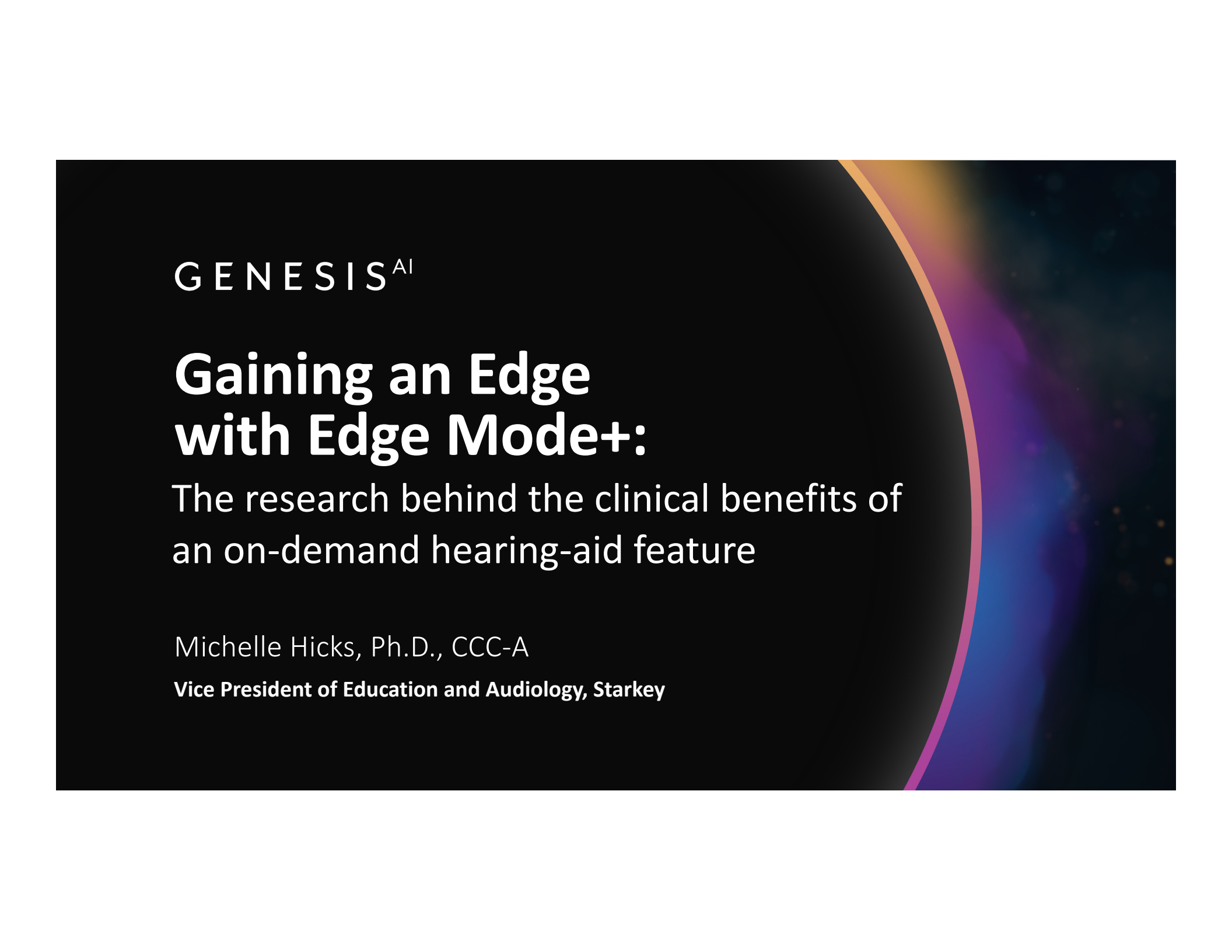




GENESIS^{AI}

Gaining an Edge with Edge Mode+:

The research behind the clinical benefits of
an on-demand hearing-aid feature

Michelle Hicks, Ph.D., CCC-A

Vice President of Education and Audiology, Starkey

Webinar FAQs

Gaining an Edge with Edge Mode+: The research behind the clinical benefits of an on-demand hearing aid feature in Genesis AI

Michelle Hicks, Ph.D.

How to Ask a Question:

- Click Q & A, type your question, and Send

Resources Tab:

- Download the course handout
- Link to course information page
- View presenter information

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- Use the Q&A window

Learner Outcomes

Upon completion of this course,
participants will be able to:

1

Describe one research outcome that demonstrates how hearing aids can contribute to reduced listening effort

2

List two evidenced-based patient benefits of Edge Mode+

3

List two of the three patient demographics demonstrated to show greater benefit of Edge Mode+

GENESIS^{AI}

StarLink Charger 2.0

StarLink
Accessories



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Available with all 2.4GHz styles and technology tiers
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MyStarkey

Hearing

Hear better with less effort
in any situation

- Volume and Program adjustments
- Edge Mode+
- Enhanced customization
- Mute
- Find My Hearing Aid
- Battery and connection status
- Tinnitus
- CROS Support
- Self Check
- Accessory and Streaming Support

Health

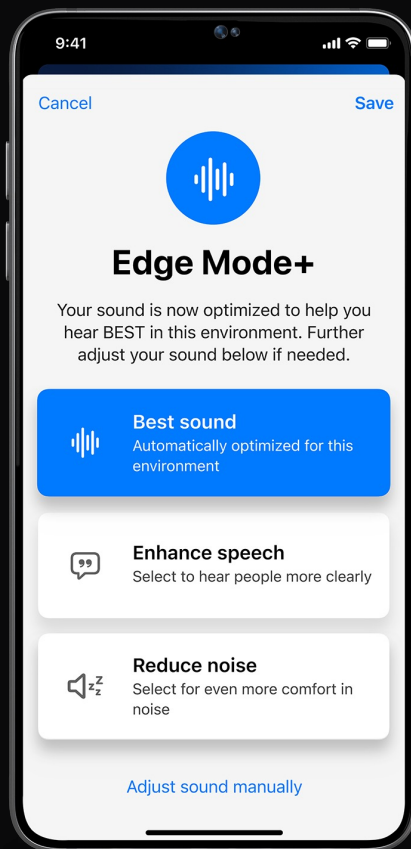
Live healthier, track activity,
and detect falls

- Activity Monitoring with double the classifications
 - Walking
 - Running
 - Indoor biking
 - Aerobics
- Hearing data
- Activity and Hearing Insights
- Fall Alert
- Caregiver data sharing

Intelligent

Simplify daily life with
assistive features

- Onboarding intros for features
- Learn
- Robust and personalized user guide
- Voice Assistant
- TeleHear
- Field firmware updates
- Reminders
- Translate
- Transcribe
- Find My Phone



Edge Mode+

With the goal of helping users in difficult listening situations, an **on-demand** processing feature was designed for Genesis AI

Edge Mode+ allows the patient to identify their listening intent (Enhance Speech or Reduce Noise) and optimize hearing aid features for preferred patient outcomes.

EXCLUSIVE
24 & 20
TECHNOLOGY

Understanding speech in difficult listening environments remains a challenge for hearing-aid users

Picou EM. Hearing Aid Benefit and Satisfaction Results from the MarkeTrak 2022 Survey: Importance of Features and Hearing Care Professionals. Semin Hear. 2022 Dec 1;43(4):301-316.

Percent of hearing aid owners satisfied with ability to hear in each listening situation	%
1:1 conversation	83%
Workplace	82%
Small group conversation	78%
Outdoors	77%
Shopping	77%
Car	76%
Large group conversation	72%
Conversation in noise	72%
Large lecture hall	72%
Classroom	70%

Hearing Aid Satisfaction

85%

Satisfaction with *physical aspects* of hearing aids
(fit, comfort, size, appearance, reliability, etc.)

81%

Satisfaction with *sound quality* of hearing aids
(noise reduction, naturalness, clarity, feedback, etc.)

Least satisfied with noise reduction capability (77%)

Most modern hearing aids use an acoustic environmental classification feature to identify and classify the current listening environment, and automatically apply environment-specific changes to gain, microphone, compression, and noise reduction settings.



But how does the classifier know what the listener **wants** to hear?



Edge Mode+

When activated by the user, the hearing aid classifies the listening environment and applies specialized changes to the hearing aid features **beyond** that available in default hearing aid settings and based on the **listener's intent**.



Edge Mode+

These classification and adaptation schemes were derived via machine learning and the use of a **Deep Neural Network (DNN)** accelerator engine, in which models were trained on a large number of real-life sound recordings and refined via input from both clinicians and listeners.

Edge Mode+

Study 1

Benefits of Edge Mode+ on
Speech Understanding in Noise

Study 2

Benefits of Edge Mode+
on Listening Effort

Study 3

Individual differences for
Edge Mode+ benefit

Speech Understanding in Noise

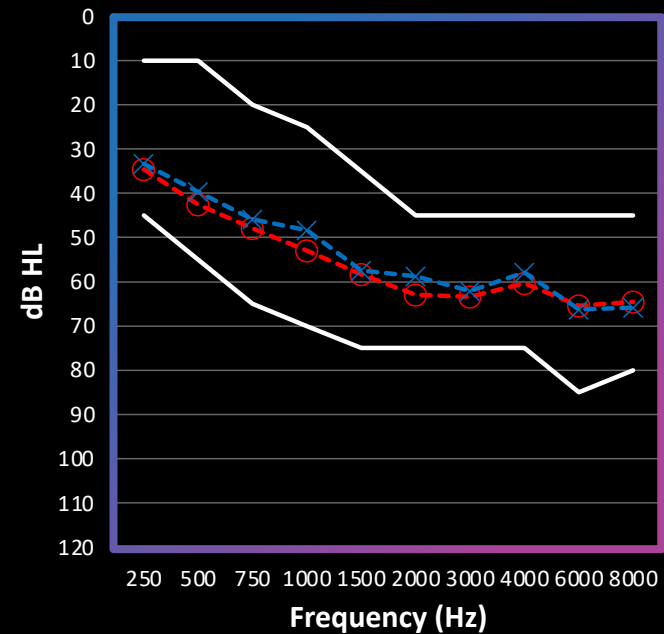
Participants

- 12 Experienced hearing aid users
- 5 females, 7 males
- 42-84 years (mean 71.1 years)

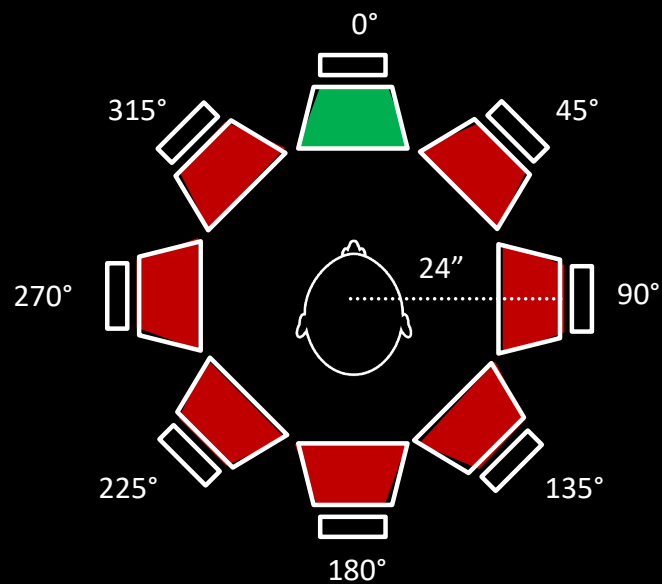
Hearing Aid Fitting

- Starkey Genesis AI 24 RIC Devices
- Audiometrically appropriate coupling
- e-STAT 2.0 Fitting Formula

Mean and Range of Audiometric Thresholds



Speech Understanding in Noise



Conditions

- Default Hearing Aid Processing
- Edge Mode+ Enhance Speech

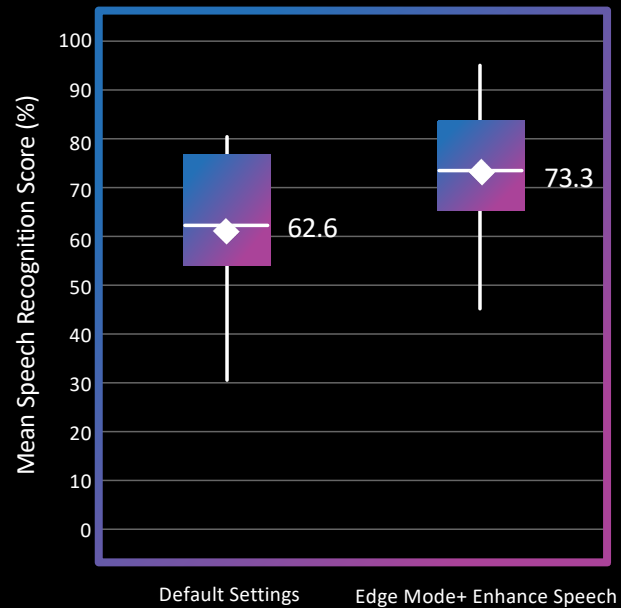
Speech

- IEEE Sentences
- Presented at individualized level to achieve ~70% speech understanding with default hearing aid processing

Noise

- Restaurant Noise at 63 dB A

Speech Understanding in Noise



Speech Recognition performance in percent correct was converted to rationalized arcsine units (RAU) for analysis.

Edge Mode+ resulted in **significantly better speech recognition in noise** than default hearing aid settings

($t(11) = 2.55$, $p=0.027$)

Edge Mode+

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Edge Mode+ benefit

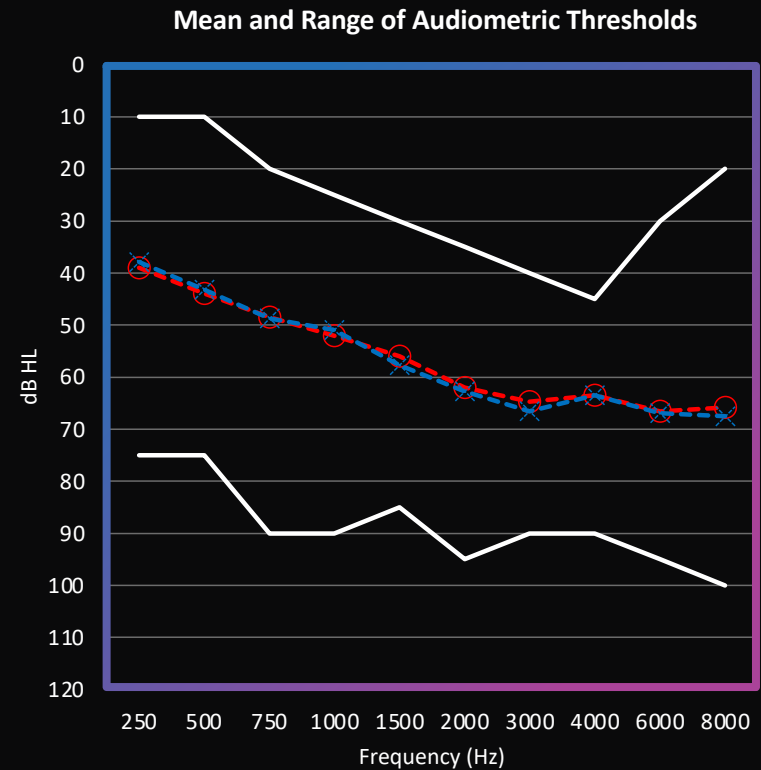
Listening Effort

Participants

- 20 Experienced hearing aid users
- 5 females, 15 males
- 42-84 years (mean 71.2 years)

Hearing Aid Fitting

- Starkey Genesis AI 24 RIC Devices
- Audiometrically appropriate coupling
- e-STAT 2.0 Fitting Formula



Listening Effort

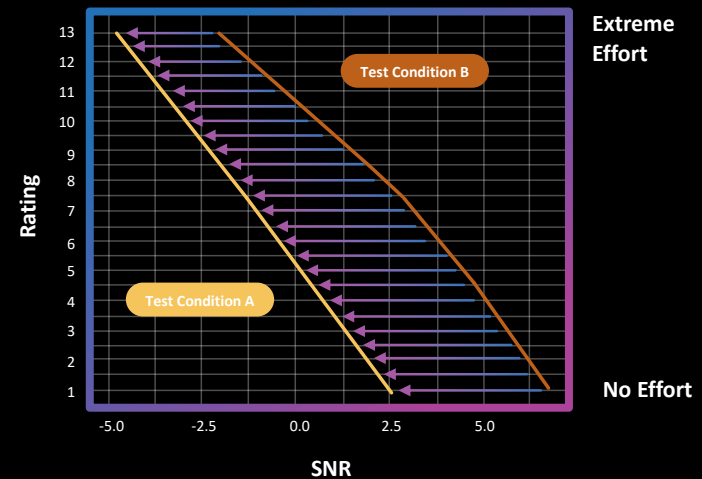
Conditions

- Default Hearing Aid Processing
- Edge Mode+ Enhance Speech

Task

- Adaptive Categorical Listening Effort Scale (ACALES)
- Speech: English Matrix Test
- Noise: Modulated Noise (ICRA250)
- Rate Listening Effort across a range of SNR values (fixed noise level).

Example ACALES data

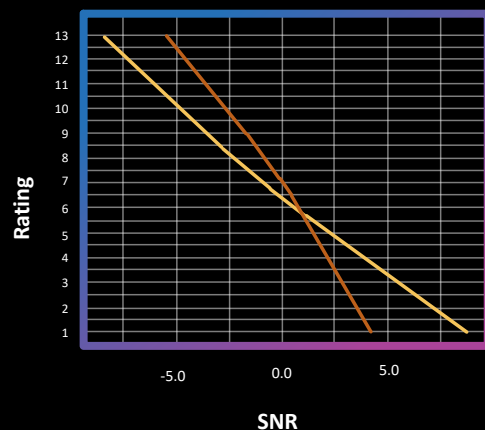


$$\text{mean SNR benefit} = \frac{\sum_{i=1}^n (\text{SNR}_{\text{Test } Ai} - \text{SNR}_{\text{Test } Bi})}{n}$$

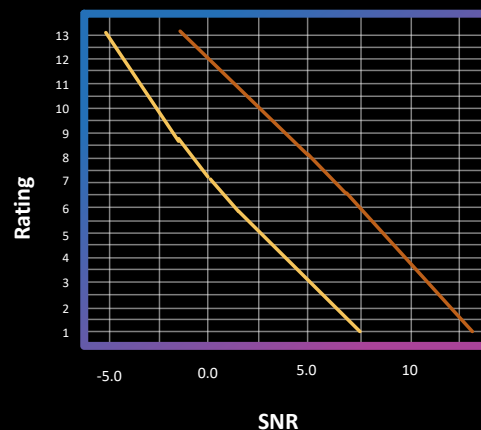
Krueger M, Schulte M, Brand T, Holube I. Development of an adaptive scaling method for subjective listening effort. J Acoust Soc Am. 2017 Jun;141(6):4680.

Participant	Left Threshold (dB HL)				Right Threshold (dB HL)				Word Recognition (%)	
	0.5k	1k	2k	4k	0.5k	1k	2k	4k	Left	Right
#1	50	50	65	65	50	50	60	65	82	78
#2	55	60	70	75	55	70	60	55	84	78

Participant #1



Participant #2



CONDITIONS

— = EDGE MODE+
— = DEFAULT SETTINGS

Listening Effort

Mean SNR benefit increased by 1.13 dB*, indicating that **Edge Mode+** can **improve (reduce) listening effort**.

*($t(19) = 2.08, p=0.05$)

Individual mean SNR benefit values varied greatly even for those with similar hearing losses.

Thus, as an on-demand feature, **Edge Mode+** can provide significant benefit for those patients that need additional assistance in noisy or difficult situations.

Edge Mode+

Study 1

Benefits of Edge Mode+ on
Speech Understanding in Noise

Study 2

Benefits of Edge Mode+
on Listening Effort

Study 3

Individual Differences for
Edge Mode+ Benefit

Individual Differences

Participants

- 20 Experienced hearing aid users
- 10 females, 10 males

Hearing Aid Fitting

- Starkey Genesis AI 24 RIC Devices
- Audiometrically appropriate coupling
- e-STAT 2.0 Fitting Formula

	Mean (Standard Deviation)	Range
Age	70.7 years (10.5 years)	42 to 85 years
Four-frequency pure tone average (PTA) of poorer ear (500, 1000, 2000, 4000 Hz)	43.0 dB (14.5 dB)	11.7 to 61.7 dB
Revised Hearing Handicap Inventory (RHHI) score Maximum possible score: 72 points	22.1 points (12.4 points)	0 to 48 points

Individual Differences

Conditions

- Default Hearing Aid Processing
- Edge Mode+ Enhance Speech

Outcome Measure 1: Speech Understanding in Noise

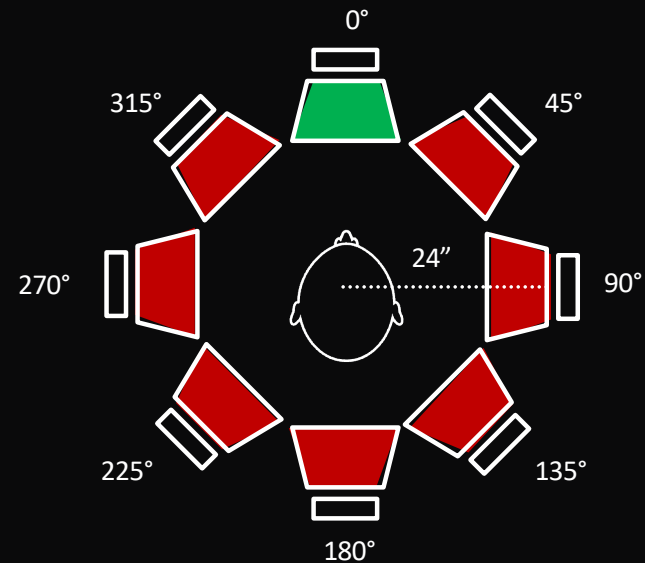
- IEEE Sentences in Restaurant Babble Noise

Outcome Measure 2: Perceived Task Demand

- Subjective effort rating scale based on NASA-Task Load Index (TLX)¹

Outcome Measure 3: Vocal Reaction Time

- Time between offset of the stimulus and the onset of the participant's response

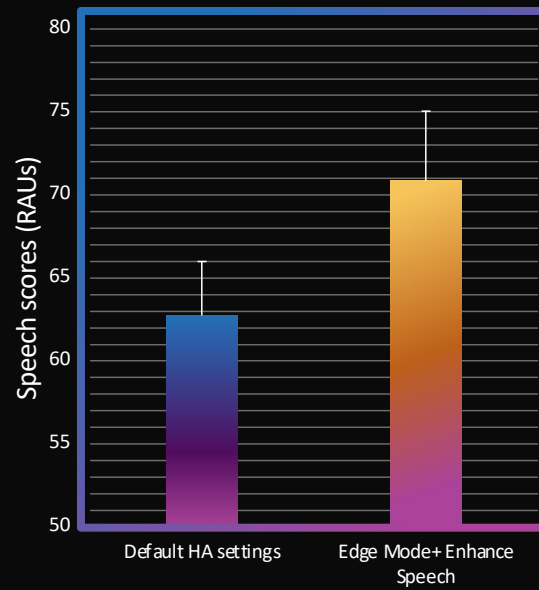


“How Mentally Demanding was the Speech Task?”

0 = “Not at all” 100 = “Extremely”

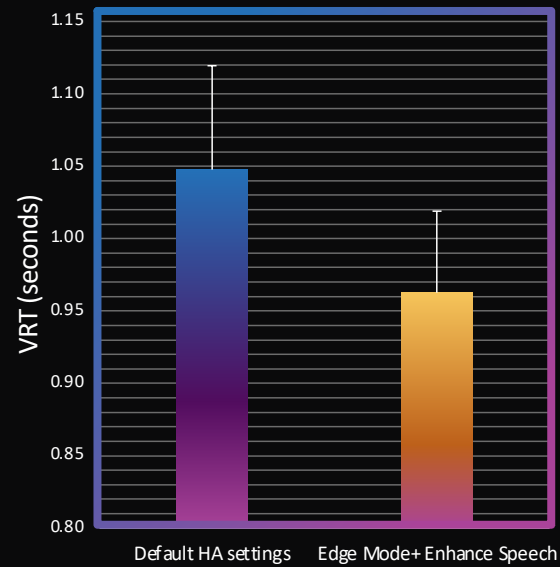
¹Hart, S. G., & Staveland, L. E. (1988). Development of NASA-TLX (Task Load Index): Results of Empirical and Theoretical Research. In P. A. Hancock & N. Meshkati (Eds.), *Advances in Psychology* (Vol. 52, pp. 139-183). North-Holland.

Speech scores improved
with Edge Mode+



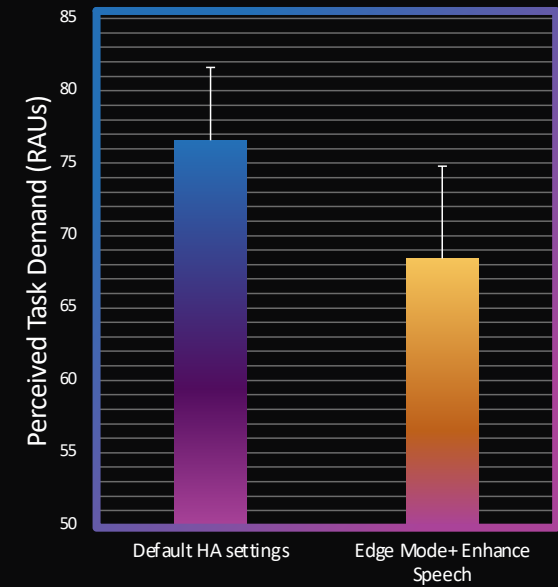
* $t(19)=2.55, p=0.02$

Vocal Reaction Times decreased
with Edge Mode+



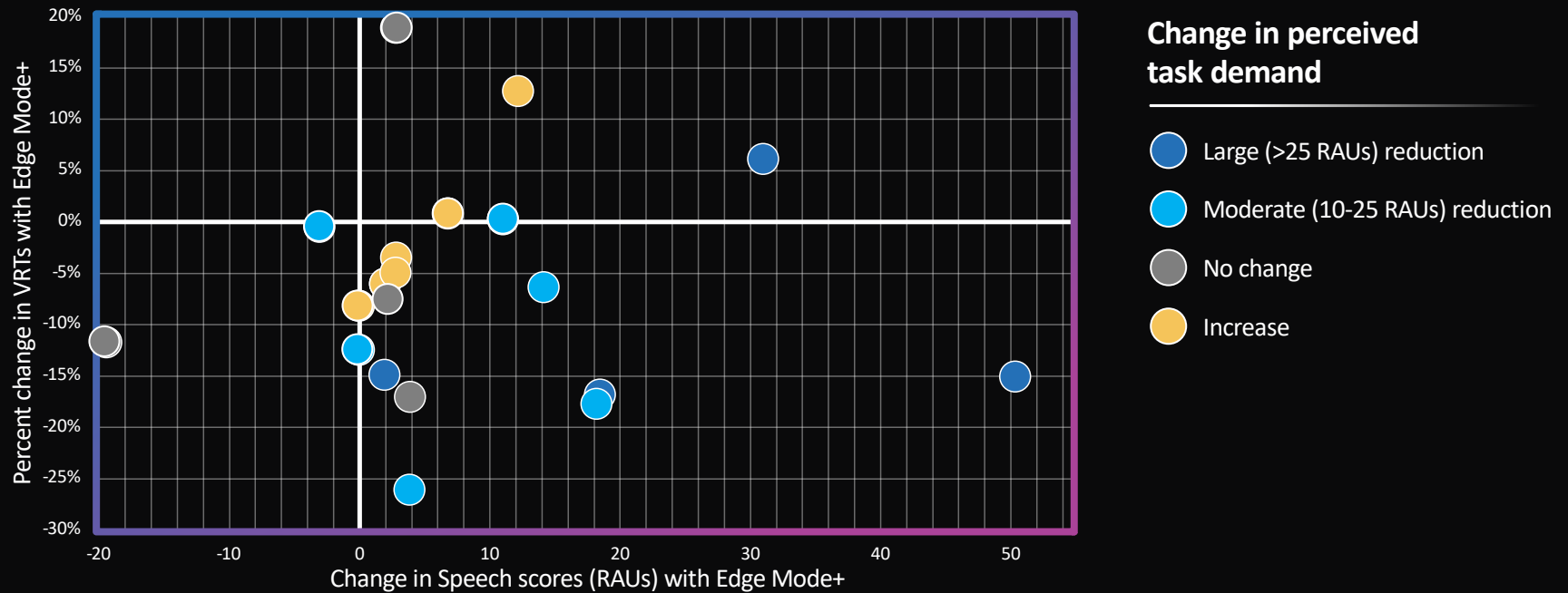
* $t(19)=2.92, p=0.009$

Perceived Task Demand decreased
with Edge Mode+

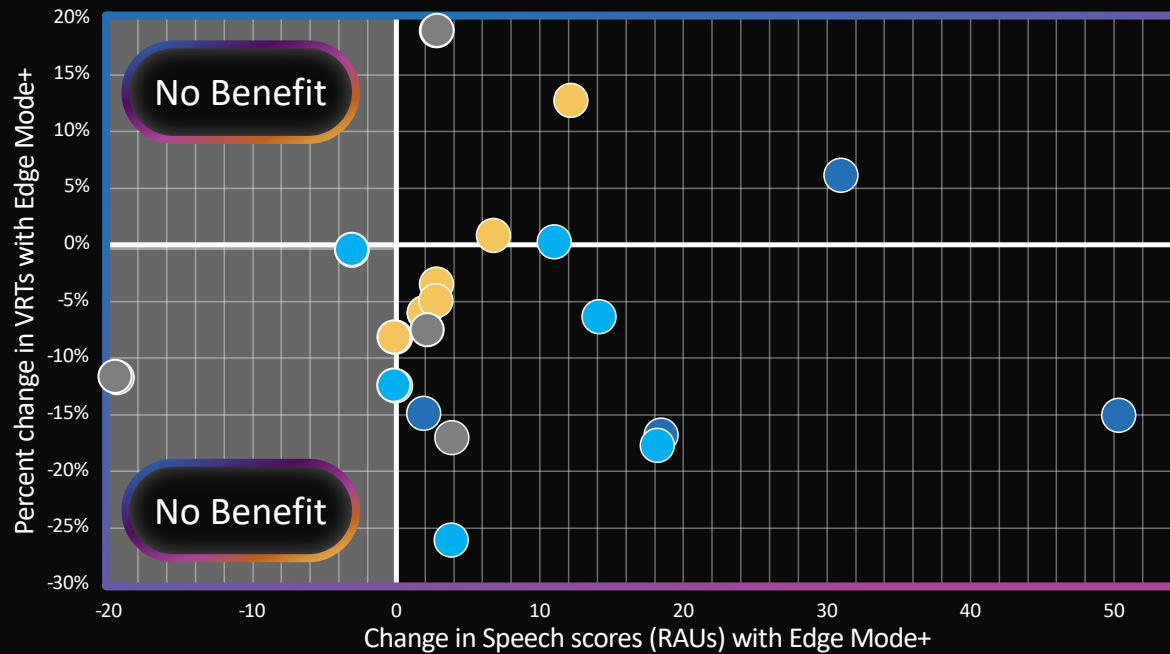


Not Significant
 $t(19)=1.58, p=0.13$

Individual Differences



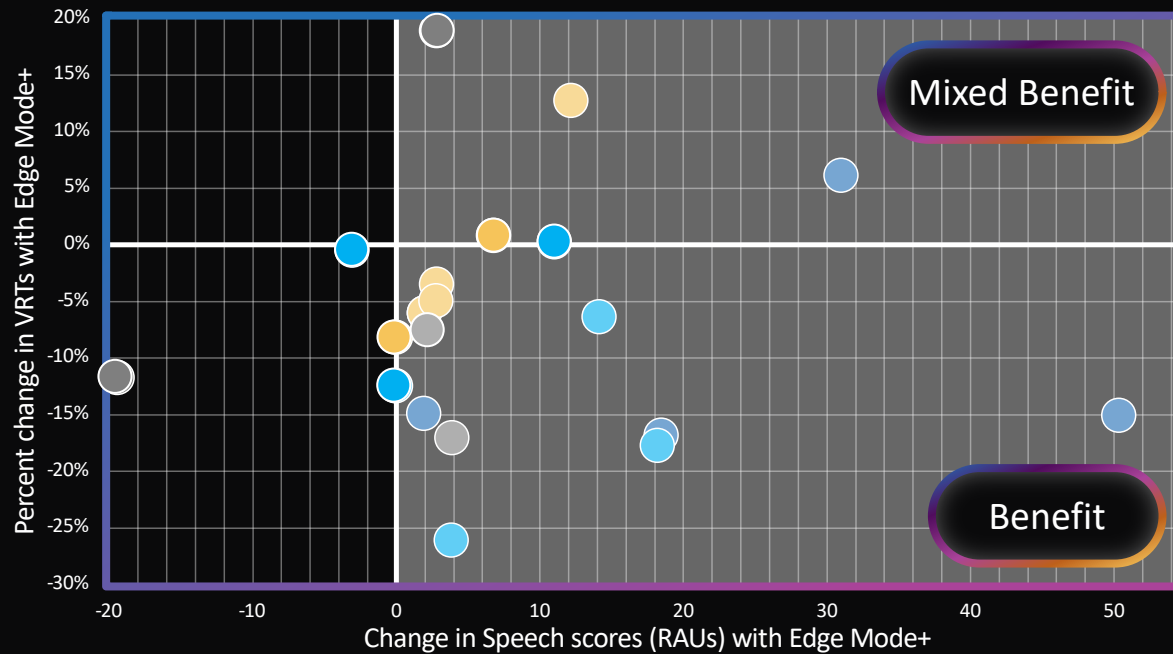
Individual Differences



Change in perceived task demand

- Large (>25 RAUs) reduction
- Moderate (10-25 RAUs) reduction
- No change
- Increase

Individual Differences

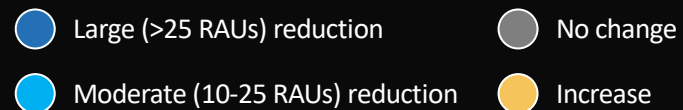


Change in perceived task demand

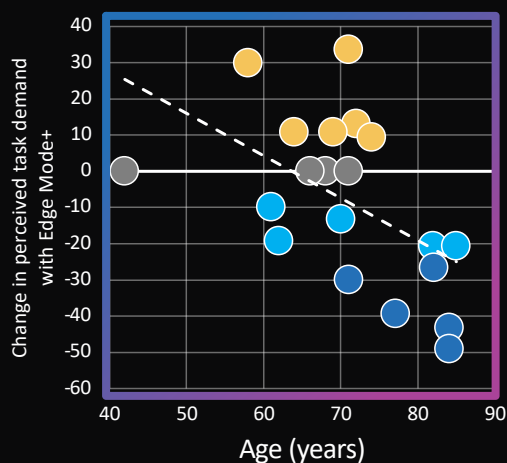
- Large (>25 RAUs) reduction
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Individual Differences

Change in perceived task demand

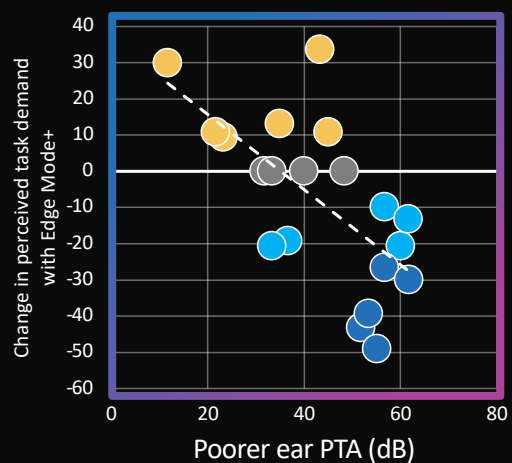


Age correlates with
Perceived Demand change



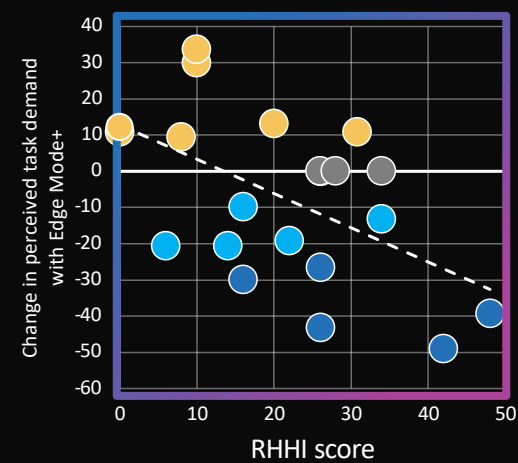
$r=-0.534, p=0.015$

Poorer Ear PTA correlates with
Perceived Demand change



$r=-0.652, p=0.002$

RHHI correlates with
Perceived Demand change



$r=-0.508, p=0.022$

Summary

On-demand processing like Edge Mode+ in realistic environments may provide broad benefits for listening effort and speech understanding in hearing aid users.

Specific sub-groups may see larger benefits than others, specifically those with:

- Greater hearing losses
- Older ages
- Greater perceived hearing handicap

Results support using a multiplicity of measures when evaluating outcomes to gain a fuller picture of each participant's listening experiences.

Acknowledgements

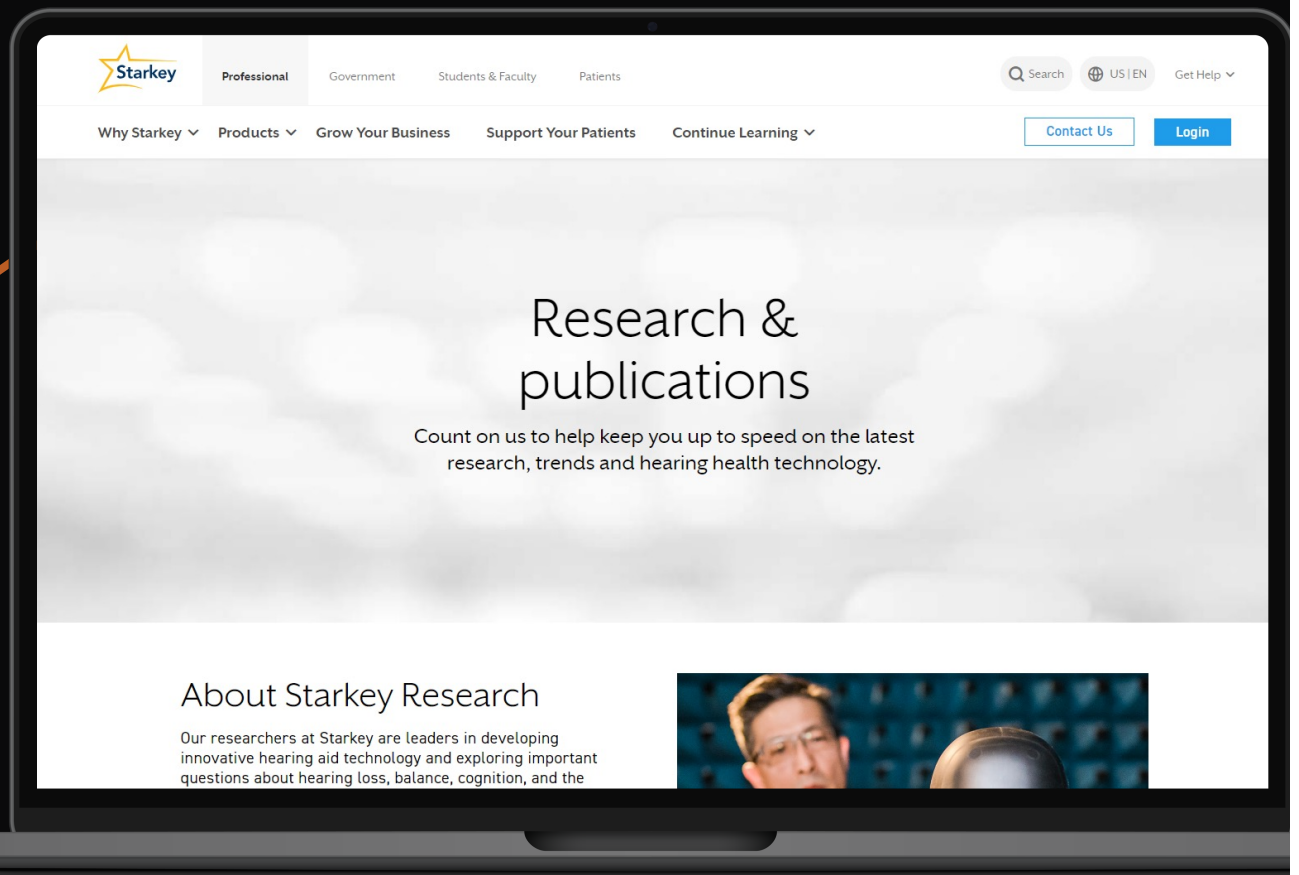
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