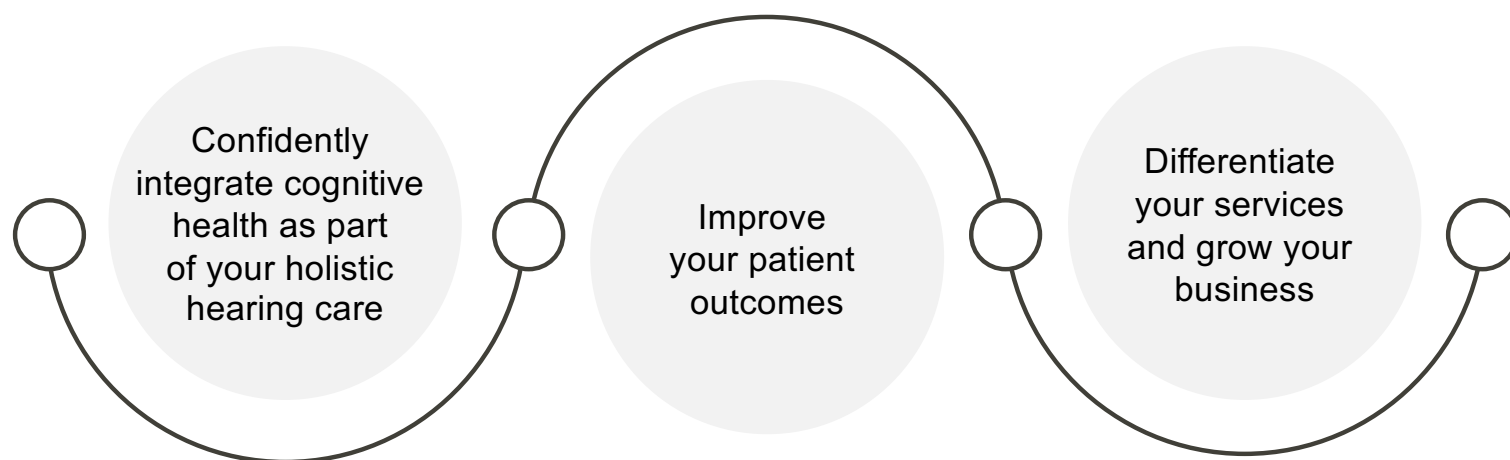
- The applicability and accuracy of the course content may vary by the clinical, geographical, and cultural context; you should evaluate the course accordingly.
- As healthcare is rapidly evolving, new findings may change the validity of the information presented in this course. Providers should always consult the latest research and guidelines from professional associations.
- The interventions discussed in this course may be limited in generalizability, requiring practitioners to consider specific individual and population factors.
- The course may not cover all possible risk factors, diagnostic methods, or treatment options, and complex cases may require additional considerations.
- Healthcare providers should apply cultural competence and sensitivity to ensure effective and respectful care based on their patients' diverse needs.
- Providers should always evaluate the limitations of diagnostic and screening tools, considering their potential for false results as well as any ethical implications.
- It is the responsibility of course participants to critically evaluate the evidence from multiple sources to guide professional practice.

Learning objectives

After this course, the participants will be able to:

- Describe how aging effects auditory processing
- List 3 important amplification characteristics to consider when fitting older adults
- Describe how Phonak technology support evidence-backed fitting recommendations

ECHHO helps you



ECHHO
Enhancing
Cognitive
Health | Hearing Optimization

Advanced healthcare and healthier living lead to longer life expectancy*



8 billion people
living
in the world,
10 billion
by 2050**

10% of the
population are 65+,
16%
by 2050**

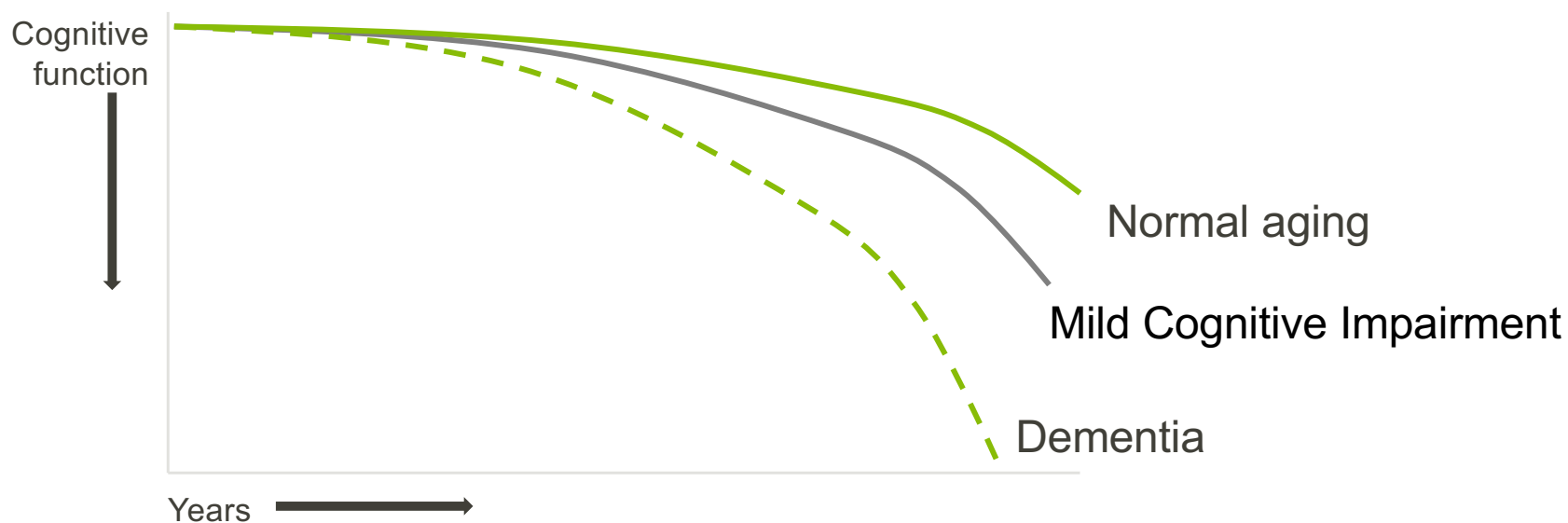
Adults
65+
doubles
by 2050**

Adults
80+
triples
by 2050**

*World Health Organization. (n.d.). Ageing and health. Retrieved November 22, 2024, from <https://www.who.int/news-room/fact-sheets/detail/ageing-and-health>

**United Nations Department of Economic and Social Affairs, Population Division (2022). World Population Prospects 2022: Summary of Results. UN DESA/POP/2022/TR/NO 3.

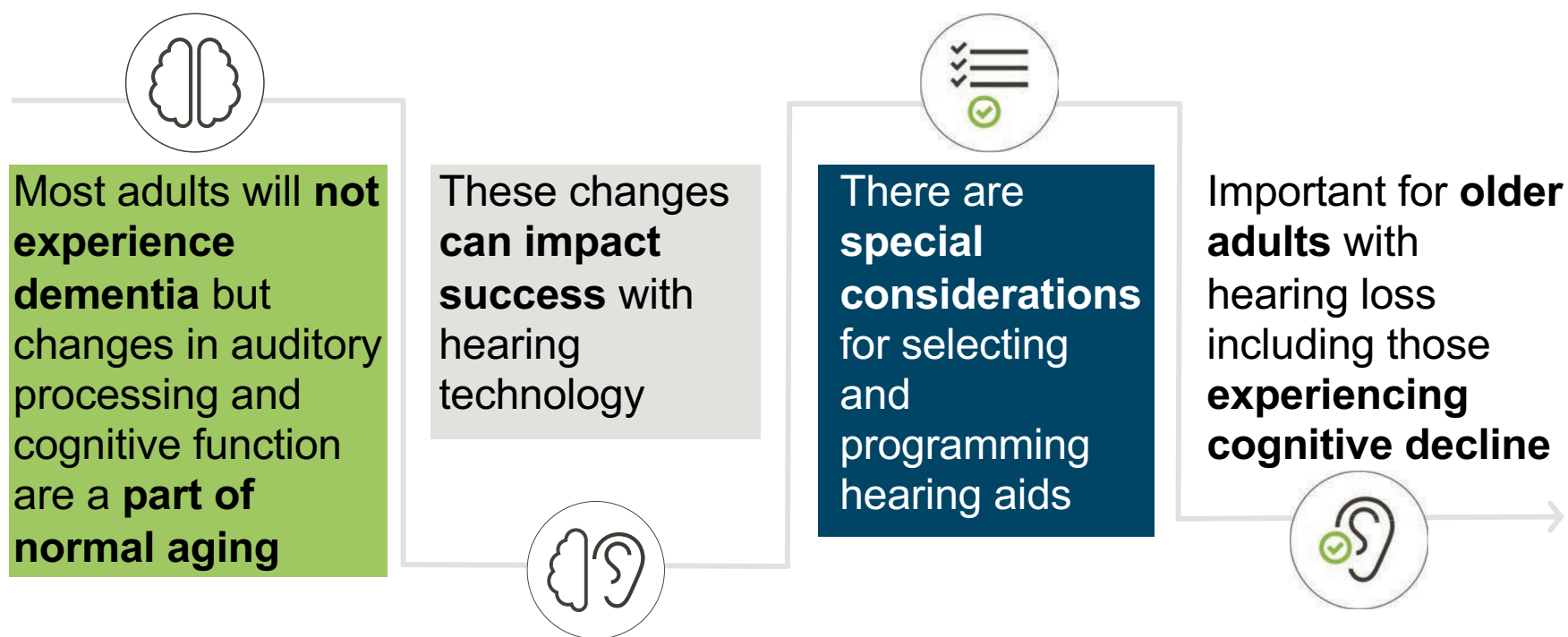
Normal versus “pathological” aging in cognition



Dementia develops **over time** and is preceded by **cognitive impairment** and **normal aging**

Figure adapted from Sperling, R. A., Aisen, P. S., Beckett, L. A., Bennett, D. A., Craft, S., Fagan, A. M., . . . Montine, T. J. (2011). Toward defining the preclinical stages of Alzheimer's disease: Recommendations from the National Institute on Aging-Alzheimer's Association workgroups on diagnostic guidelines for Alzheimer's disease. *Alzheimer's & Dementia*, 7(3), 280-292.

A focus on the links between hearing loss and cognition





Agenda

- 01** Auditory processing and cognitive changes with aging and the impact on speech perception

- 02** Considerations and practical guidance for selecting and fitting older adults with hearing aids

- 03** Phonak technologies that improve SNR, reduce listening effort and support optimal outcomes





Aging and speech perception

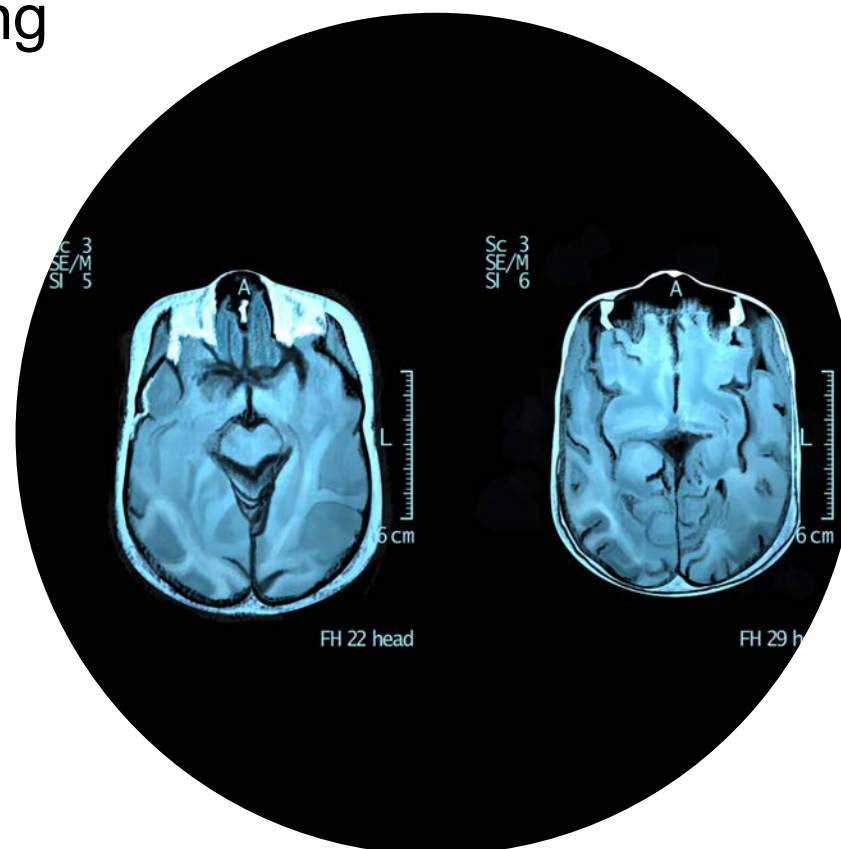
Auditory processing is a complex cognitive process

- The **brain processes** different parts of speech **in various areas**
- Some neurons respond to **loudness**, while others detect **rhythms or patterns**
- Ability to **tell sounds apart** or combine them depends on multiple systems
- Recognizing words, understanding phrases and sentences, and grasping grammar and meaning, all involve **complex connections**



Aging affects auditory processing

- As a result of aging, the brain has **fewer connections**
- Affects **processing of timing** information, **gap detection**, **localization** and **frequency perception**
- These changes make it **harder to pick out specific sounds** in a noisy environment, focus on a particular speaker, and understand speech clearly in background noise



Envelope and temporal information is critical for speech perception

Temporal information in speech is conveyed across different frequency bands:

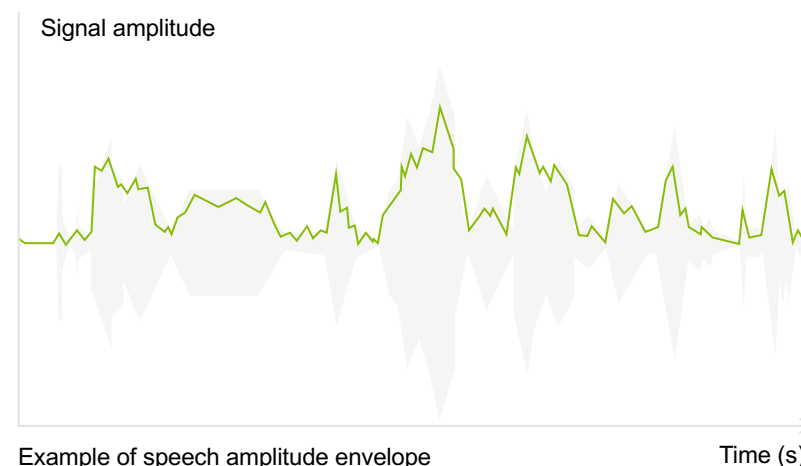
Speech envelope (ENV): Below 50 Hz

Provides cues about the overall amplitude fluctuations in speech

Voicing and periodicity: 50 – 500 Hz

Temporal fine structure (TFS): Above 500 Hz

Helps with the fine-grained details of speech sounds, such as pitch and formants



Theories behind changing cognitive abilities

The auditory system processes sounds, cognitive processes interpret those sounds

✓ 1

Processing – speed theory

- Mental processing slows down
- Slower thinking takes up mental resources
- Becomes harder to remember past events & to start more complex tasks

✓ 2

Working memory stores and processes information relevant to a current task and there is a limited amount of resources available

✓ 3

Inability to filter out irrelevant information can further reduce processing capacity

Cognitive changes impact speech perception

A meta-analysis** revealed correlations between SIN performance and **various cognitive functions**:

- Processing speed
- Inhibition
- Working memory (WM)
- Episodic memory

These cognitive domains decline with age and **may have additive effects** on listening ability



* Windle reference in APA: Windle, R., Dillon, H., & Heinrich, A. (2023). A review of auditory processing and cognitive change during normal ageing, and the implications for setting hearing aids for older adults. *Frontiers in Neurology*, 14, Article 1122420. <https://doi.org/10.3389/fneur.2023.1122420>. | ** Dryden, A., Allen, H. A., Henshaw, H., & Heinrich, A. (2017). The Association Between Cognitive Performance and Speech in Noise Perception for Adult Listeners: A Systematic Literature Review and Meta-Analysis. *Trends in Hearing*, 21, 2331216517744675. <https://doi.org/10.1177/2331216517744675>

Cognitive changes can increase listening effort

Listening effort is finite and is expended at varying rates depending on:

- The **difficulty** of the listening task
- The individual's **motivation** to overcome listening obstacles

Listening effort should be evaluated because it can influence:

- **Motivation to comply** with treatment
- **Willingness to engage** socially



Windle, R., Dillon, H., & Heinrich, A. (2023). A review of auditory processing and cognitive change during normal ageing, and the implications for setting hearing aids for older adults. *Frontiers in Neurology*, 14, Article 1122420. <https://doi.org/10.3389/fneur.2023.1122420>

What to expect from hearing aids

Hearing aids can ...



- ... address some peripheral sensitivity loss
- ... enhance the signal-to-noise ratio (SNR)
- ... suppress distracting noise, potentially reducing listening effort
- ... reduce listening fatigue

Barriers to determining specific settings

Clinical tests may not clearly guide decisions



Cognitive tests, including verbally delivered ones, are influenced by hearing loss



Standard speech audiometry* may provide insights into overall ability



Cognitive tests and their clinical utility remains uncertain



Standard speech audiometry* is unlikely to directly inform specific hearing aid settings or preferences

*Unaided/under headphones
Windle, R., Dillon, H., & Heinrich, A. (2023). A review of auditory processing and cognitive change during normal ageing, and the implications for setting hearing aids for older adults. *Frontiers in Neurology*, 14, Article 1122420.
<https://doi.org/10.3389/fneur.2023.1122420>

Hearing aid settings and patient centered care



- Inappropriate hearing aid **settings can impact the input signal**, negatively affecting auditory processing, speech perception, listening comfort, and effort
- Particularly for older adults with **reduced auditory processing and cognitive abilities**



- Prioritize **patient-specific concerns**
- Incorporate **patient input**
- Apply **evidence-based principles** to optimize hearing aid settings



Practical guidance
for fitting older adults

What you can do in the clinic

Evidence-based principles for fitting older adults*

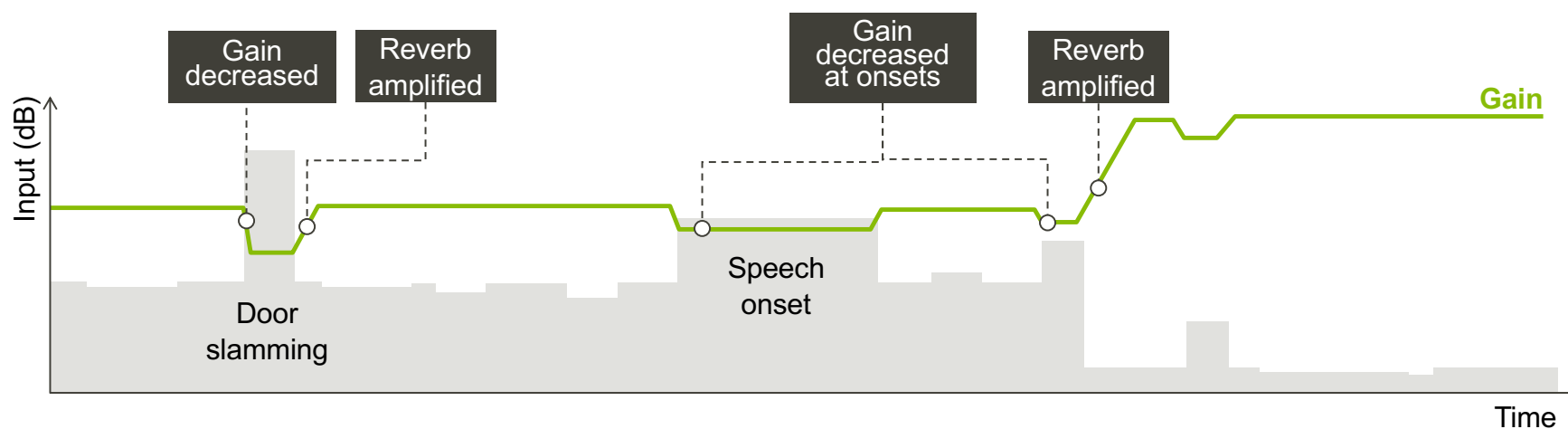
- Make speech audible with minimal distortion to the envelope
- Maintain the quiet gaps between the elements of speech



Optimize compression settings

*Windle, R., Dillon, H., & Heinrich, A. (2023). A review of auditory processing and cognitive change during normal ageing, and the implications for setting hearing aids for older adults. *Frontiers in Neurology*, 14, Article 1122420. <https://doi.org/10.3389/fneur.2023.1122420>.
**Derleth, P., Georganti, E., Latzel, M., Courtois, G., Hofbauer, M., Raether, J., & Kuehnel, V. (2021). Binaural Signal Processing in Hearing Aids. *Seminars in hearing*, 42(3), 206–223. <https://doi.org/10.1055/s-0041-1735176>

Advantages of fast-acting compression (FAC)



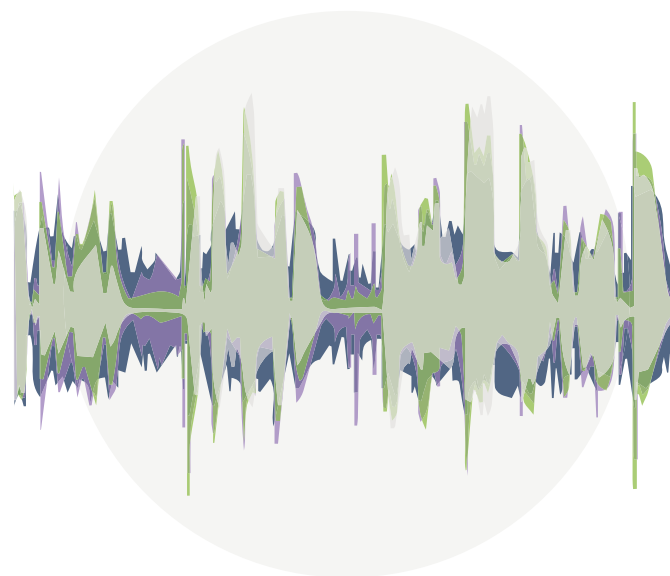
Advantages

- Preserves the audibility of speech signals*
- Improved clarity for low input levels**
- Better speech intelligibility in quiet and noise for soft inputs***

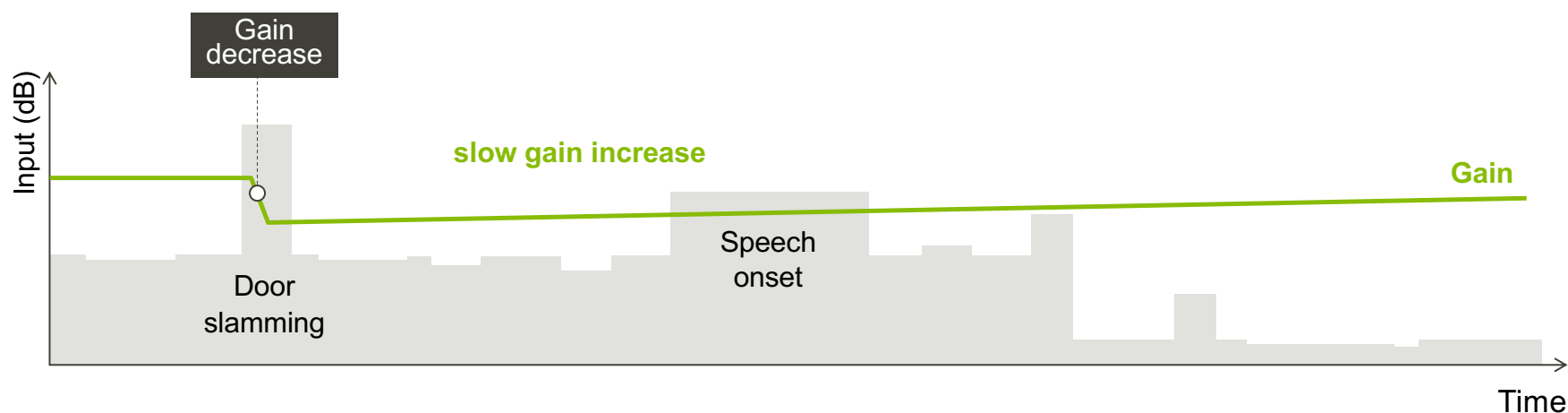
* Gatehouse, S., Naylor, G., & Elberling, C. (2006). Linear and nonlinear hearing aid fittings-1. Patterns of benefit. *International Journal of Audiology*, 45 (3), 130-152. | ** Kowalewski, B., Zaar, J., Fereczkowski, M., MacDonald, E., Strelcyk, O., May, T., & Dau, T. (2017). Effects of slow and fast-acting compression on hearing impaired listeners' consonant-vowel identification in interrupted noise. In *International Symposium on Auditory and Audiological Research*. The Danavox Jubilee Foundation. | *** Moore, B. C., Füllgrabe, C., & Stone, M. A. (2011). Determination of preferred parameters for multichannel compression using individually fitted simulated hearing aids and paired comparisons. *Ear and Hearing*, 32(5), 556-568.

Fast-acting compression may impair speech perception

- Distorting speech envelope cues
- Amplifying noise in gaps, hindering gap detection
- Reducing modulation detection, which aids in separating individual speakers
- May impair sound localization in reverberant conditions
- Increasing frequency channels in FAC reduces spectral contrast



Advantages of slow-acting compression (SAC)



Advantages

- More spatial contrast and more linear for better loudness comfort*
- Increased comfort when listening to speech**
- Slow-acting compression can do a better job of helping the brain understand speech clearly compared to fast-acting compression in noisy situations***

*Gatehouse, S., Naylor, G., & Elberling, C. (2006). Linear and nonlinear hearing aid fittings—1. Patterns of benefit. International Journal of Audiology, 45, 130-152. <https://doi.org/10.1080/14992020500429518> |

Moore, B. C., Füllgrabe, C., & Stone, M. A. (2011). Determination of preferred parameters for multichannel compression using individually fitted simulated hearing aids and paired comparisons. Ear and Hearing, 32(5), 556-568. | *Windle, R., Dillon, H., & Heinrich, A. (2023). A review of auditory processing and cognitive change during normal ageing, and the implications for setting hearing aids for older adults. Frontiers in Neurology, 14, Article 1122420. <https://doi.org/10.3389/fneur.2023.1122420>

A comparison of fitting strategies

Fast-Fast	Fast-Slow	Slow-Slow
Offered superior speech intelligibility		Provided most comfort
More benefit under ideal conditions	Preferred by users	
Benefits declined with poorer SNR and higher speech levels		
Negative correlation between cognition and speech perception	Consistent across all cognitive levels	

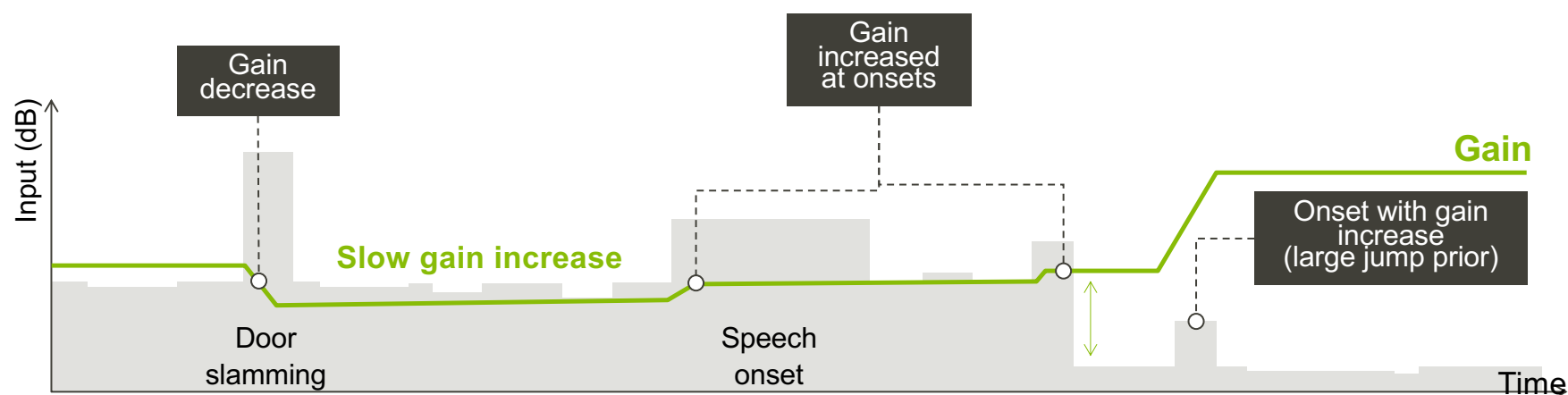
Windle, R., Dillon, H., & Heinrich, A. (2023). A review of auditory processing and cognitive change during normal ageing, and the implications for setting hearing aids for older adults. *Frontiers in Neurology*, 14, Article 1122420. <https://doi.org/10.3389/fneur.2023.1122420>

Gatehouse, S., Naylor, G., & Elberling, C. (2006). Linear and nonlinear hearing aid fittings—2. Patterns of candidature. *International Journal of Audiology*, 45, 153-171. <https://doi.org/10.1080/14992020500429484>

Gatehouse, S., Naylor, G., & Elberling, C. (2006). Linear and nonlinear hearing aid fittings—1. Patterns of benefit. *International Journal of Audiology*, 45, 130-152. <https://doi.org/10.1080/14992020500429518>

Gatehouse, S., Naylor, G., & Elberling, C. (2003). Benefits from hearing aids in relation to the interaction between the user and the environment. *International Journal of Audiology*, 42(Supplement 1), S77-S85. <https://doi.org/10.3109/14992020309074627>

Adaptive Phonak Digital 3.0 - Adaptive Compression



Advantages

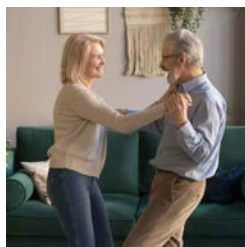
- More dynamic range*
- Reduction of perceived amount of reverberation*
- Comfort in noise**
- Comfort for impulsive loud sounds***

*Hassager, H. G., Wiinberg, A., and Dau, T. (2017a). "Effects of hearing aid dynamic range compression on spatial perception in a reverberant environment," J. Acoust. Soc. Am. 141, 2556–2568. | **Kowalewski, B., Zaar, J., Fereczkowski, M., MacDonald, E., Strelcyk, O., May, T., & Dau, T. (2017). Effects of slow-and fast-acting compression on hearing impaired listeners' consonant-vowel identification in interrupted noise. In International Symposium on Auditory and Audiological Research. The Danavox Jubilee Foundation. | ***Lopez-Poveda, E. A., Johannesen, P. T., Perez-González, P., Blanco, J. L., Kalluri, S., & Edwards, B. (2017). Predictors of hearing aid outcomes. Trends in hearing, 21, 1-28.

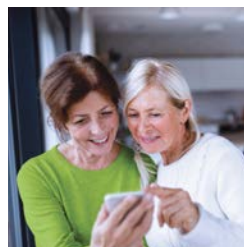
Implementation of adaptive compression



Noisy situations



Music



Media streaming



Calm situations

Adaptive

Slow

Adaptive

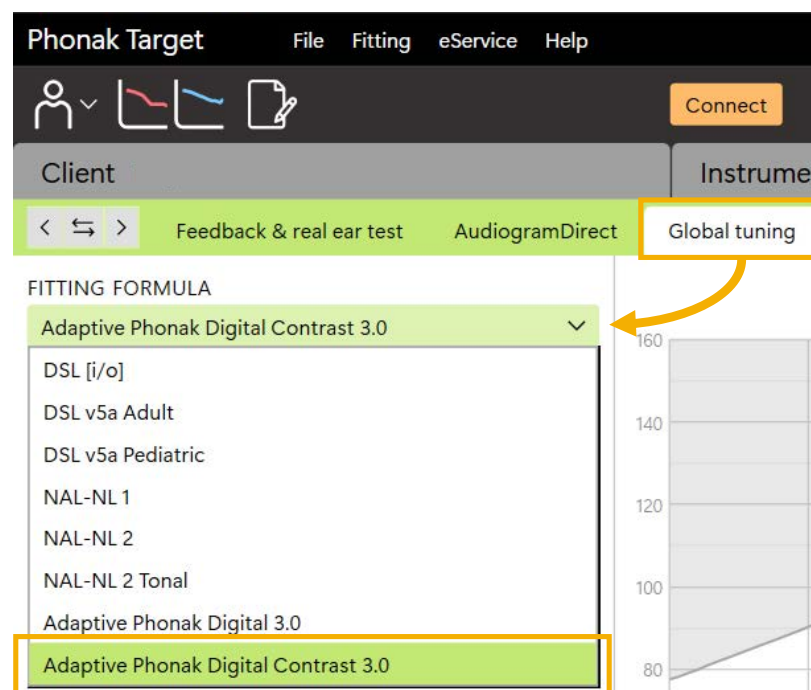
*Hassager, H. G., Wiinberg, A., and Dau, T. (2017a). "Effects of hearing aid dynamic range compression on spatial perception in a reverberant environment," J. Acoust. Soc. Am. 141, 2556–2568. | **Kowalewski, B., Zaar, J., Fereczkowski, M., MacDonald, E., Strelcyk, O., May, T., & Dau, T. (2017). Effects of slow-and fast-acting compression on hearing impaired listeners' consonant-vowel identification in interrupted noise. In International Symposium on Auditory and Audiological Research. The Danavox Jubilee Foundation. | ***Lopez-Poveda, E. A., Johannesen, P. T., Perez-González, P., Blanco, J. L., Kalluri, S., & Edwards, B. (2017). Predictors of hearing aid outcomes. Trends in hearing, 21, 1-28.

Consider APD Contrast

APD Contrast

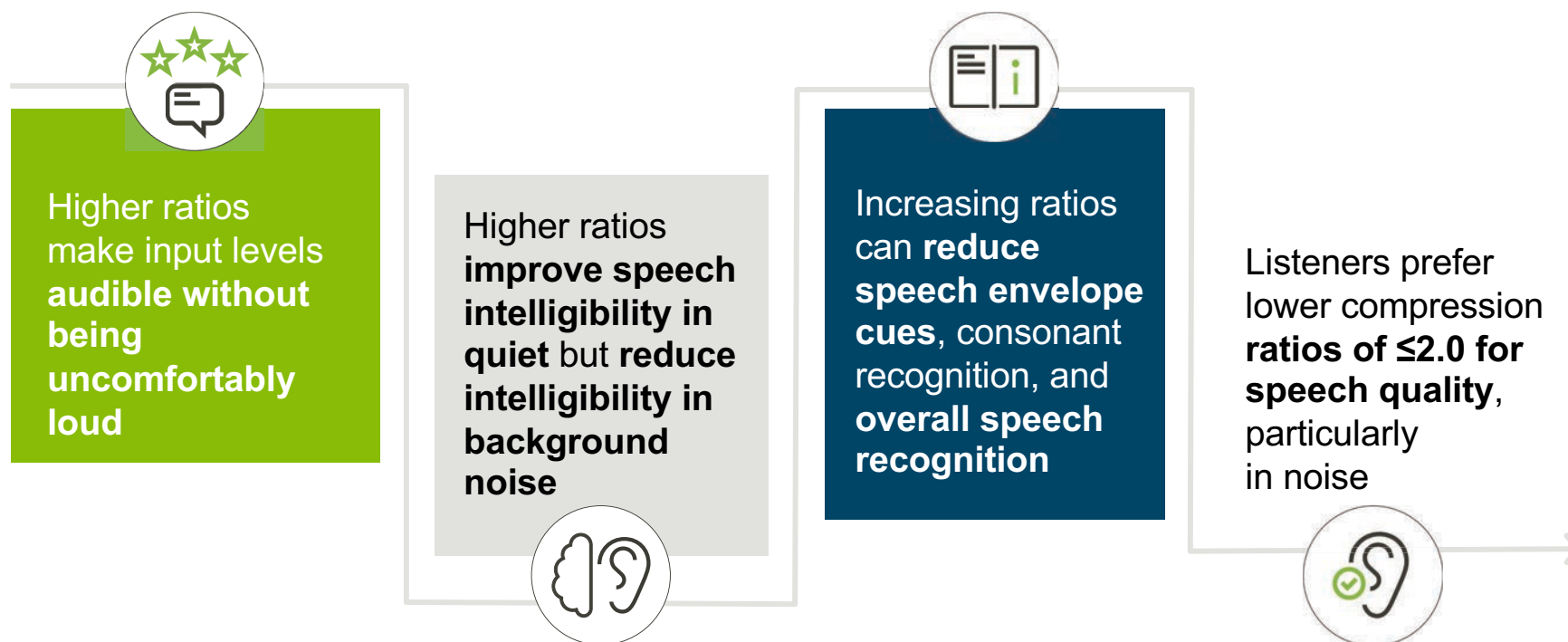
Individuals with reduced cognitive abilities perform better with Slow-acting compression in challenging listening situations.*

Global Tuning→Fitting Formula



*Windle, R., Dillon, H., & Heinrich, A. (2023). A review of auditory processing and cognitive change during normal ageing, and the implications for setting hearing aids for older adults. *Frontiers in Neurology*, 14, Article 1122420. <https://doi.org/10.3389/fneur.2023.1122420>

Compression ratios impact speech perception

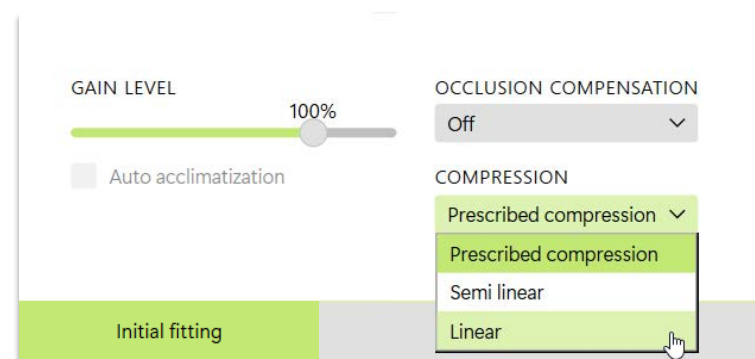


Other options for optimizing compression

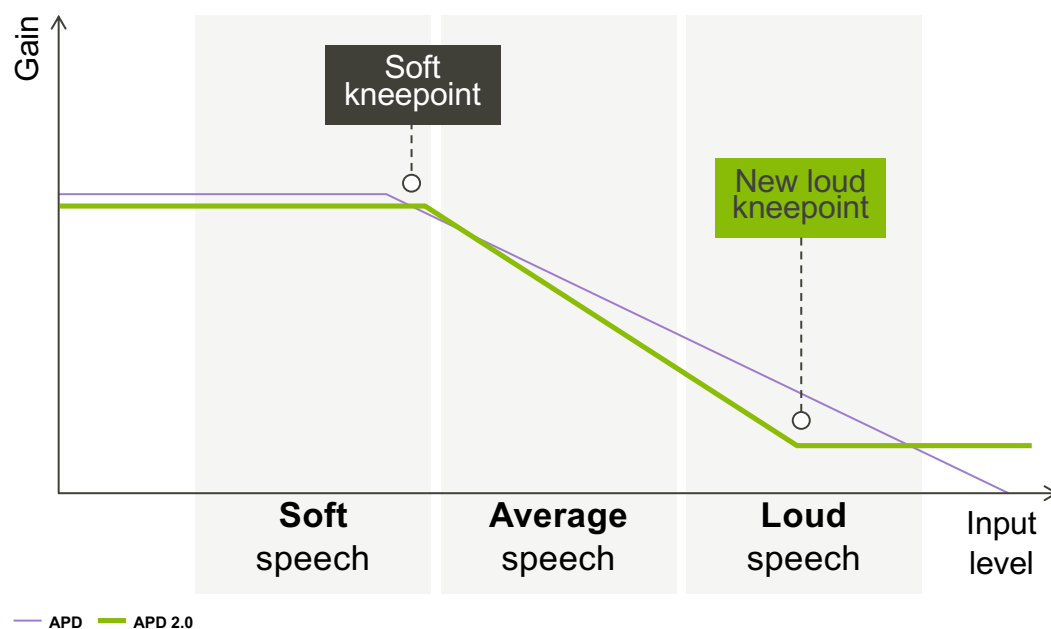
Minimize the compression ratio for fast-acting compression when possible –

- **Choose Semi-linear or Linear**
G65 for speech remains stable
G50 is reduced while G80 is increased

Global Tuning→Compression



Linearized high-level gain



Advantages

- Loudness comfort at high input levels*
- Speech intelligibility for loud speech in noise*
- More freedom to fine tune soft, mid and loud speech targets more easily



*Lopez-Poveda, E. A., Johannesen, P. T., Perez-González, P., Blanco, J. L., Kalluri, S., & Edwards, B. (2017). Predictors of hearing aid outcomes. Trends in hearing, 21, 1 – 28.

Taking compression settings into account

Use adaptive compression algorithms

- **Adaptive Phonak Digital (APD)**

Default to slow-acting compression for older adults in noisy environments

- **APD Contrast** (slow-acting in all situations)

Minimize the compression ratio

- **Choose semi-linear or linear in global tuning**



What you can do in the clinic

Evidence-based principles for fitting older adults*

- Make speech audible with minimal distortion to the envelope
- Maintain the quiet gaps between the elements of speech



Optimize compression settings

*Windle, R., Dillon, H., & Heinrich, A. (2023). A review of auditory processing and cognitive change during normal ageing, and the implications for setting hearing aids for older adults. *Frontiers in Neurology*, 14, Article 1122420. <https://doi.org/10.3389/fneur.2023.1122420>.
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What you can do in the clinic

Evidence-based principles for fitting older adults*

- Make speech audible with minimal distortion to the envelope
- Maintain the quiet gaps between the elements of speech



Optimize compression settings

- Preserve interaural timing and level differences
- Consider unilateral aiding if binaural interference is noted



Choose binaural processing** or consider unilateral aiding

*Windle, R., Dillon, H., & Heinrich, A. (2023). A review of auditory processing and cognitive change during normal ageing, and the implications for setting hearing aids for older adults. *Frontiers in Neurology*, 14, Article 1122420. <https://doi.org/10.3389/fneur.2023.1122420>.
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Benefits of binaural processing in hearing aids

Binaural processing can help integrate sound level and timing cues to form a unified spatial representation of sound

- Enhancing the ability to **distinguish a target voice** from background noise
- **Improving SNR** by reducing the impact of masking sounds
- **Reducing the cognitive effort** required for auditory focus and sound separation



Sometimes two ears may not be better than one

Some older adults may experience binaural interference and not adapt to binaural hearing aid use

To evaluate if performance is better by aiding only one ear, you can measure speech intelligibility in noise and listening comfort in 3 configurations*:

- Binaural
- Left monaural and
- Right monaural

Test in the sound field with speech at 0 degrees and noise at 180 degrees using (for example): the Hearing in noise test (HINT) or the Connected sentences test (CST)**



*Windle, R., Dillon, H., & Heinrich, A. (2023). A review of auditory processing and cognitive change during normal ageing, and the implications for setting hearing aids for older adults. *Frontiers in Neurology*, 14, Article 1122420. <https://doi.org/10.3389/fneur.2023.1122420> | **Mussol, B. S. S., & Bentler, R. A. (2017). Binaural Interference and the Effects of Age and Hearing Loss. *Journal of the American Academy of Audiology*, 28(1), 5–13. <https://doi.org/10.3766/jaaa.15011>



What you can do in the clinic

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Optimize compression settings

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Choose binaural processing** or consider unilateral aiding

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What you can do in the clinic

Evidence-based principles for fitting older adults*

- Make speech audible with minimal distortion to the envelope
- Maintain the quiet gaps between the elements of speech



Optimize compression settings

-
- Preserve interaural timing and level differences
 - Consider unilateral aiding if binaural interference is noted



Choose binaural processing** or consider unilateral aiding

-
- Use directionality to improve SNR
 - Use noise reduction settings to minimize cognitive load and listening effort



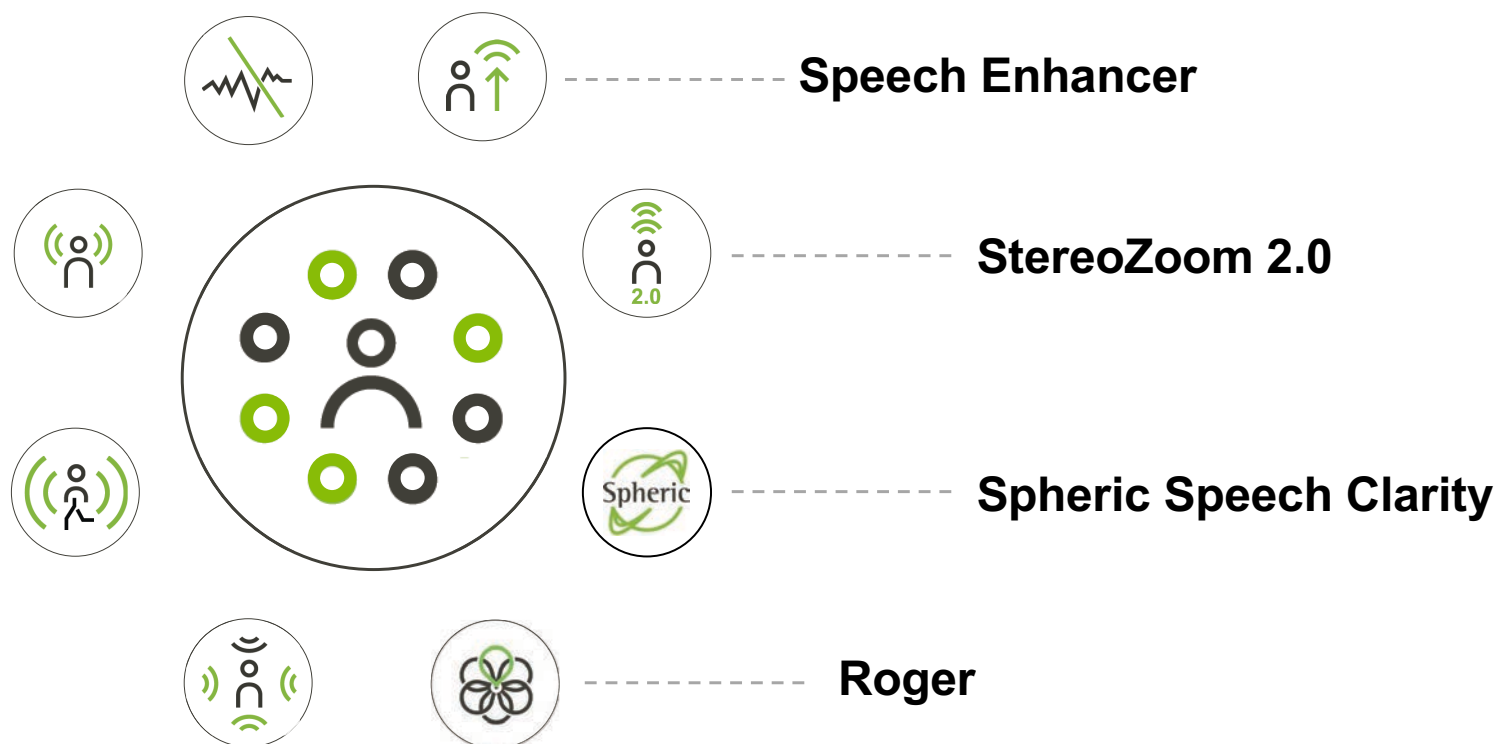
Use noise management and advanced features to improve SNR

*Windle, R., Dillon, H., & Heinrich, A. (2023). A review of auditory processing and cognitive change during normal ageing, and the implications for setting hearing aids for older adults. *Frontiers in Neurology*, 14, Article 1122420. <https://doi.org/10.3389/fneur.2023.1122420>. | **Derleth, P., Georganti, E., Latzel, M., Courtois, G., Hofbauer, M., Raether, J., & Kuehnel, V. (2021). Binaural Signal Processing in Hearing Aids. *Seminars in hearing*, 42(3), 206–223. <https://doi.org/10.1055/s-0041-1735176>



Phonak SmartSpeech™ Technology

A collection of features that are **adaptively activated in a seamless way** with the goal of improved **speech understanding** and **reduced listening effort** in many listening environments.



Speech Enhancer leads to ...



... less listening effort*

34%

less listening effort with
speech **from a distance**

45%

less effort when listening
to someone speak **from
another room**



... less fatigue**

21%

less fatigue at the end
of the day



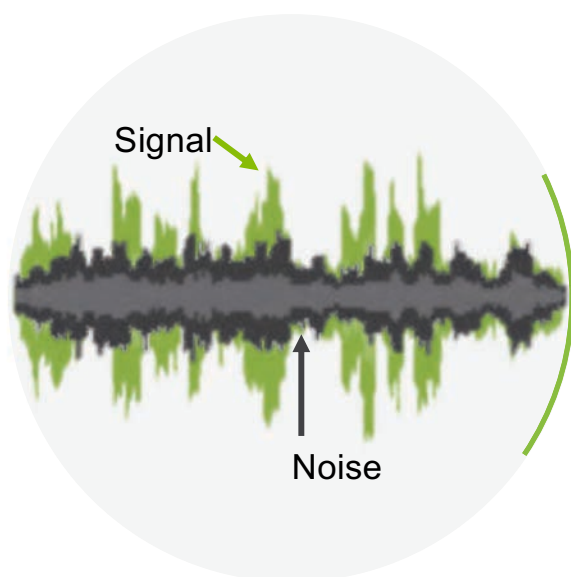
Improved **memory
and comprehension**
performance

Speech Enhancer on versus off

*Latzel, M, Heeren, J & Lesimple, C. (2024). "Speech Enhancer reduces listening effort and fatigue." Phonak Field Study News. Retrieved from www.phonak.com/evidence

**Habicht, J. & Schuepbach-Wolf, M. (2024). Speech Enhancer reduces subjective listening effort of speech by up to 45%. Phonak Field Study News. Retrieved from www.phonak.com/evidence

Every dB counts when it comes to SNR improvement



8% to 10% improvement in word recognition
per 1 dB of Signal to Noise Ratio (SNR)*

For **every 10 dB of hearing loss**, a wearer
requires an **additional 1 – 3 dB** of SNR to
maintain their unaided intelligibility**

*Taylor, B., & Mueller, G. (2017). Fitting and dispensing hearing aids (2nd ed.). Plural Publishing.

**Dillon, H. (2012). Hearing aids (2nd ed.). Thieme Publishers

Benefits of directional microphone technology



**26% better speech
understanding^{*|**}**

^{*}Compared to unaided, moderate to severe hearing loss

^{**}Woodward, J. & Latzel, M. (2022). New implementation of directional beamforming configurations show improved speech understanding and reduced listening effort. Phonak Field Study retrieved from www.phonak.com/evidence

Hear more conversation with StereoZoom 2.0 and Speech Sensor

3 dB better signal-to-noise ratio when **speech is coming from the front** in challenging environments*

3.4 dB better SNR with fixed directional when **speech is from the side****

Additional **2.5 dB better** signal-to-noise ratio at maximum strength compared to default

2.5 dB better SNR with Real-Ear Sound when **speech is from behind**

More access to sound not only provides clarity but reduces listening effort**

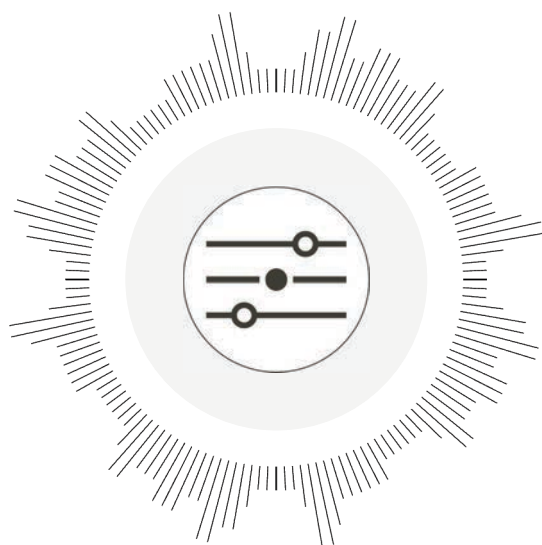
*Compared to Real-Ear Sound with power dome

**with power dome.

Woodward, J., Kühnel, V., & Latzel, M. (2022). *Innovative speech understanding solutions: Lumity with Phonak SmartSpeech™ Technology*. Phonak. Retrieved from www.Phonak.com

***Pichora-Fuller, M.K., & Singh, G. (2006). Effects of Age on Auditory and Cognitive Processing: Implications for Hearing Aid Fitting and Audiologic Rehabilitation. *Trends in Amplification*, 10(1), 29–59. <https://doi.org/10.1177/108471380601000103>

Moderate noise reduction improves listening comfort



Noise reduction algorithms **enhance listening comfort and sound quality** but **do not improve speech intelligibility**

Strong noise may hinder those with lower cognitive or working memory abilities

Noise reduction **strength and speed** (fast or slow-acting) can disrupt speech signals

Moderate noise reduction **improves listening comfort without significantly affecting speech intelligibility**

Introducing DEEPSONIC

Available exclusively in Audéo Sphere Infinio

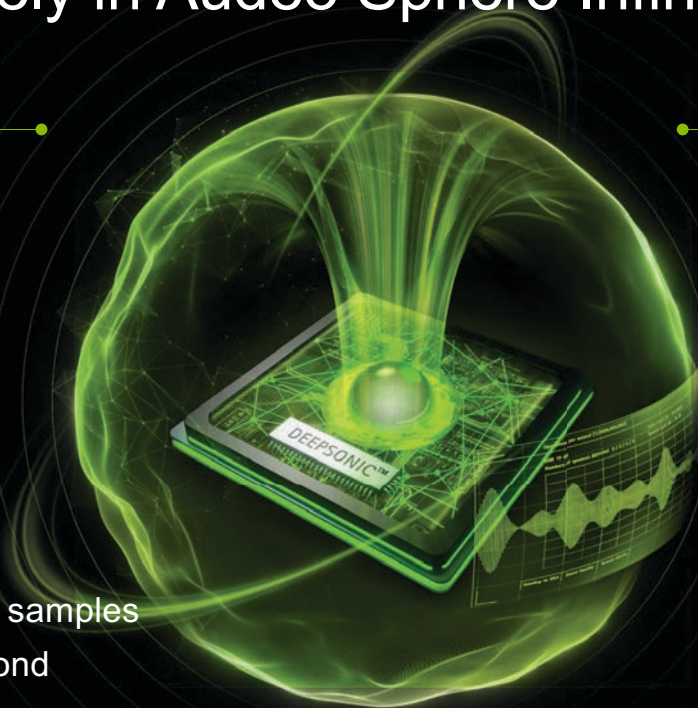
A dedicated real-time AI/Deep Neural Network (AI/DNN) DEEPSONIC chip

4.5 million Neural connections

- 53x more processing power compared to current industry chip technology*
- Trained with 22 million sound samples
- 7.7 billion operations per second

Spheric Speech Clarity – expands the access to speech to any direction.

Significantly reduced listening effort in a challenging environment with Spheric Speech Clarity.**

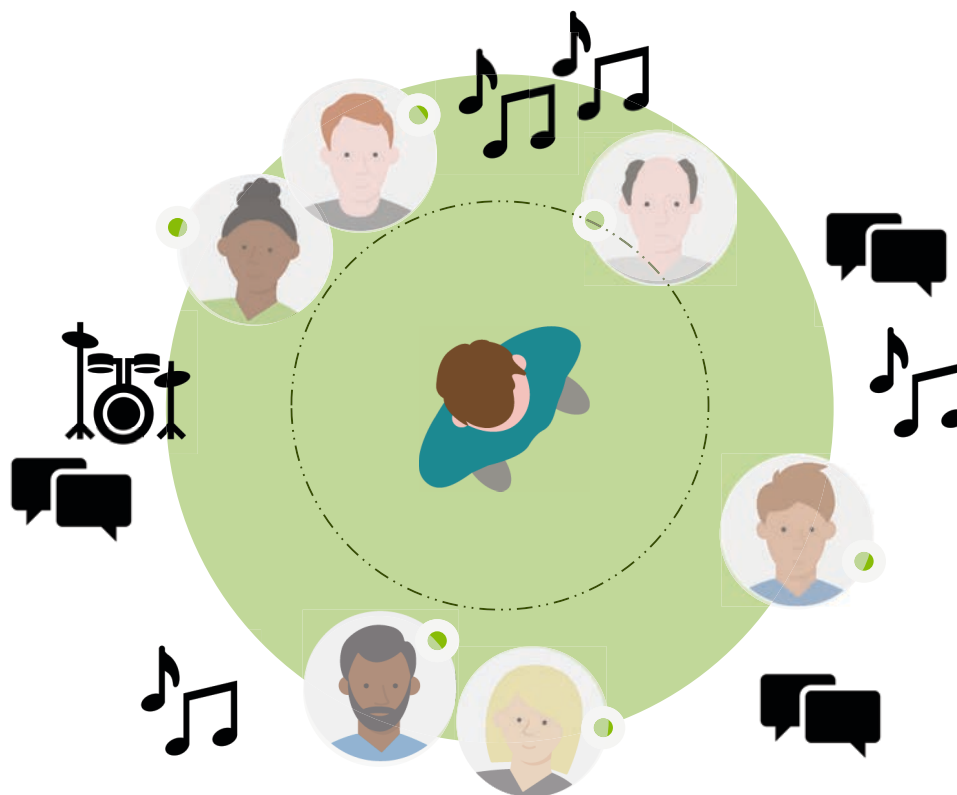


*At time of launch

**Wright, A., et al Spheric Speech Clarity applies DNN signal processing to significantly improve speech understanding from any direction and reduce the listening effort. Phonak Field Study News. Retrieved from <https://www.phonak.com/evidence>

Spheric Speech Clarity

Spheric Speech Clarity **extracts, enhances** and **integrates** speech in real-time for unmatched hearing from any direction, in any situation.



Spheric Speech Clarity

Spheric Speech Clarity **extracts, enhances** and **integrates** speech in real-time for unmatched hearing from any direction, in any situation.



Audéo Sphere is the industry leader in sound cleaning

Audéo Sphere vs
Brand A

+2.6 dB SNR

Audéo Sphere vs
Brand B

+3.6 dB...

Audéo Sphere vs
Brand C

+ 3.7 dB SNR

up to
3.7 dB
more SNR
benefit

Being in the moment was never this easy

10 dB
SNR

SNR benefit*;
up to 3.7 dB
more than other
brands

2X
more
likely...

... to hear and
understand
every word in
any direction**

Up to
36.7%

Increase in speech
understanding
compared to two
other brands'
devices**



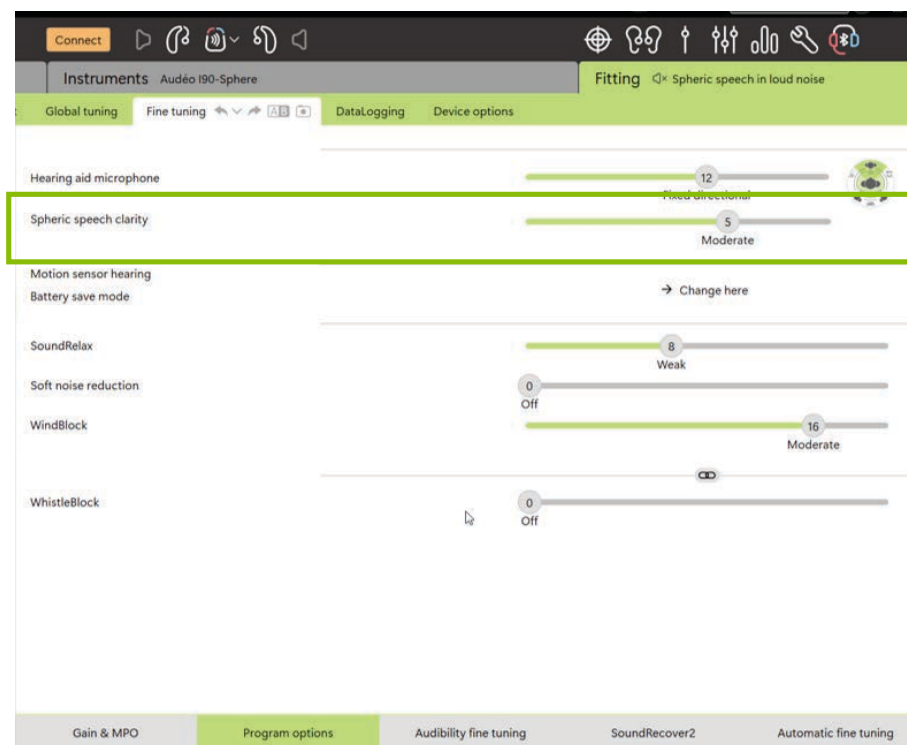
*compared to omni;

*Raufer, S., Kohlhauser, P., Jehle, F., Kühnel, V., Preuss, M., Hobi, S. (2024). Spheric Speech Clarity proven to outperform three key competitors for clear speech in noise. Phonak Field Study News. www.phonak.com/evidence

**Wright, A., et al "Spheric Speech Clarity applies DNN signal processing to significantly improve speech understanding from any direction and reduce the listening effort". Phonak Field Study News. www.phonak.com/evidence

Set noise reduction to moderate

Moderate noise reduction **improves listening comfort without significantly affecting speech intelligibility**

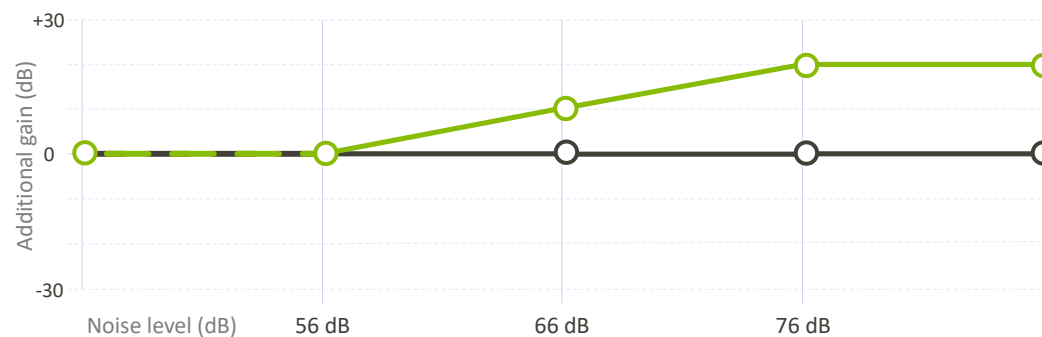


Windle, R., Dillon, H., & Heinrich, A. (2023). A review of auditory processing and cognitive change during normal ageing, and the implications for setting hearing aids for older adults. *Frontiers in Neurology*, 14, Article 1122420. <https://doi.org/10.3389/fneur.2023.1122420>

Roger for proven performance



Adaptive Gain provides
proven SNR improvement





What you can do in the clinic

Evidence-based principles for fitting older adults*

- Make speech audible with minimal distortion to the envelope
- Maintain the quiet gaps between the elements of speech



Optimize compression settings

-
- Preserve interaural timing and level differences
 - Consider unilateral aiding if binaural interference is noted



Choose binaural processing** or consider unilateral aiding

-
- Use directionality to improve SNR
 - Use noise reduction settings to minimize cognitive load and listening effort



Use noise management and advanced features to improve SNR

*Windle, R., Dillon, H., & Heinrich, A. (2023). A review of auditory processing and cognitive change during normal ageing, and the implications for setting hearing aids for older adults. *Frontiers in Neurology*, 14, Article 1122420. <https://doi.org/10.3389/fneur.2023.1122420>. | **Derleth, P., Georganti, E., Latzel, M., Courtois, G., Hofbauer, M., Raether, J., & Kuehnel, V. (2021). Binaural Signal Processing in Hearing Aids. *Seminars in hearing*, 42(3), 206–223. <https://doi.org/10.1055/s-0041-1735176>

In summary

- Older adults experience **changes in auditory processing and cognitive abilities**
- These changes can **impact listening effort and motivation** to use hearing aids successfully
- **Evidence-based guidance** is available to help you optimize hearing aids for older adults
- The Lumity and Infinio families from **Phonak** offer **key technologies** to support older adults with **improved SNR and reduced listening effort**



Moving forward with confidence: **Phonak.com/cognition**



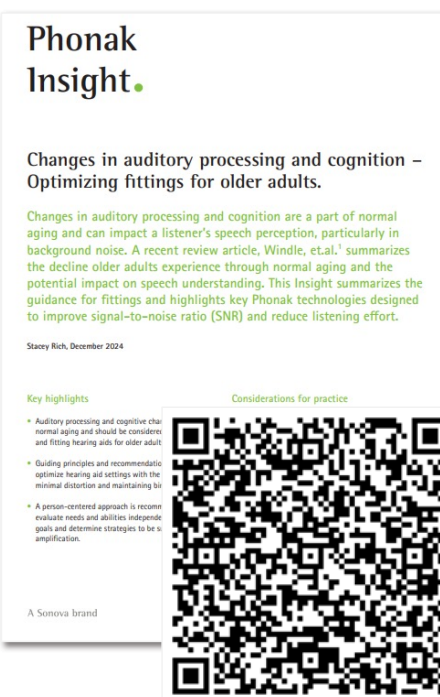
Brochures

028-2577-03 English
028-2623-42 Spanish



Kit Cognition

041-2790-03





Together,
we change lives.

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