Lori Rakita, AuD

Researcher, Phonak Audiology Research Center

A Sonova brand

PHONAK life is on

Disclosures

- **Lori Rakita, Au.D.**

- Lori Rakita is a research audiologist at Phonak. Lori has managed a significant program of research including extensive technical assessments to participant testing to improve the application, evidence basis and clinical support of Phonak products. Lori received her Bachelor of Science in Psychology from the University of Wisconsin- Madison and Doctorate of Audiology from Washington University, St. Louis.

- *Financial-Phonak employee who receives a salary for employment*
- *Nonfinancial-No relevant nonfinancial relationships exists*

PHONAK life is on

Learner Objectives

- After this course learners will be able to identify what makes automatic technology so important for hearing aid users.
- After this course learners will be able to explain how AutoSense OS is unique compared to previous Phonak automatic systems.
- After this course learners will be able to explain the results from the cross-competitor comparison of automatic systems in real world environments.

PHONAK life is on

Essential

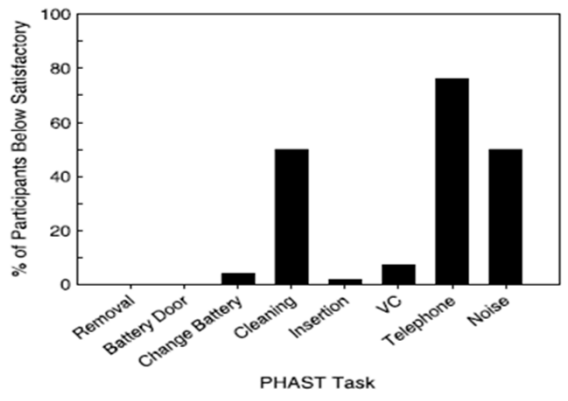
PHONAK life is on

Consumer INSIGHT

PARC
Phonak Audiology Research Center

Even experienced users find it hard to use their hearing aids

Figure 3. The percentage of participants scoring below satisfactory for each PHAST skill task. VC = volume control.



Source: Desjardins JL, and Doherty KA. (2009) Do Experienced Hearing Aid Users Know How to Use Their Hearing Aids Correctly? American Journal of Audiology. 18 (June):69-76.

PHONAK life is on

PHONAK life is on

A Need for An Automatic Program:
A “Noise” program is not going to cut it!

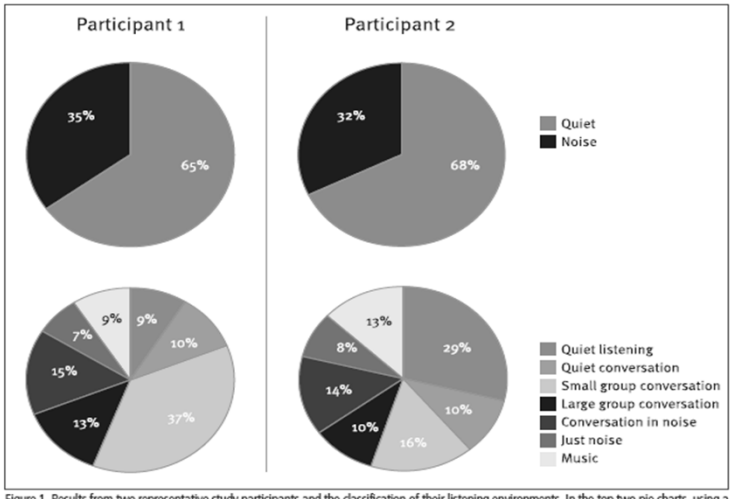


Figure 1. Results from two representative study participants and the classification of their listening environments. In the top two pie charts, using a 2-destination (quiet or noise) paradigm to classify their listening environments, one could be led to believe that they encounter very similar listening environments and have very similar listening needs. However, a more granular 7-item categorization of the listening environments (bottom two pie charts) reveals important differences for these two individuals.

Hearing aids can have up to 8 different hearing aid program types

The Hearing Review: Does Current Hearing Aid Technology Meet the Needs of Healthy Aging? February 2015

PHONAK life is on

Acoustically-Optimized Programs
Quiet
Noise

PHONAK life is on

Consumer INSIGHT

PARC
Phonak Audiology Research Center

Rank	Stated reason for not wearing hearing aids	Number of mentions	Percent of respondents	Estimated number of hearing aid owners
1	Poor benefit from hearing aids	103	29.6%	268,510
2	Background noise/noisy situations	88	25.3%	229,407
3	Fit & comfort	65	18.7%	169,448
4	Negative side effects of H.A.	38	10.9%	99,062
5	Price & cost of repairs	36	10.3%	93,848
6	Don't need help	28	8.0%	72,993
7	Hearing aid is broken	27	7.8%	70,386
8	Sound quality is poor	22	6.3%	57,352
9	Unspecified - do not wear	21	6.0%	54,745
10	Volume control adjustment	17	4.9%	44,317
11	Whistling and feedback	15	4.3%	39,103
12	Nuisance/hassle/annoying	14	4.0%	36,497
13	Poor service from dispenser	11	3.2%	28,676
14	High-frequency loss not helped	10	2.9%	26,069
15	Stigma of wearing hearing aids	10	2.9%	26,069

Source: Reason #10 individuals are not wearing hearing aids: Volume control adjustments MarketTrak V February 2000. Vol 53. No. 2

PHONAK life is on

hearing aid users should not have to **think** about **switching** their hearing aid program

PHONAK life is on

PHONAK life is on

How has Automatic Classification Technology Evolved?

PHONAK life is on

Feature Detection Model

PHONAK life is on

PHONAK life is on

Acoustic Scene Analysis

PARC Phonak Audiology Research Center

PHONAK life is on

Evolution of Automatic Hearing Aid Technology - Phonak

AutoSelect	AutoPilot	SoundFlow
Speech in Quiet/ Noise only	**Calm Situation**	**Calm**
Speech in Noise	Speech in Noise	Speech in Noise
	Comfort in Noise	Comfort in Noise
	Music (came later)	Music
		Speech in Loud Noise (came later)

PARC Phonak Audiology Research Center

PHONAK life is on

AutoSense OS

- Fourth iteration of Phonak automatic classification

Now on the Belong platform….

- Faster processing
- More memory
- Less power consumption
- More accurate at classifying the acoustic environment
- Does this multiple times per second (3 times faster than SoundFlow)

PARC Phonak Audiology Research Center

PHONAK life is on

Why is AutoSense … Powerful?

Exclusive Classes

- 31-feature extr…
- Identifies … proportion of different ac… …ations are p… …e environment
- Make… …ed on … rules or con…
- Smoothing proc…

Speech in Noise

Comfort in Echo

Speech in Loud Noise

Speech in Car

Speech in Noise

Music

Comfort in Echo

Comfort in Noise

Calm Situation

…% Comfort in Echo

100% Exclusive Class

…0% Speech in Noise

PARC Phonak Audiology Research Center

PHONAK life is on

Challenges for Automatic Classification Systems

- Power
- Fast-acting
- Correct identification of the sound class
- Correct activation of features
- No audible transitions

PHONAK life is on

Accuracy and precision are both important

Accuracy:

– How many sound environments can the hearing aid correctly identify?

Example:

“Am I in noise” or “ Am I in quiet”?	→ EASY
“Am I in a noisy car” or “Am I in a noisy café”?	→ HARDER

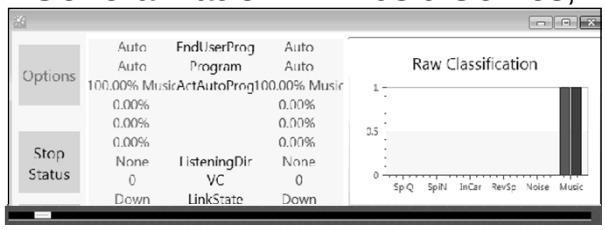
Why is accuracy important?

– The hearing aids will accurately recognize the sound environment

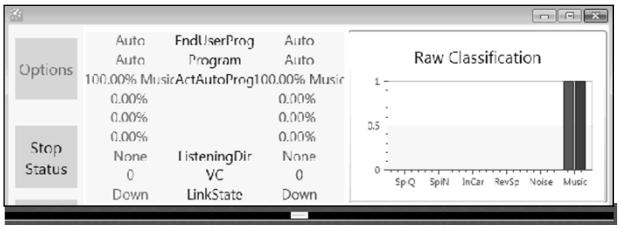
PARC Phonak Audiology Research Center

PHONAK life is on

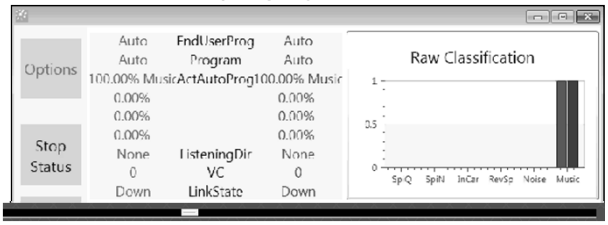
Generalization: 4 Music Genres, 1 Classification



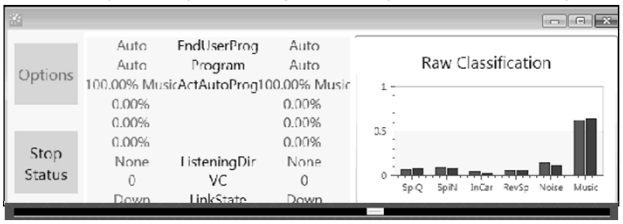
Classical Music
“Spring” by Vivaldi



Ballad
“When you Say Nothing At All” by Ronan Keating



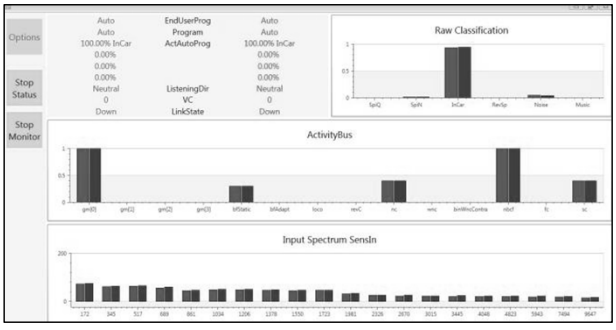
Pop Music
“Love Song” by Sara Bareilles



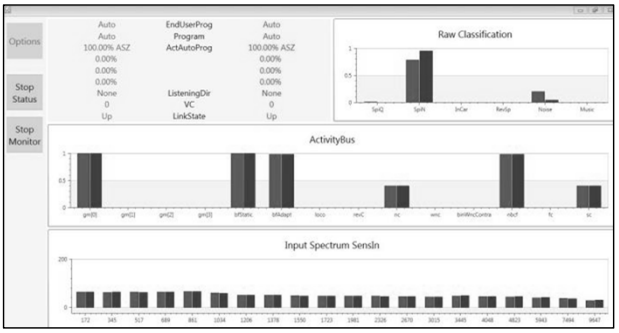
Techno
“Call on Me” by Eric Prydz

PHONAK
life is on

Specification



Car Noise and Speech
0 dB SNR



Multitalker Babble and Speech
0 dB SNR

PARC
Phonak Audiology Research Center

PHONAK
life is on

PHONAK
life is on

Automatic Programs - Phonak

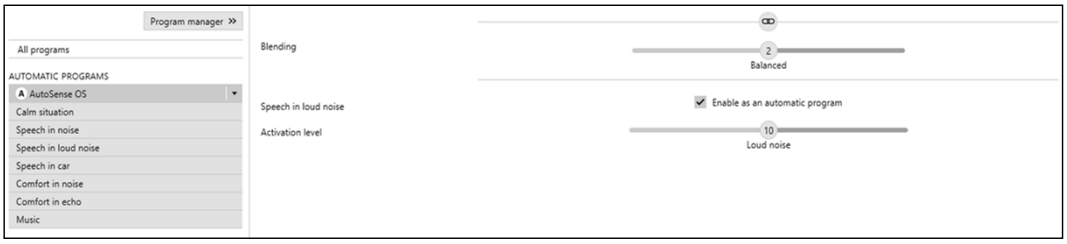
Automatic Programs
Calm
Speech in Noise
Speech in Loud Noise
Speech in Car
Comfort in Noise
Comfort in Echo
Music

Same as manual exclusive programs

PARC
Phonak Audiology Research Center

PHONAK
life is on

Audiologist Control and Flexibility



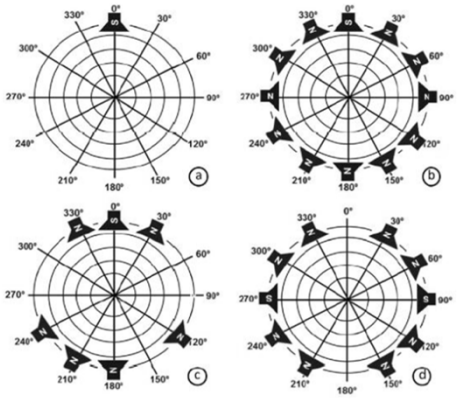
- Changes to AutoSense OS (globally)

- Changes to Programs within AutoSense OS

PHONAK
life is on

PHONAK
life is on

Four Scenes



	Manual Programs
A	Calm Situation
B	Speech in Noise
C	Speech in Loud Noise
D	Speech in Car

Question #1: Which manual program does the participant prefer in each of the four acoustic scenes?

PHONAK life is on

PHONAK life is on

Program selected as “favorite”

Program selected by individual subject	Program selected by AutoSense OS: Calm	SiN	SiLN	CAR
Calm	SiLN	SiN	SiLN
SiN	SiLN	SiN	SiLN
Calm	SiLN	SiLN	SiN
CAR	ComIN	ComIN	SiN
Calm	ComIN	ComIN	Calm
CAR	ComIN	ComIN	Calm
SiN	SiLN	ComIN	ComIN
SiN	SiN	ComIN	ComIN
SiN	ComIN	ComIN	SiN
SiN	SiLN	SiN	ComIN
SiLN	SiN	SiLN	CAR
SiLN	ComIN	SiN	SiN
Calm	SiN	SiLN	CAR
CAR	SiN	ComIN	ComIN

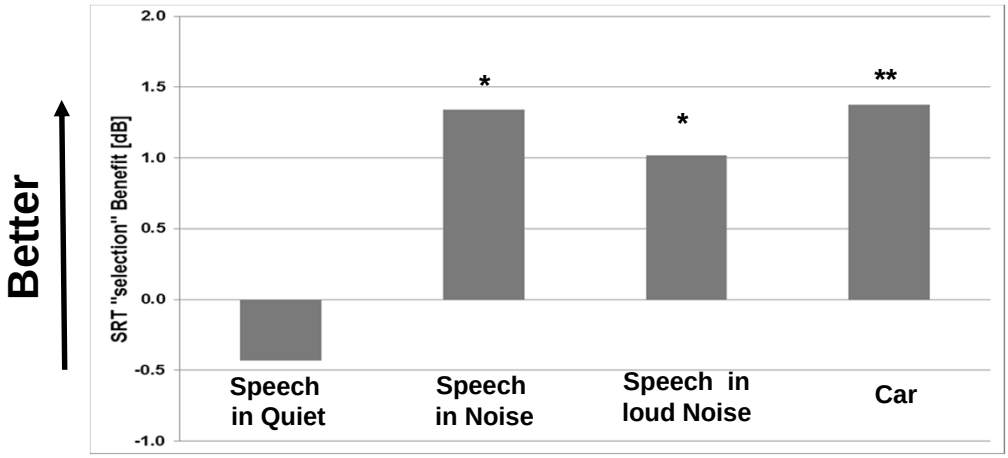
automatic selection # manual selection
automatic selection = manual selection

No more than 4 participants chose the same program as AutoSense OS in any scene

PHONAK life is on

Objective benefit of AutoSense OS

Goettinger sentence test



** ⇔ 0.01
* ⇔ 0.05

The program selected by AutoSense OS provides better speech intelligibility in each noisy situation.

PHONAK life is on

PHONAK life is on

How to Test Automatics?

PARC'S Answer:

Instead of "Recreating" the real world,
BRING participants into the
REAL WORLD

A Need for A Study Done Outside of PARC's walls…

How do we know what is happening in the REAL WORLD?

PHONAK life is on

PHONAK life is on

Scene Creation

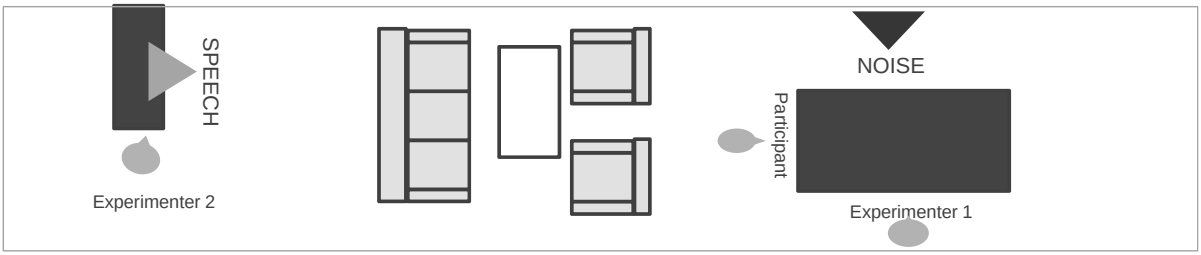
Challenges:
- Speech from behind
- Reverberation
- Noise

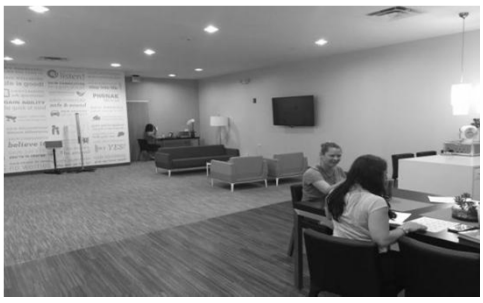
Challenges:
- Road Noise
- Speech from side

Challenges:
- LOTS of noise
- Reverberation

PHONAK life is on

Scene #1: Listening Loft

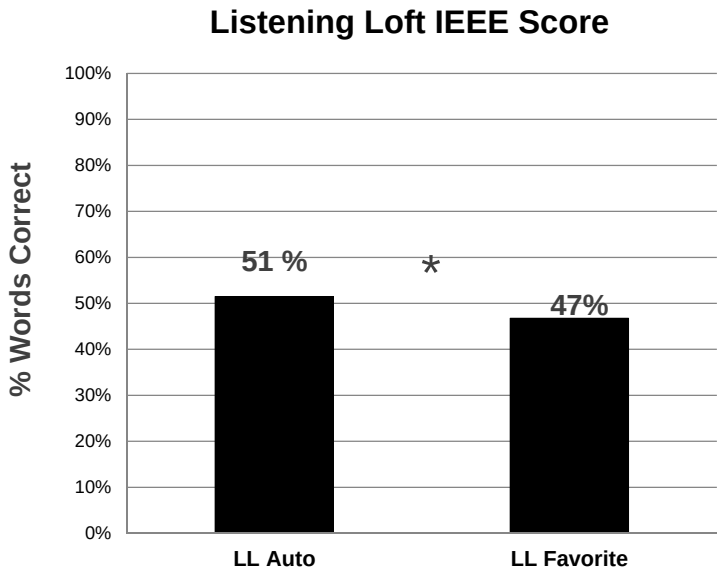




PHONAK life is on

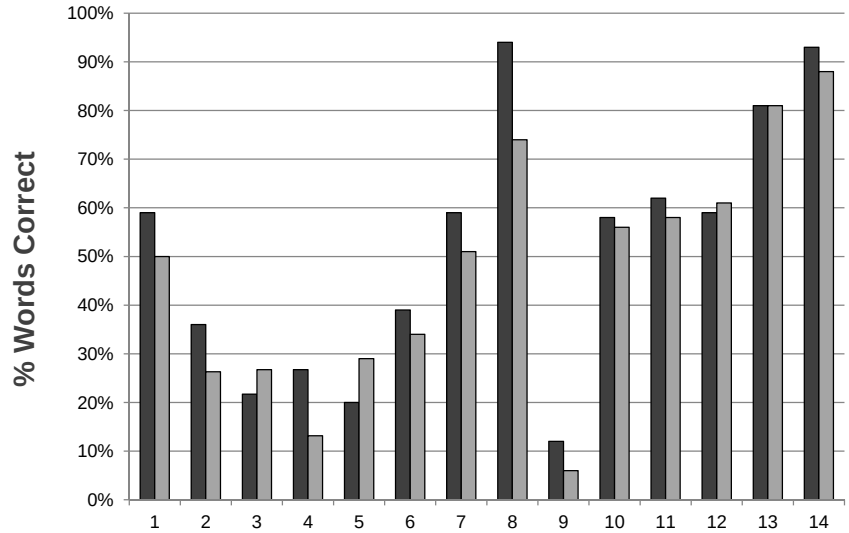
PHONAK life is on

Objective score



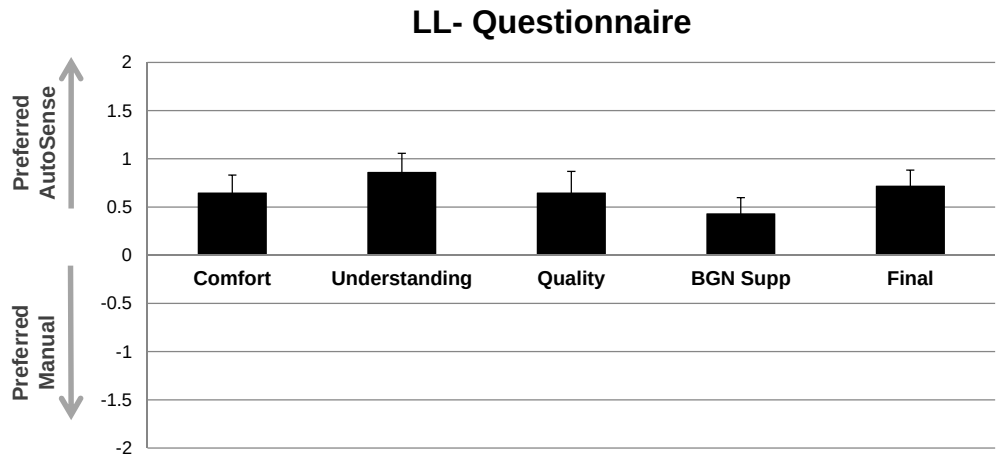
* = p < 0.05

Listening loft speech performance



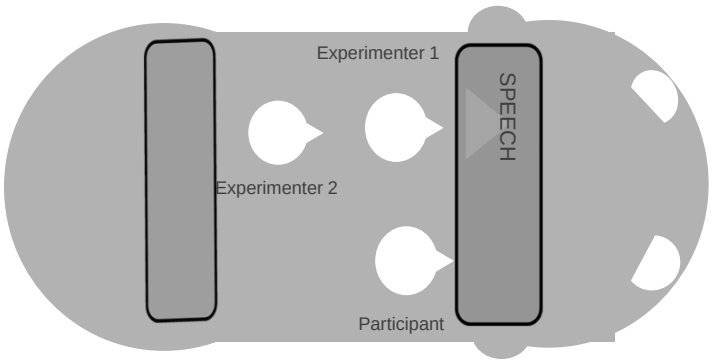
12/14 participants performed the same or better in Auto than Favorite

Do participants prefer AutoSense or “Favorite” Manual Program?



PHONAK life is on

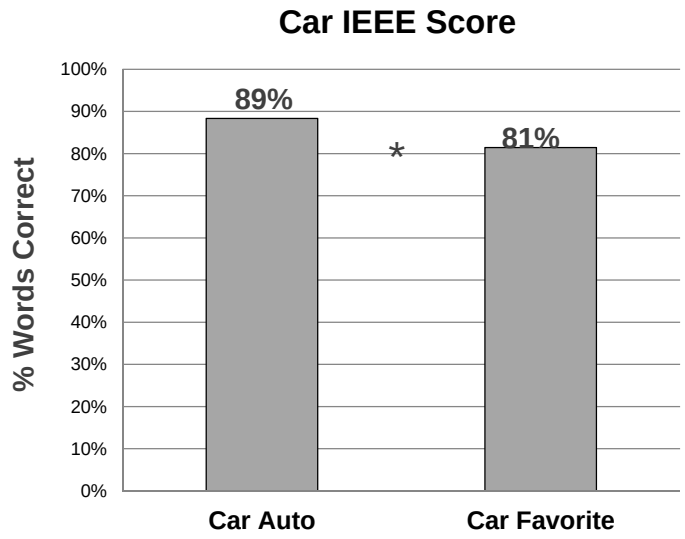
Scene #2: Car



PHONAK life is on

PHONAK life is on

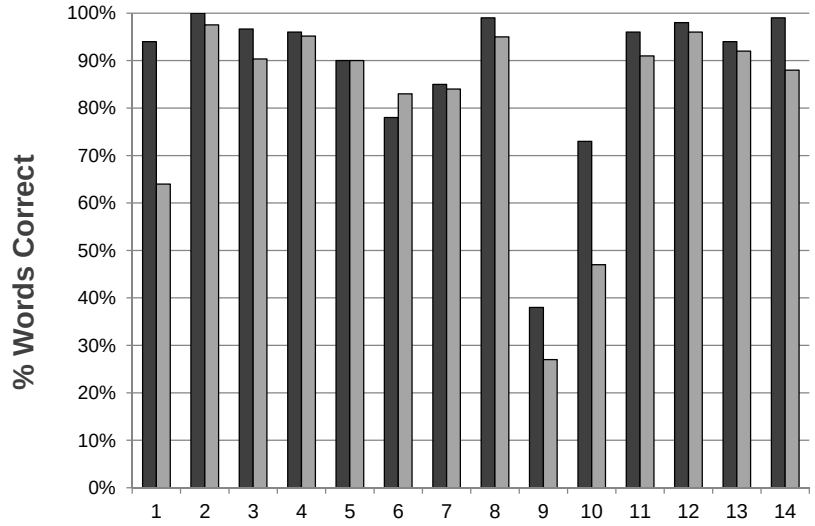
Objective Score



* = p < 0.05

PHONAK life is on

Car speech performance

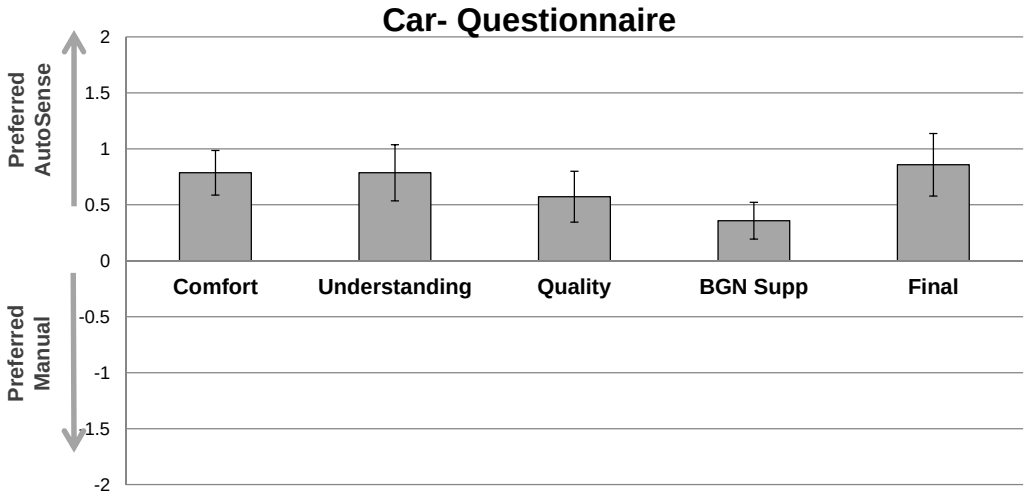


13/14 participants performed the same or better in Auto than Favorite

PHONAK life is on

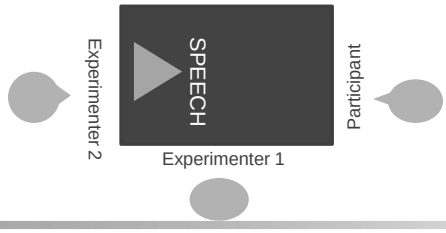
PHONAK life is on

Do participants prefer AutoSense or “Favorite” Manual Program?



PHONAK life is on

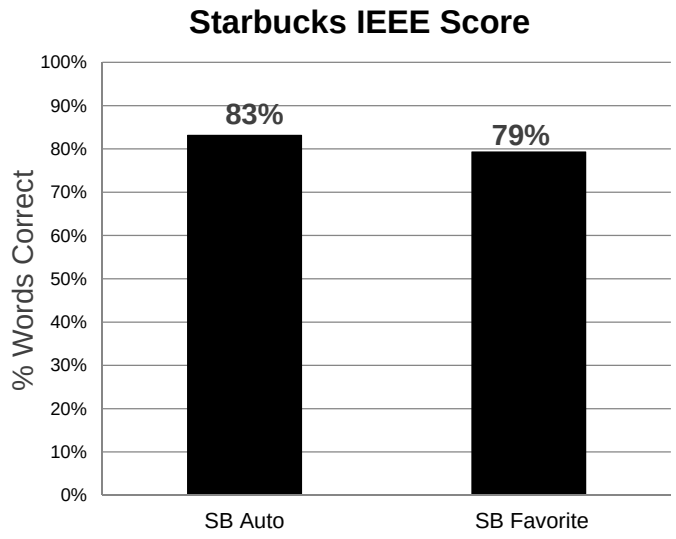
Starbucks



PHONAK life is on

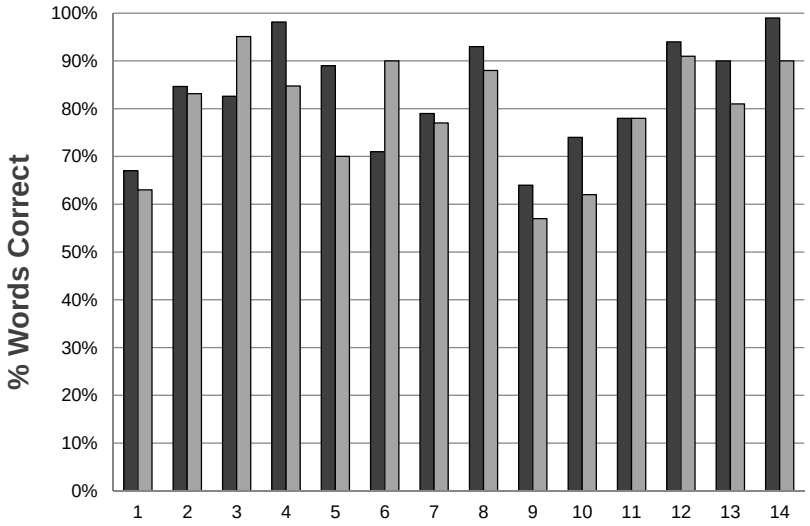
PHONAK life is on

Objective Score



PHONAK life is on

Starbucks Speech Performance

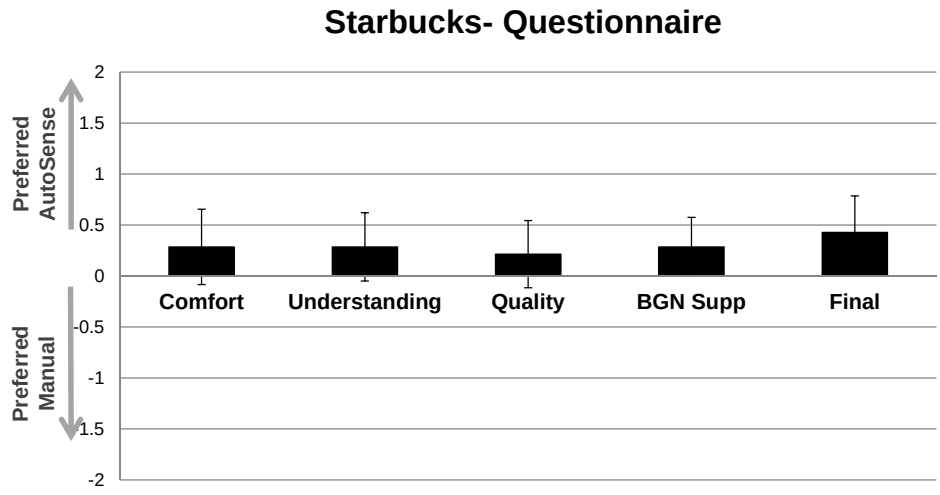


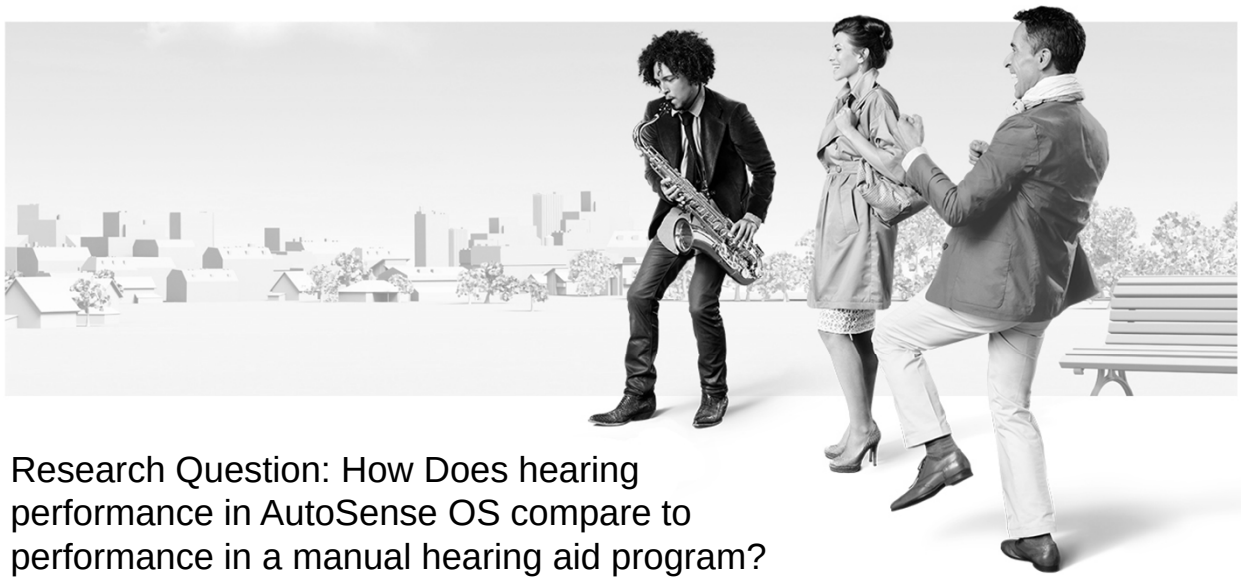
12/14 participants performed the same or better in Auto than Favorite

PHONAK life is on

PHONAK life is on

Do participants prefer AutoSense or “Favorite” Manual Program?





Research Question: How Does hearing performance in AutoSense OS compare to performance in a manual hearing aid program?

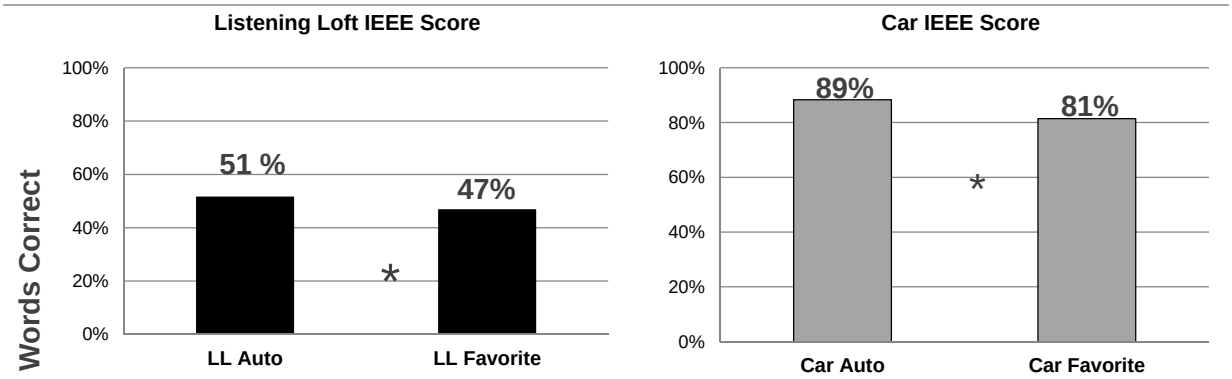
Scene Creation

Challenges:
- Speech from behind
- Reverberation
- Noise

Challenges:
- Road Noise
- Speech from side

Challenges:
- LOTS of noise
- Reverberation

PHONAK life is on



* = p < 0.05

PARC Phonak Audiology Research Center

PHONAK life is on

PHONAK life is on

Study Conclusions

- AutoSense OS is an incredibly powerful and **accurate** scene classification system
- Participants **performed better** in AutoSense OS than their preferred manual program
- Participants **performed better** in AutoSense OS than the “acoustically appropriate” target program
- Participants **preferred AutoSense OS** in all three listening scenes

PARC
Phonak Audiology Research Center

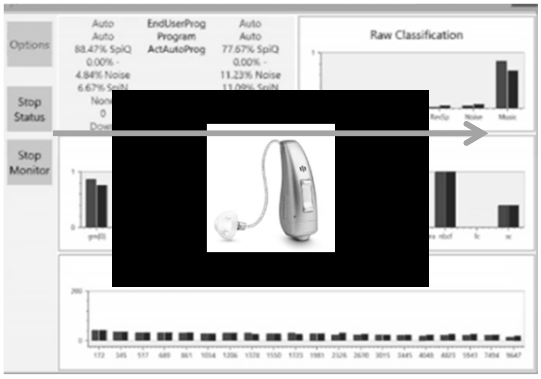
PHONAK
life is on

PHONAK
life is on

How to investigate the automatic systems of competitors:

Exclusive Manual Program

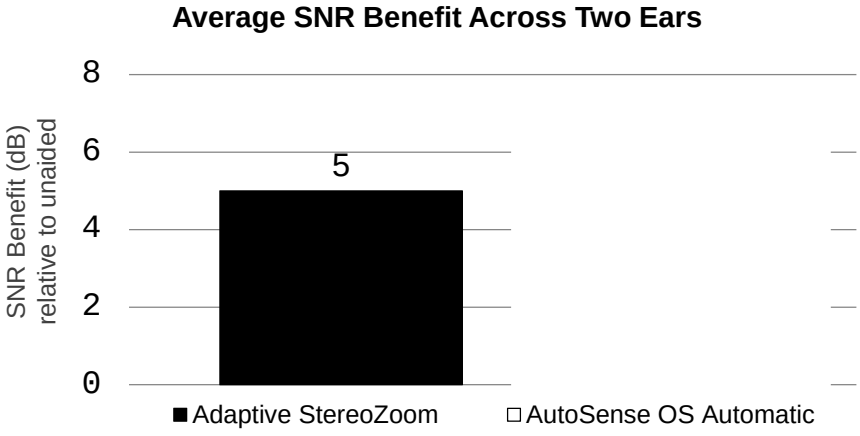
Automatic Program

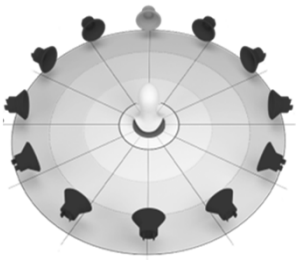


PARC Phonak Audiology Research Center

PHONAK life is on

“Narrow” noise program- Phonak



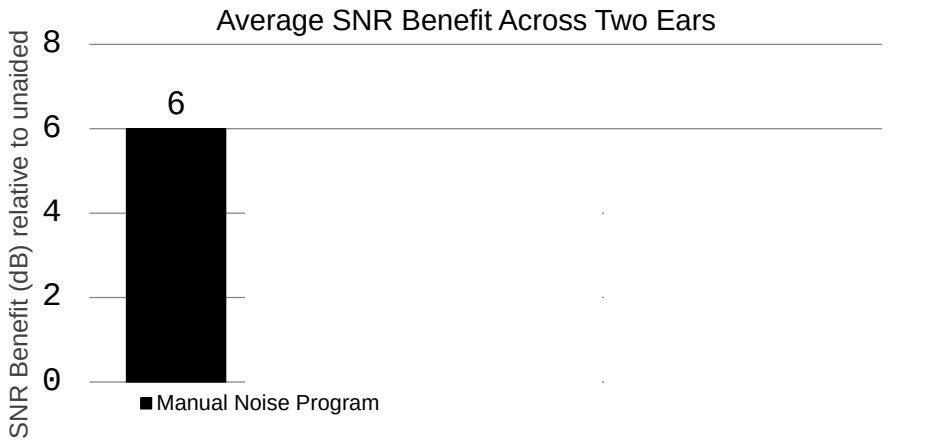


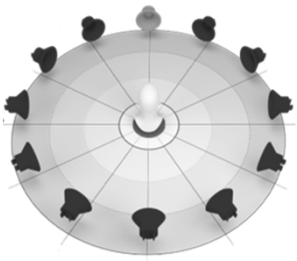
PARC Phonak Audiology Research Center

PHONAK life is on

PHONAK life is on

Benefit in “Narrow” Noise Program = Automatic?

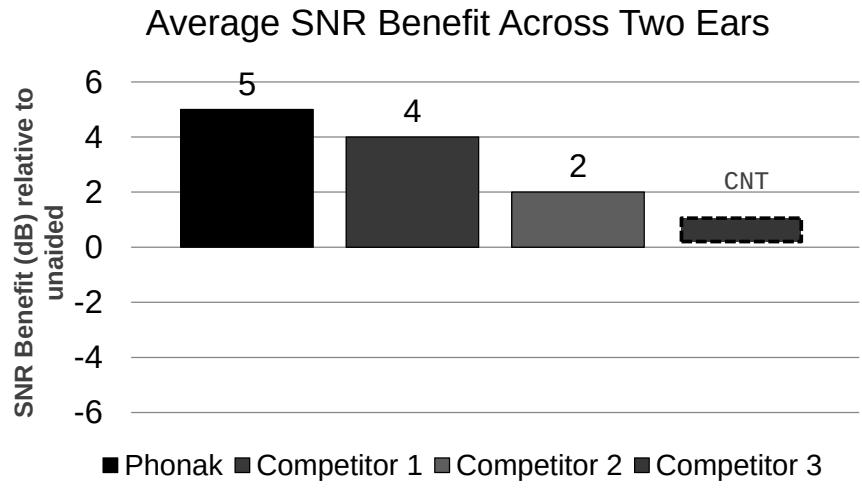




PARC Phonak Audiology Research Center

PHONAK life is on

Automatic Programs- Noise Stimuli



PARC Phonak Audiology Research Center

PHONAK life is on

PHONAK life is on

Primary objective

Competitive Automatic Study

Comparison how hearing aid automatics

- *in measures of speech understanding*
- *perceived effort in real world environments.*

PARC
Phonak Audiology Research Center

PHONAK
life is on

PHONAK
life is on

Study Design
Competitive Automatic Study

Study Design

Double blind repeated measures

***Subjects**:*

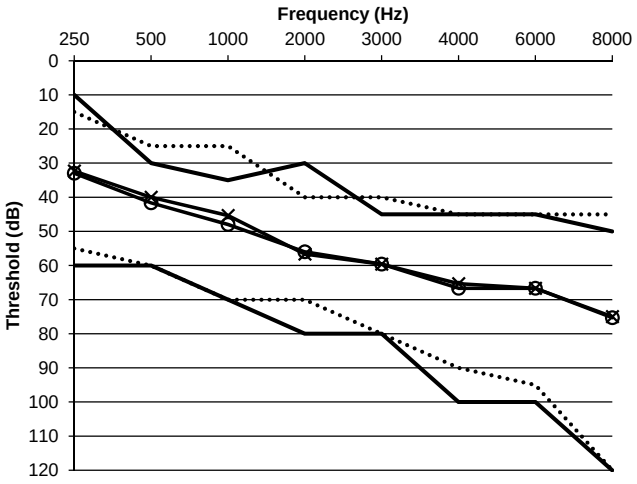
14 subjects

Mild to severe sloping SNHL on average

Hearing aids:

Audéo B 90 and 2 competitors

All fitted to NAL-NL2



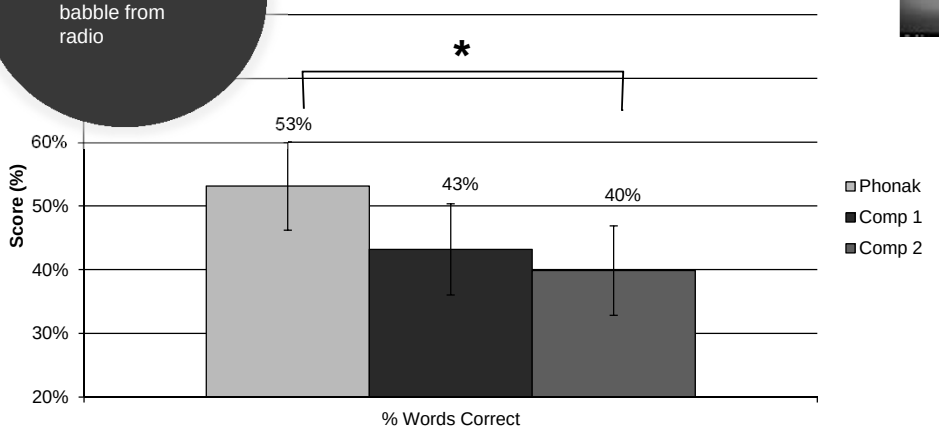
PARC
Phonak Audiology Research Center

PHONAK
life is on

PHONAK
life is on

Speech performance results - CAR

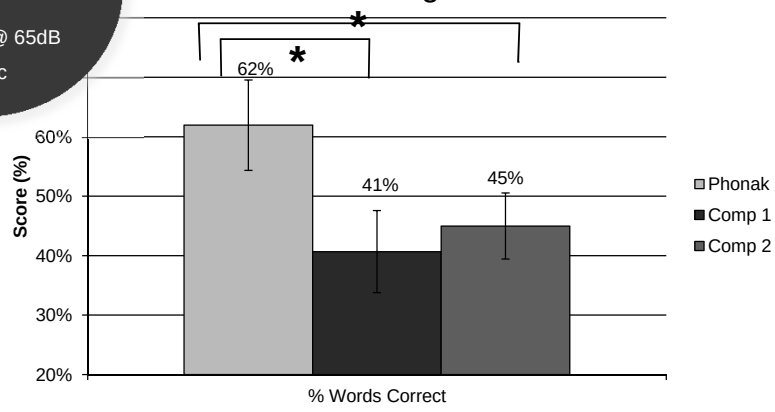
- Speaker from backseat
- 60dB speech babble from radio



PHONAK life is on

Speech performance results – COMPLEX ACOUSTICS

- PARC Loft
- 4 corner noise speakers @ 60dB
- Speech @ 65dB
- RT=.8 sec

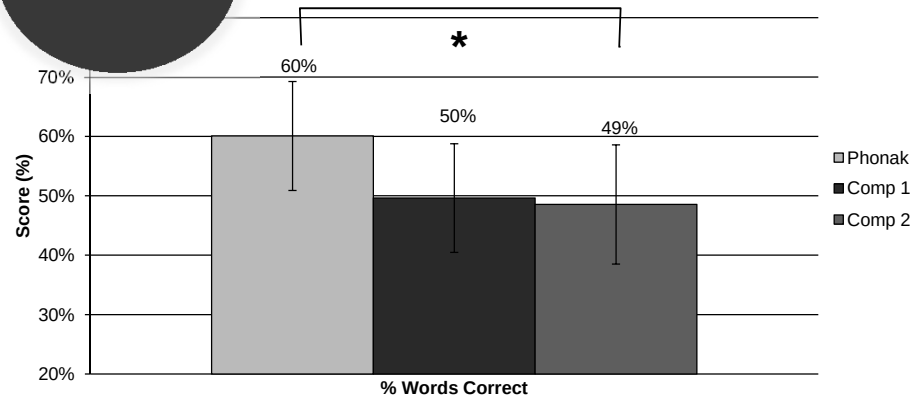


PHONAK life is on

PHONAK life is on

Speech performance – soft speech

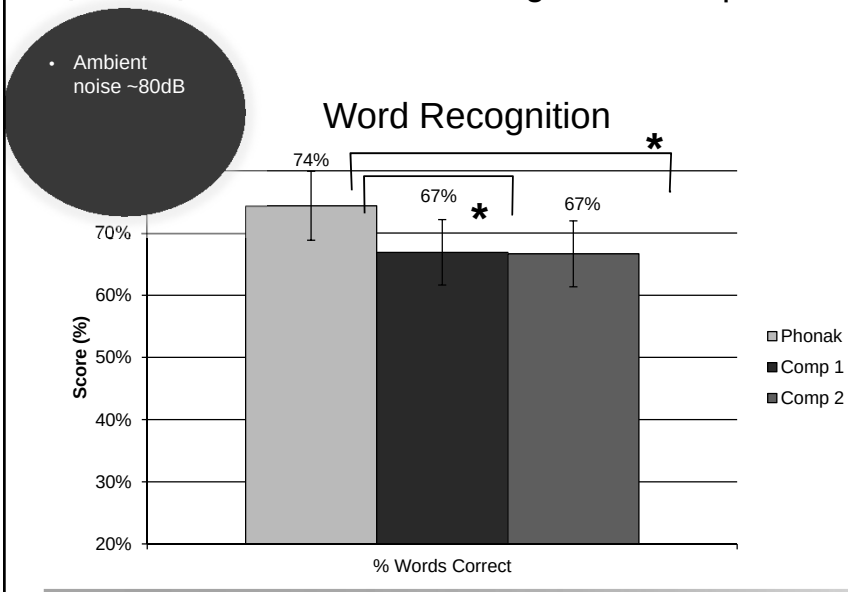
- PARC Loft
- Speech @ 50 dB



PHONAK life is on

Speech performance – bustling coffee shop

- Ambient noise ~80dB

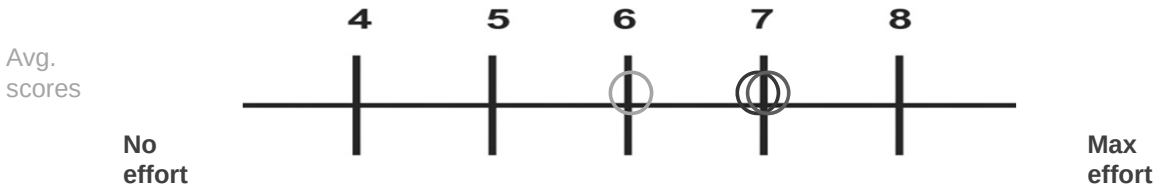


PHONAK life is on

PHONAK life is on

Listening effort results

In each of the 3 scenes Phonak received the lowest average scores for listening effort*



	Loft	Soft sp	Car	Starbucks
Phonak	6.9	6.1	7.1	4.7
Comp 1	8.1	6.2	7.9	5.6
Comp 2	8.1	7.1	7.6	5.5

*differences did not meet statistical significance

PHONAK life is on

AutoSense OS Conclusions

- AutoSense OS is more than just a convenience
- It optimizes hearing performance in real time
- And does this better than any other manufacturer tested

PHONAK life is on

Take Aways

- Automatic classification systems should be a priority for any hearing aid manufacturer, since this ultimately affects how hearing aid users interact with his/her hearing aid
- With new advancements hearing aids have become increasingly more complex in their ability to adapt to a number of environments, and automatic classification systems allow hearing aid users to take

Thank You