

6th Phonak European Pediatric Conference

How to Use E-Technologies for Progress in Better Hearing

Michael Boretzki, Sonova AG, Switzerland

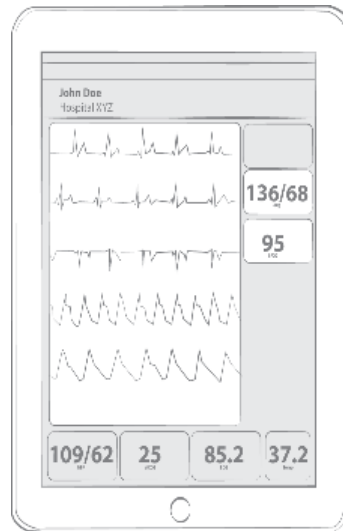


Digital Technologies in Medicine



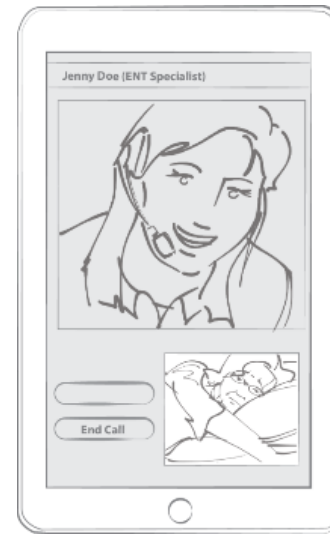
**Self
Diagnosis**

App for diabetes
management



**Health
Coaching**

Health data
captured in real life



**Remote
Support**

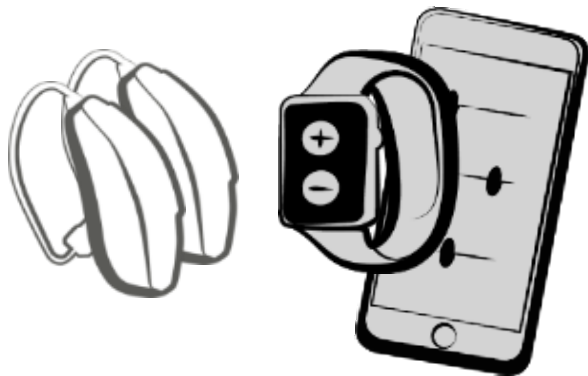
Online Services



**Self
Adjustment**

App for hand
prosthesis

Digital Technologies in Audiology



- Remote control
- Audio streaming
- Situation specific fitting of hearing aids
- Contact to audiologist via eMedia
- Otoscopy with mobile device
- Hearing screening
- Audiometry with mobile device

How to Use E-Technologies for Progress in Better Hearing

1. Better Hearing
 2. Remote Support by Audiologist
 3. Ecological Momentary Assessment by User
 4. Collaborative Fitting by Audiologist and User
 5. Big Data and Predictive Analytics
-

Quality Dimensions of Better Hearing

How it can look when **Clarity** is lacking



Thanks to Jean Anne Schnittker

Quality Dimensions of Better Hearing

How it can look when **Hearing Comfort** is lacking



Thanks to Jean Anne Schnittker

Which parts does hearing have?

Sound(scape)s

- Acoustically different
- Different ease
- Different importance

Activities

Auditory selection and attention

- Focused outwards
- Floating
- Focused inwards

Hearing values

Hearing comfort

- Not too loud
- Familiar

Clarity

- Audible
- Discriminable
- Localizable
- Recognizable

Why is better hearing wanted?

Sound(scape)s

- Acoustically different
- **Different ease** ↓
- Different importance

Activities

Auditory selection and attention ↓

- Focused outwards
- Floating
- Focused inwards

Hearing values

Hearing comfort

- Not too loud
- Familiar

Clarity

- Audible ↓
- Discriminable ↓
- Localizable ↓
- Recognizable ↓

↓ = worsened

What is better hearing about?

Sound(scape)s

- Acoustically different
- Different ease
- Different importance

Activities

- Auditory selection and attention +
- Focused outwards
 - Floating
 - Focused inwards

Hearing values

Hearing comfort

- Not too loud !
- Familiar !

Clarity

- Audible +
- Discriminable +
- Localizable +
- Recognizable +

! = Quality kept + = Performance improved

Making hearing better: Prescriptive Fitting, Validation, Managing Trade-Offs

	Moderate speech	Loud speech	Soft speech	Speech in noise	Loud speech in noise	Soft speech in noise	Music	Loud music	Birds singing	Traffic noise	Construction noise	Alarm signals
Audible			+			+			+			+
Distinguishable	+	+	+	+	+	+	+	+	+			+
Localizable	+	+	+	+	+	+	+	+	+			+
Recognizable	+	+	++	++	++	++	+	+	+			+
Familiar	!	!	!	!	!	!	!	!	!	!	!	!
Not too loud	!	!!	!	!	!!	!	!	!	!	!!	!!	!!

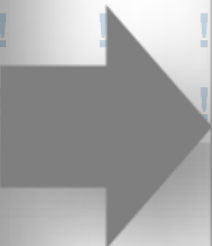
! = Quality kept + = Performance improved

Making hearing better: Prescriptive Fitting, Validation, Managing Trade-Offs

Moderate speech
Loud speech
Soft speech
Speech in noise
Loud speech in noise
Soft speech in noise
Music
Loud music
Birds singing
Traffic noise
Construction noise
Alarm signals

Audible		+		+		+		+		+		+
Distinguishable	+	+	+	+	+	+	+	+	+	+	+	+
Localizable	+											
Recognizable	+											
Familiar	!											
Not too loud	!											

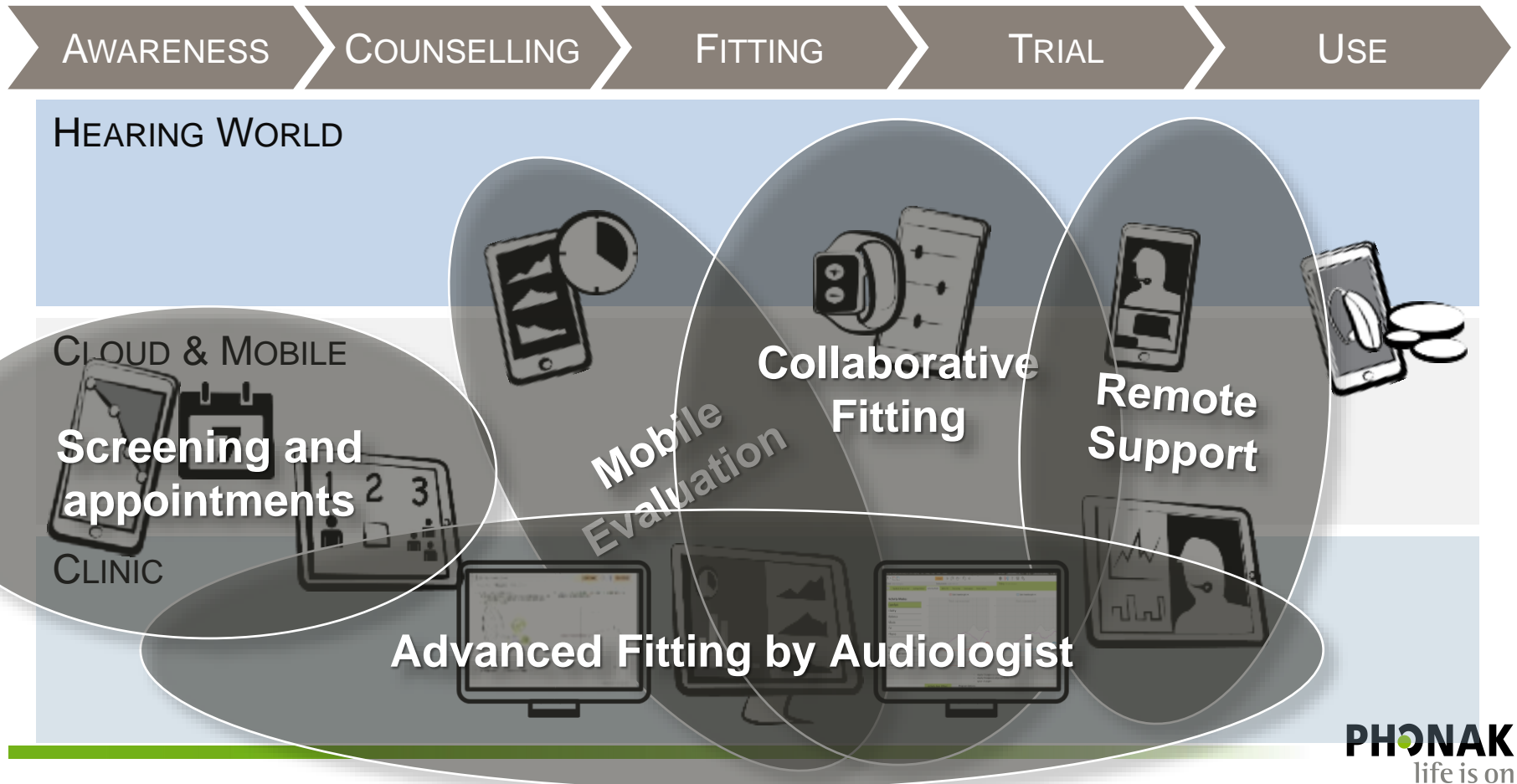
Audible	✗
Distinguishable	✗
Localizable	✗
Recognizable	✗
Familiar	✓
Not too loud	✓



Audible	+
Distinguishable	+
Localizable	+
Recognizable	+
Familiar	✓
Not too loud	✓

Patient Journey – Today and Tomorrow

Fitting distributed across roles, tasks, places



Remote Support by Audiologist



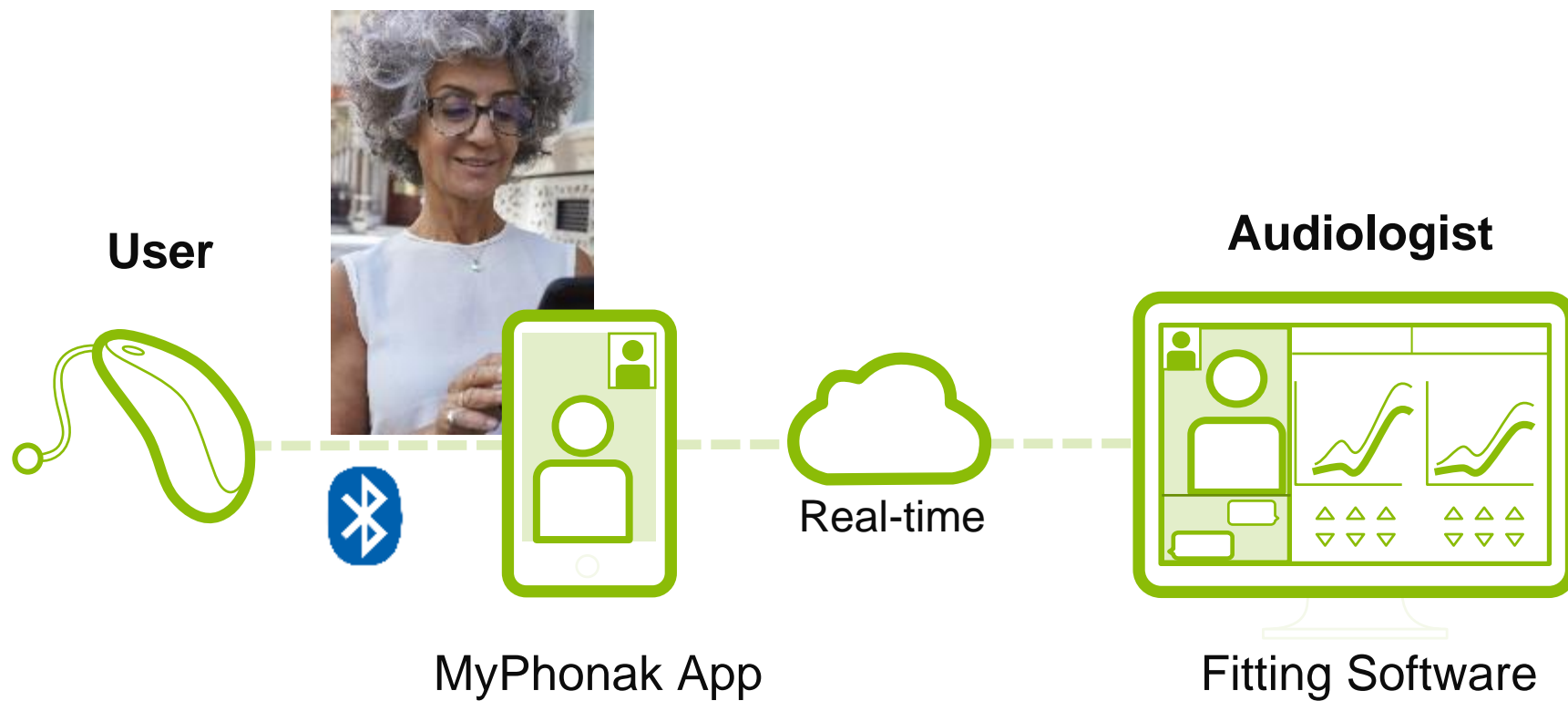
Remote Support



Remote Support



Remote Support



Remote Support – Convenient Access to Audiological Care

Conventional



With Distance Support



Remote Support – True Environmental Optimization

Still to be explored!

Conventional



With Distance Support

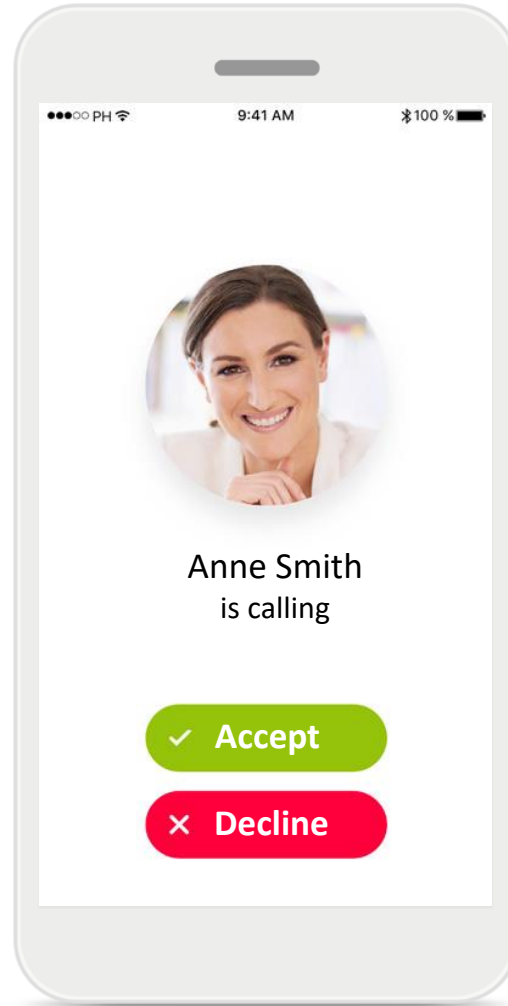


Remote Support – Results with Prototype

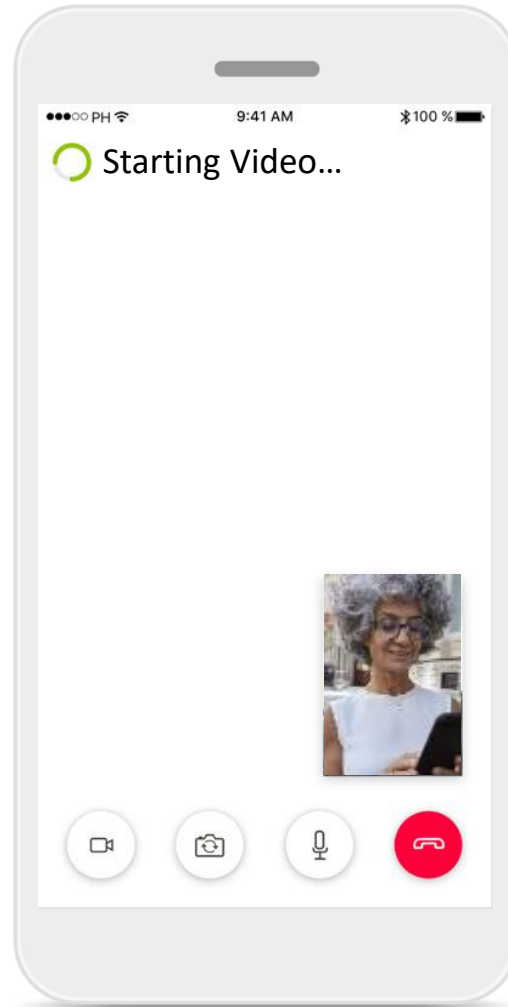
Angley, Schnittker & Tharpe (2017). Remote Hearing Aid Support: The Next Frontier.

- 80% of audiologists acknowledge remote sessions as efficient as face-to-face appointments
- 88% of users prefer remote sessions under certain conditions (mobility issues, transportation difficulties, weather conditions)
- 92% of users would recommend remote sessions to other users
- 64% of users prefer remote sessions over a face-to-face sessions
- 82% of audiologists are satisfied with the outcome of remote sessions

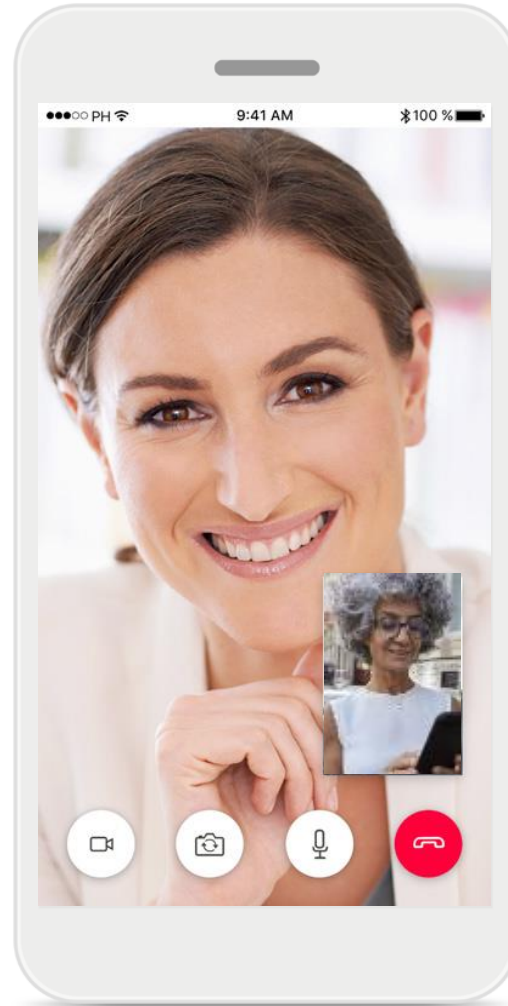
Remote Support – Accepting Video Call



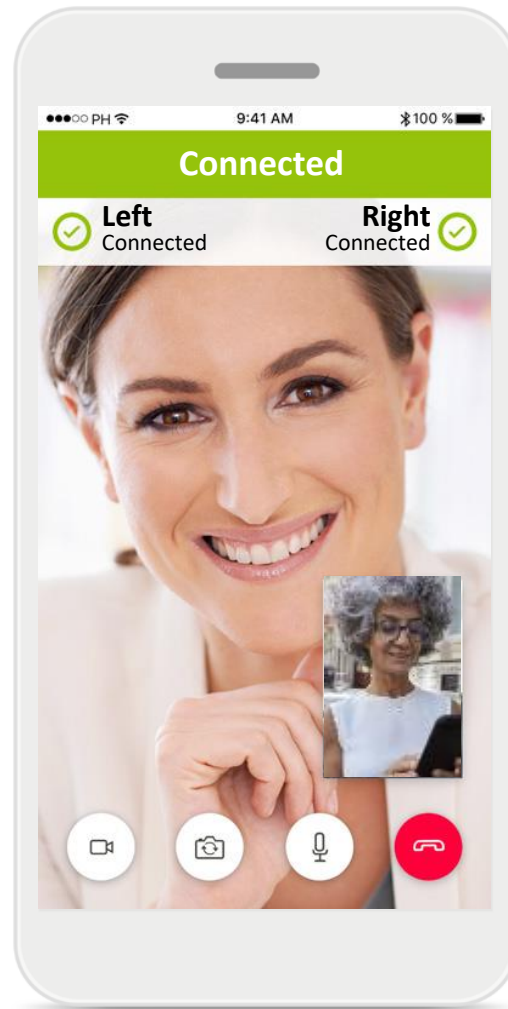
Remote Support – Starting Video Call



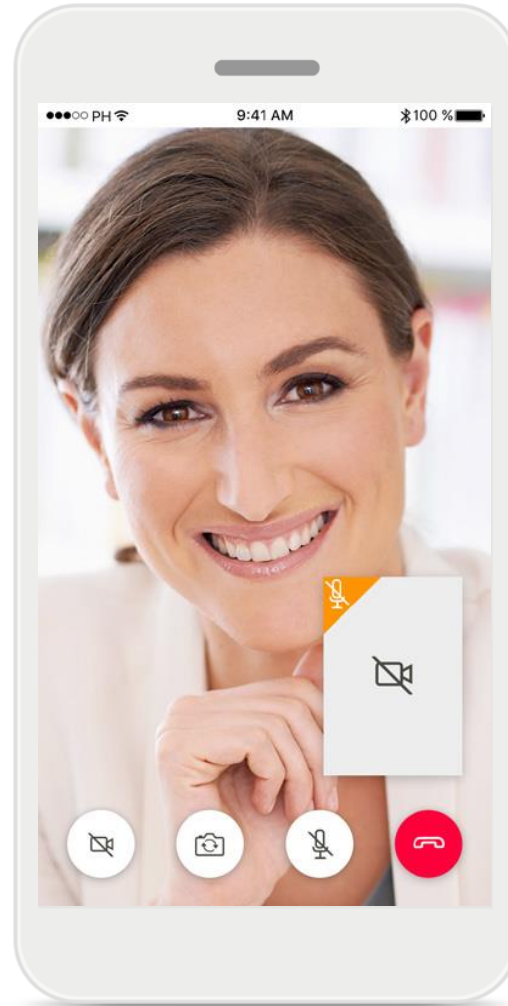
Remote Support – Ongoing Call



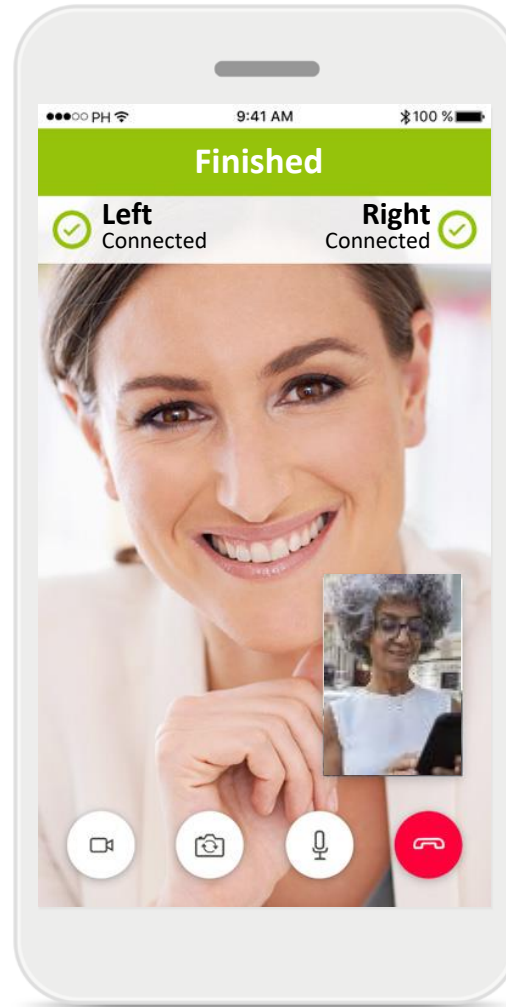
Remote Support – Connected Hearing Aids



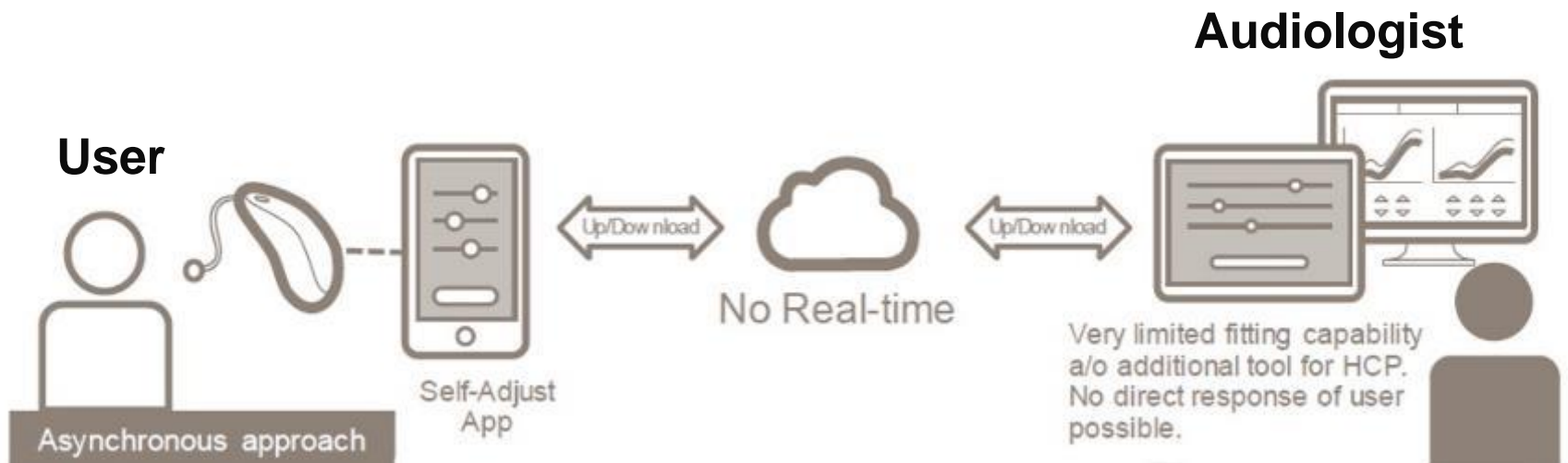
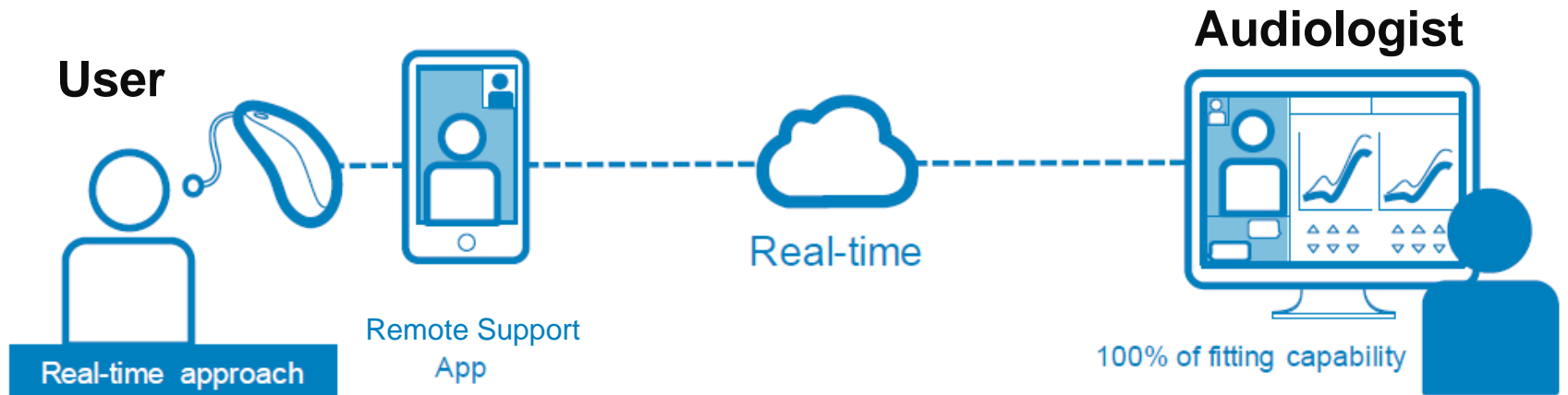
Remote Support – No Video



Remote Support – New Settings Saved



Remote Support – Synchronous versus asynchronous



Remote Support in Pediatric Audiological Care

- Teenagers: Study of Gwen Carr et al. 2018
- Parents of toddlers?
- ...



Ecological Momentary Assessment

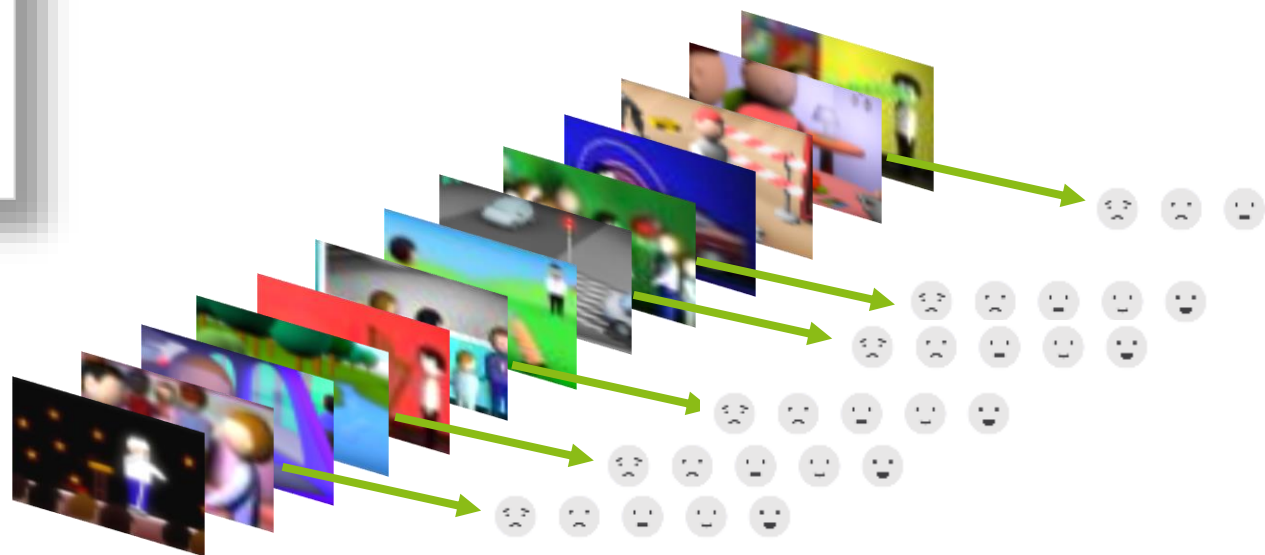
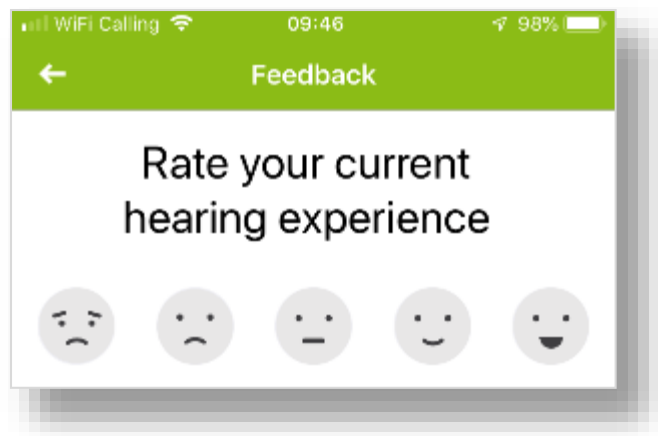
Traditional Evaluation of Aided Hearing

	Without hearing aid	With hearing aid
1. When I am in the supermarket, talking to the cashier, I can follow the conversation.	ABCDEF G	ABCDEF G
2. I miss information when I attend classes, courses or talks.	ABCDEF G	ABCDEF G
3. Unexpected sounds such as car alarms are uncomfortable.	ABCDEF G	ABCDEF G
4. I have difficulties in hearing the conversation with my family at home.	ABCDEF G	ABCDEF G
5. I have difficulties to understand a dialogue in the cinema or in the theater.	ABCDEF G	ABCDEF G
6. When I am listening to the news in the car radio and other family members are talking, I have difficulty to understand what is being said.	ABCDEF G	ABCDEF G
7. When I am in a dinner table with many people and I am trying to talk with one of them, it is difficult to understand their talk.	ABCDEF G	ABCDEF G
8. Sounds from traffic are very intense.	ABCDEF G	ABCDEF G
9. When I am talking to someone in a large empty room, I understand the words.	ABCDEF G	ABCDEF G
10. When I am in a small room, asking or answering questions, I have difficulties to follow on the conversation.	ABCDEF G	ABCDEF G
11. When I am in a theater or at the cinema watching a play or a movie, people around me are whispering or crunching.	ABCDEF G	ABCDEF G
12. When I am talking in a low voice with a friend, I have difficulties to understand.	ABCDEF G	ABCDEF G
13. The sounds of running water, such as from the kitchen tap, in the bathroom or in the shower are uncomfortable or intense.	ABCDEF G	ABCDEF G
14. When a speaker addresses a small group of people and everyone is listening attentively, I have to strain myself in order to understand.	ABCDEF G	ABCDEF G
15. When I am talking with my physician in the examination room, I have difficulties to follow on the conversation.	ABCDEF G	ABCDEF G
16. I can understand the conversation even when many people are talking at the same time.	ABCDEF G	ABCDEF G
17. Construction work noise is uncomfortable or intense.	ABCDEF G	ABCDEF G
18. It is difficult for me to understand what is being said when I am in a crowd.	ABCDEF G	ABCDEF G
19. I can communicate with others when I am in a noisy environment.	ABCDEF G	ABCDEF G
20. The sound of a neighbor's television or radio is uncomfortable or intense.	ABCDEF G	ABCDEF G
21. I can follow the conversation when I am in a noisy environment.	ABCDEF G	ABCDEF G
22. The sound of a neighbor's television or radio is uncomfortable or intense.	ABCDEF G	ABCDEF G
23. I can follow the conversation when I am in a noisy environment.	ABCDEF G	ABCDEF G



	Without hearing aid	With hearing aid
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Ecological Momentary Assessment – Mobile Evaluation of Aided Hearing



Systematic hearing performance sampling using a mobile device



Wi-Fi Calling 09:46

← Feedback

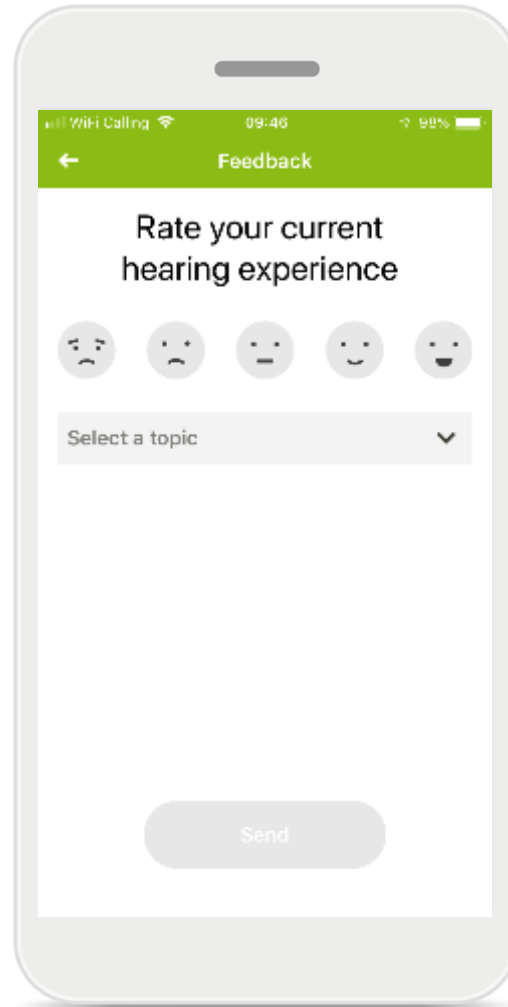
Rate your customer hearing experience

☹️ ☹️ ☹️

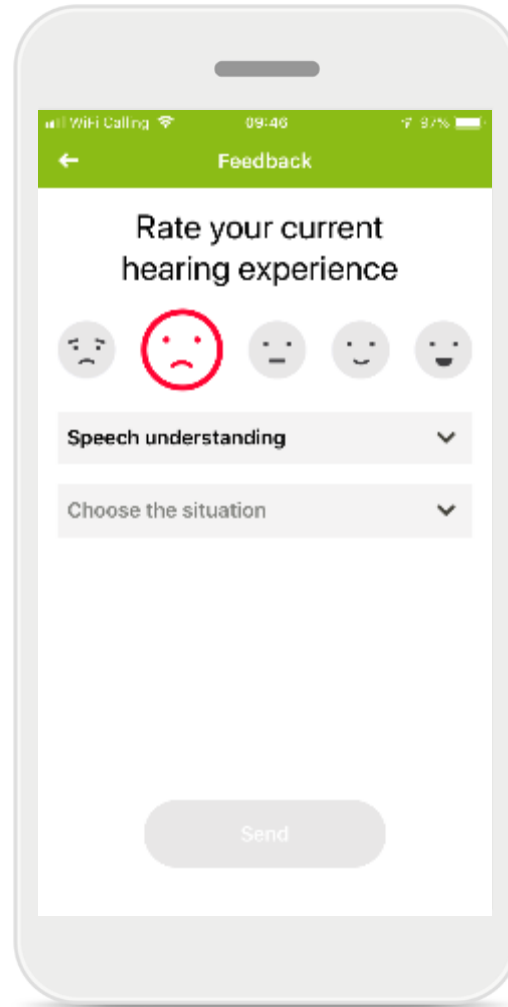
Select a topic

Send

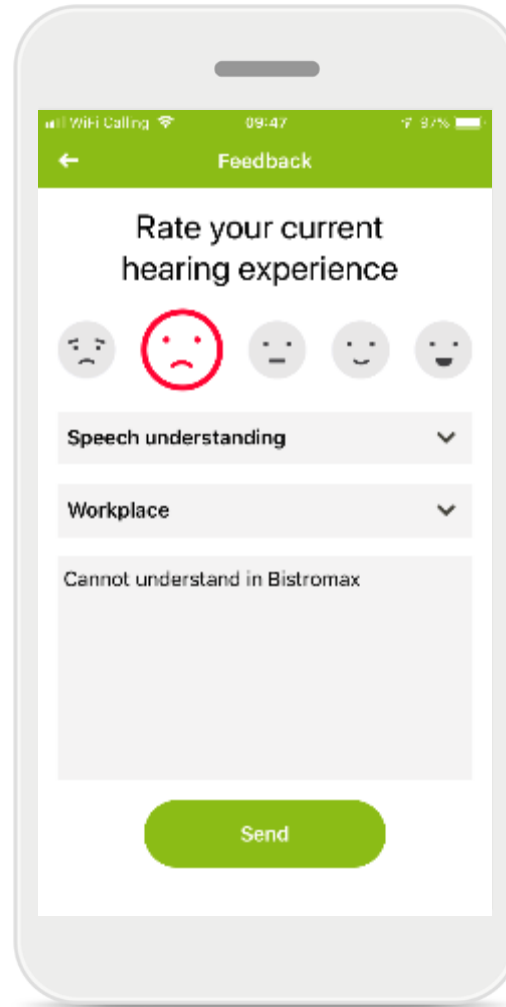
HearingDiary – Rating Hearing Experience



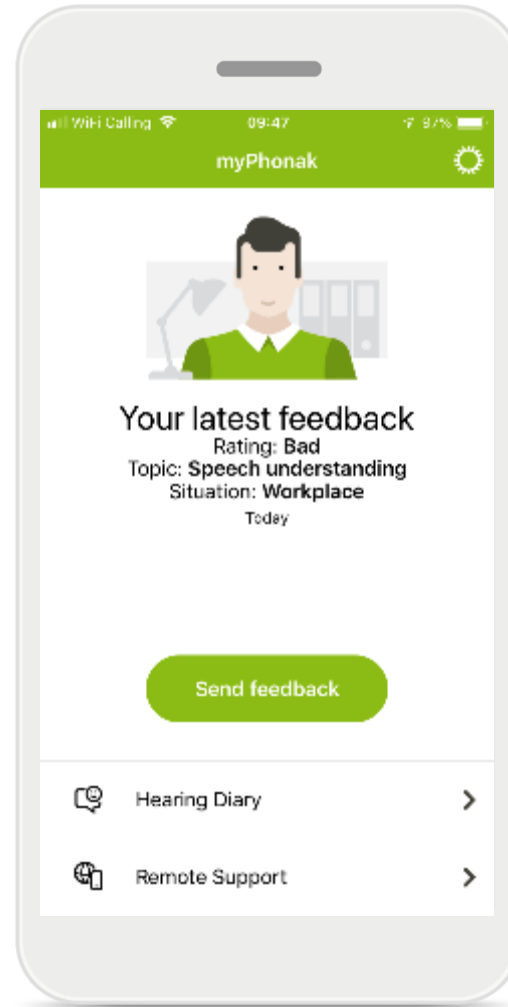
HearingDiary – Rating Hearing Experience



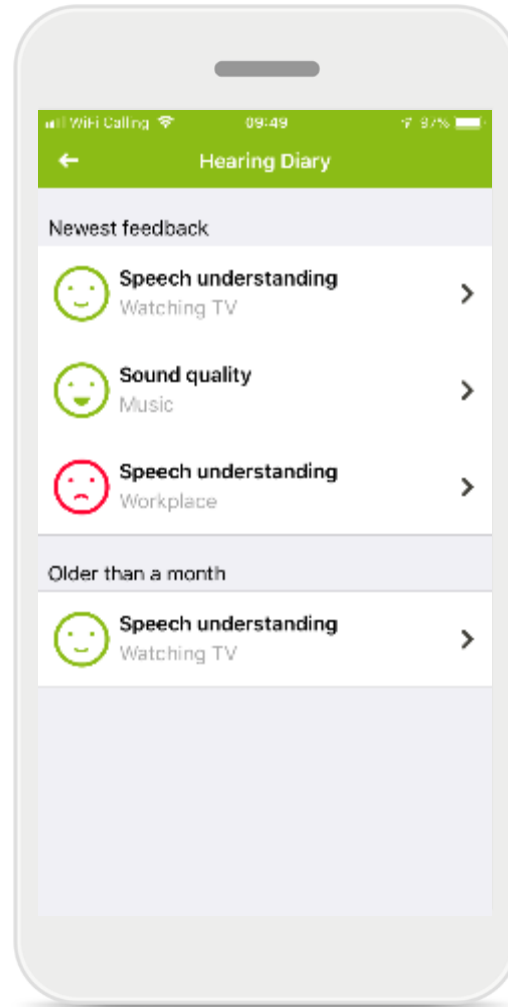
HearingDiary – Rating Hearing Experience



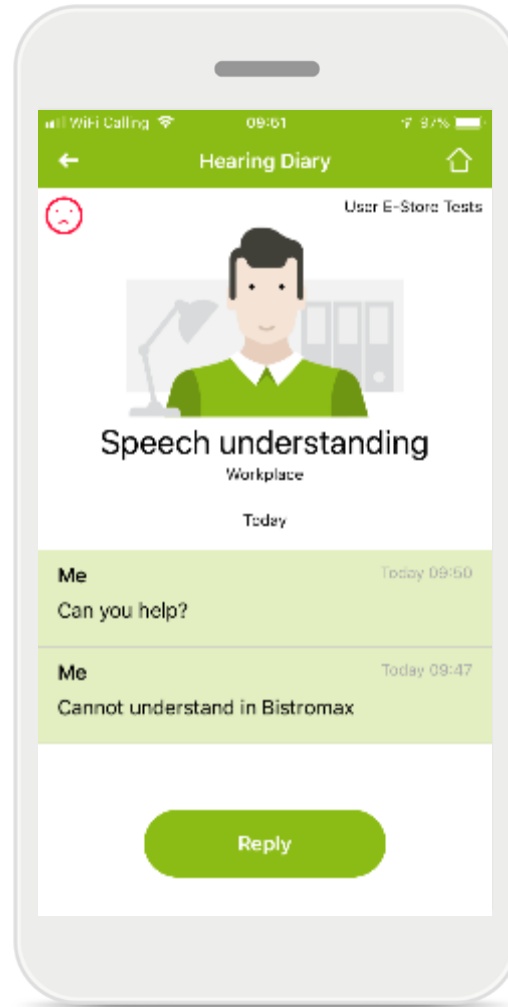
HearingDiary – Rating Hearing Experience



HearingDiary – Rated Topics



HearingDiary – Communicating with Audiologist



HearingDiary – Communicating with Audiologist

The screenshot displays the Hearing Diary dashboard for a client named Mibo. The main content area shows a list of feedback entries:

- Speech understanding** (Workplace): Rating Bad, Situation Workplace, Created 29.4.2019 - 9:47. Description: Mibo, Environmental Optimization 29.4.2019 - 9:47. Cannot understand in Bistromax.
- Speech understanding** (Watching TV): Rating Good (orange dot), Created 29.4.2019 - 9:50. Description: Mibo, Environmental Optimization 29.4.2019 - 9:50. Can you help?
- Sound quality** (Music): Rating Good (orange dot).

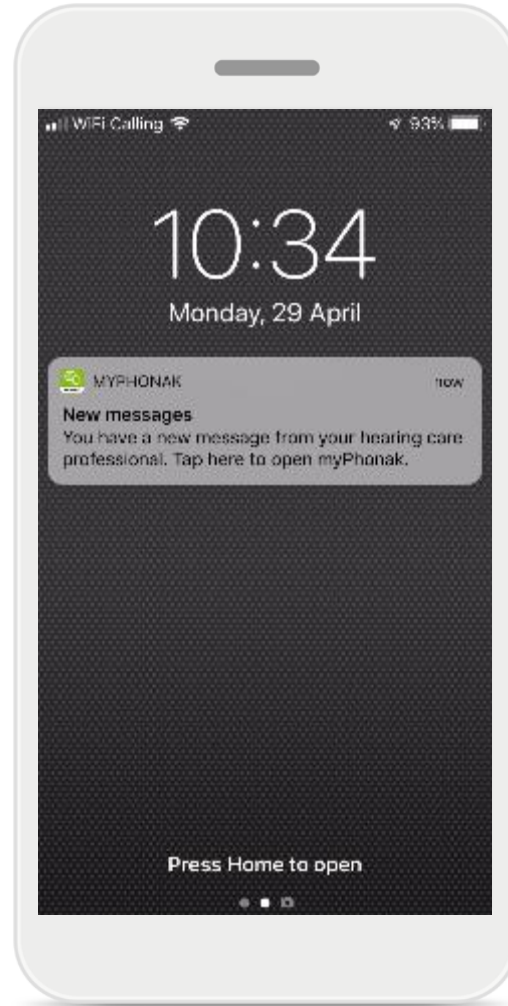
The selected entry is expanded to show a detailed view:

- Rating:** Bad (red sad face icon)
- Situation:** Workplace
- Created:** 29.4.2019 - 9:47
- Feedback text:** Mibo, Environmental Optimization 29.4.2019 - 9:47. Cannot understand in Bistromax.
- Response text:** Mibo, Environmental Optimization 29.4.2019 - 9:50. Can you help?

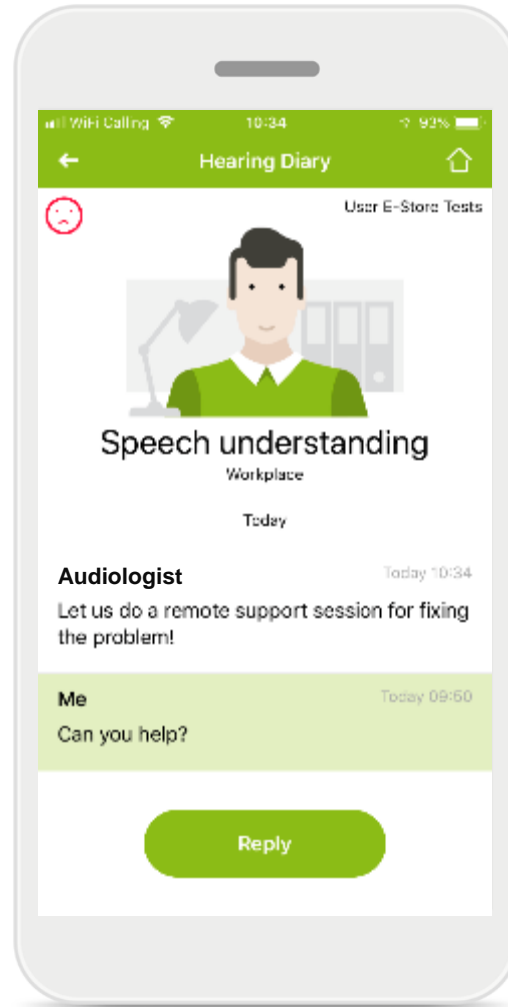
At the bottom of the expanded view, there is a text input field containing the message: "Let us do a remote support session for fixing the problem!" and a green "Send" button.

The dashboard sidebar includes the PHONAK logo, navigation links (Home, Products), and a "Feedback" section with filters (All, All topics) and a list of recent feedback items, each with a "ME" icon and the topic "Speech understanding" or "Sound quality".

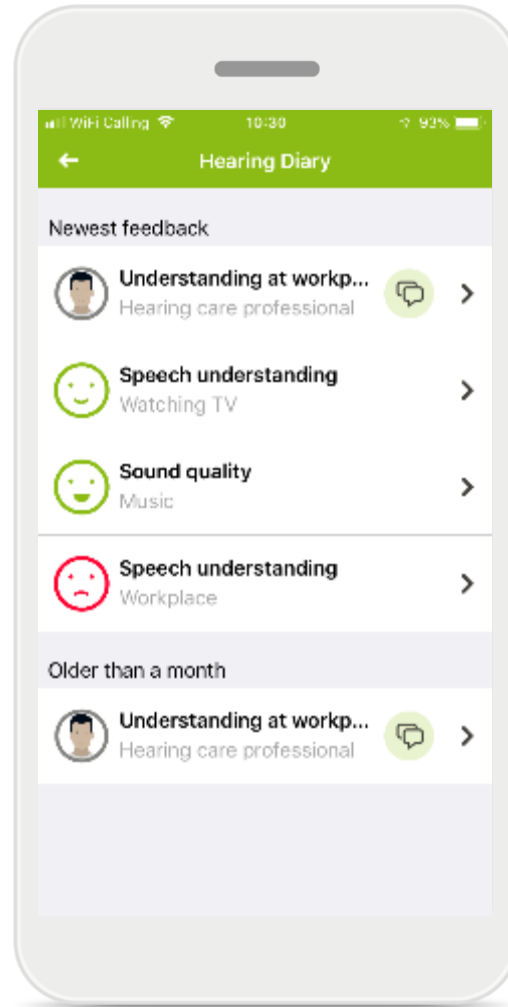
HearingDiary – Communicating with Audiologist



HearingDiary – Communicating with Audiologist



HearingDiary – Overview

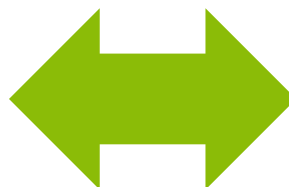


HearingDiary – Future

Compare aided hearing and with unaided hearing!
For experiencing the benefit of aided hearing!

Unaided hearing

Audible	✘
Distinguishable	✘
Localizable	✘
Recognizable	✘
Familiar	✓
Not too loud	✓

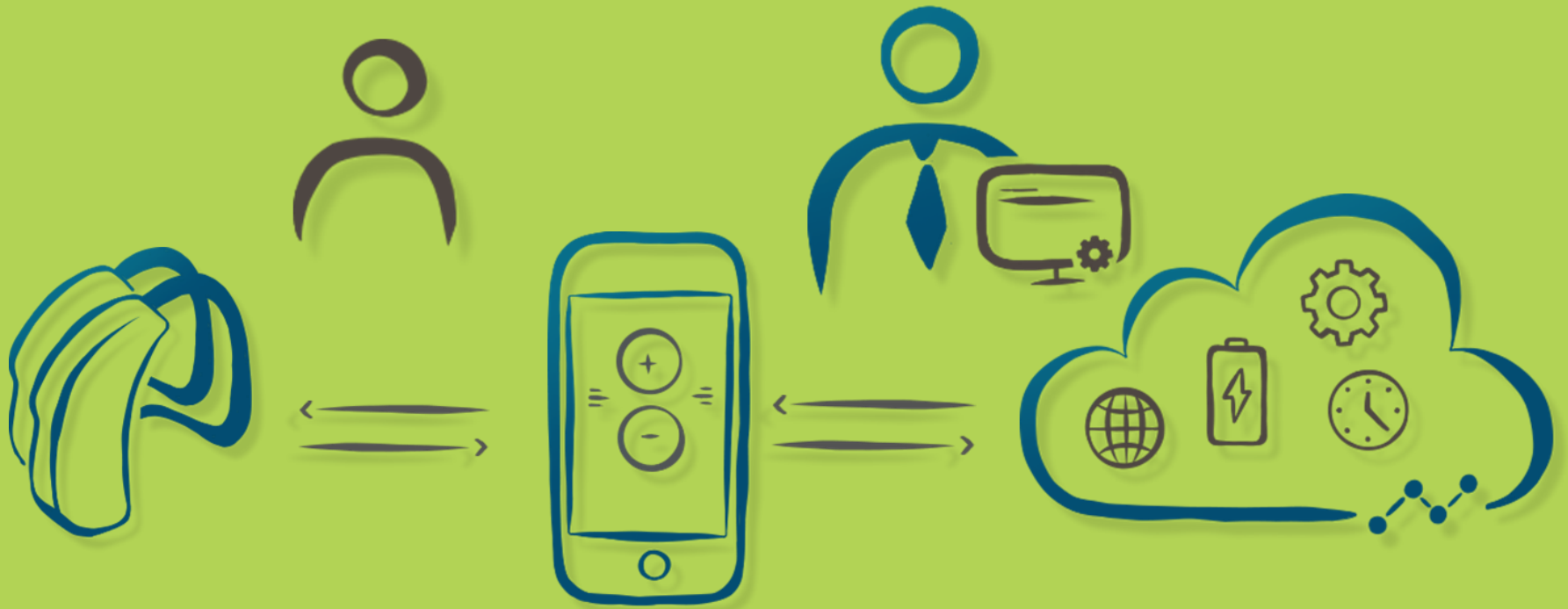


Aided hearing

Audible	+
Distinguishable	+
Localizable	+
Recognizable	+
Familiar	✓
Not too loud	✓

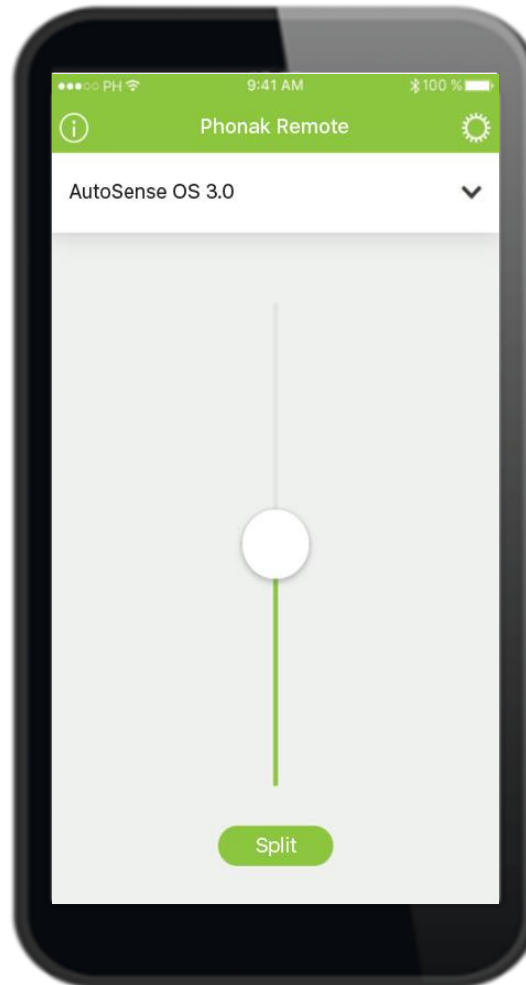
Ecological Momentary Assessment in Pediatric Audiological Care

- Real life validation of solutions?
- ...

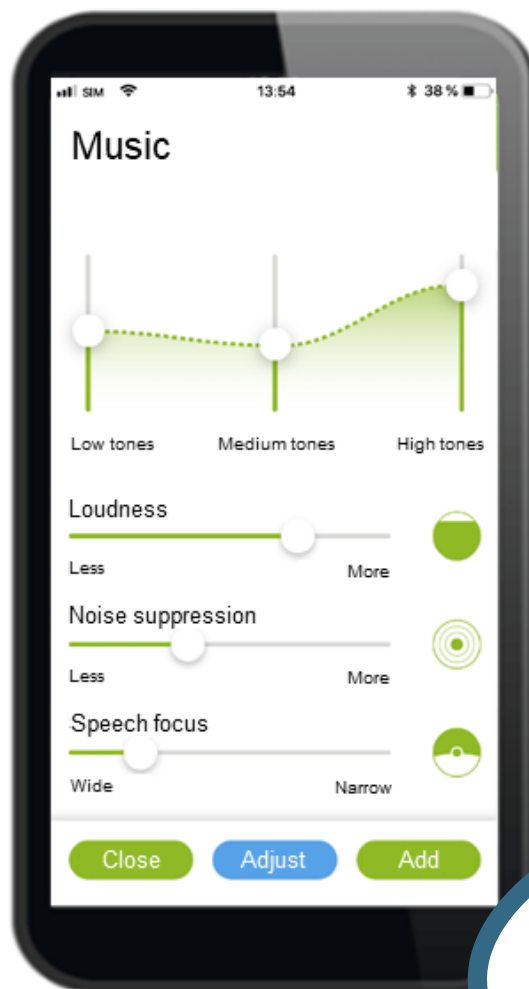


Collaborative Fitting

Remote Control



Extended Remote Control



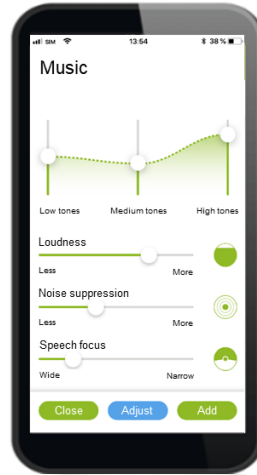
**This is one
of the
prototypes!**

Collaborative Fitting – with Extended Remote Control

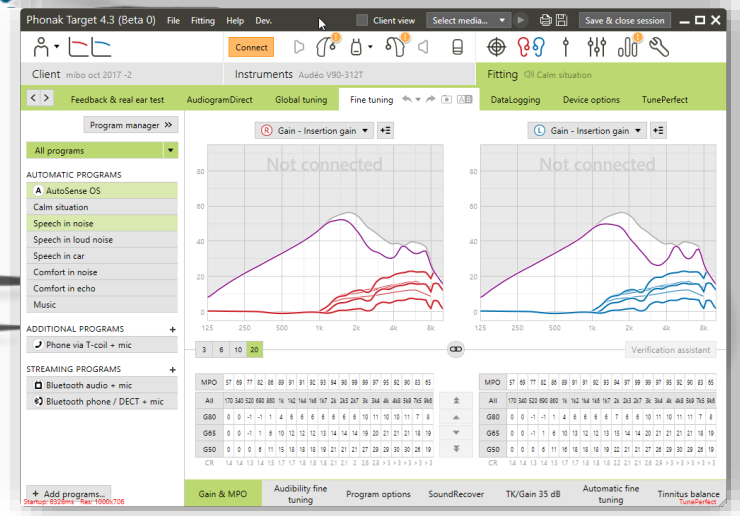


Collaborative Fitting – with Extended Remote Control - Prototype

User



Audiologist



Situation specific adjustment of

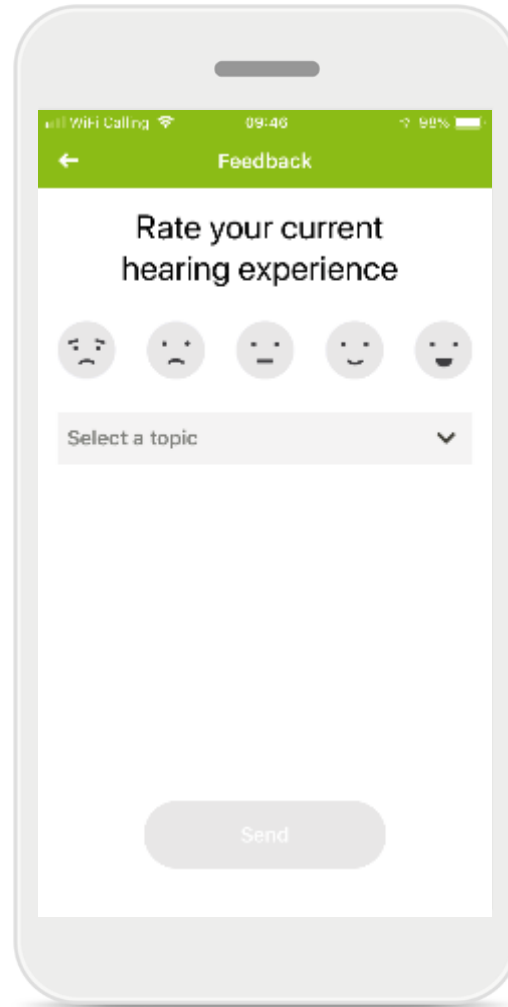
- Loudness
- Timbre
- Noise Suppression
-

Collaborative Fitting – Collaborative Optimization of Real Life Hearing

	Moderate speech	Loud speech	Soft speech	Speech in noise	Loud speech in noise	Soft speech in noise	Music	Loud music	Birds singing	Traffic noise	Construction noise	Alarm signals
Audible			+			+			+			+
Distinguishable	+	+	+	+	+	+	+	+	+			+
Localizable	+	+	+	+	+	+	+	+	+			+
Recognizable	+	+	++	++	++	++	+	+	+			+
Familiar	!	!	!	!	!	!	!	!	!	!	!	!
Not too loud	!	!!	!	!	!!	!	!	!	!	!!	!!	!!

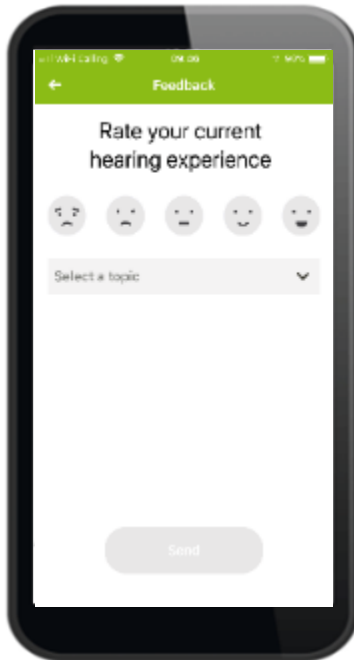
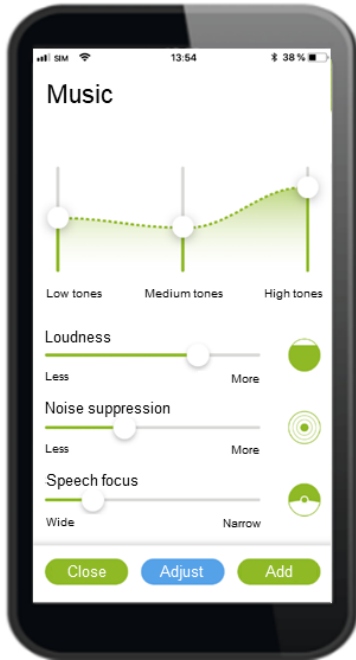
! = Quality kept + = Performance improved

Collaborative Fitting – Giving Feedback on Aided Hearing



- Real life metric
- Documentation
- Trigger for audiological care

Collaborative Fitting – Connected Tools



Phonak Target 4.3 (Beta 0) desktop software interface. The window title is 'Phonak Target 4.3 (Beta 0)'. The interface includes a menu bar (File, Fitting, Help, Dev.), a toolbar with 'Connect' and other icons, and a main workspace. The main workspace is divided into several sections: 'Client' (mibo oct 2017 -2), 'Instruments' (Audeo V90-312T), and 'Fitting' (Calm situation). Below these are tabs for 'Feedback & real ear test', 'AudiogramDirect', 'Global tuning', and 'Fine tuning'. The 'Fine tuning' section contains two graphs showing frequency response curves (125 to 8k Hz) with 'Gain - Insertion gain' controls. Below the graphs are two data tables for MPO, G80, G65, and G50. The bottom of the interface has a status bar with 'Gain & MPO', 'Audibility fine tuning', 'Program options', 'SoundRecover', 'TK/Gain 35 dB', 'Automatic fine tuning', and 'Tinnitus balance TunePerfect'.

MPO	57	69	77	82	86	89	91	91	92	93	94	98	99	99	97	95	92	90	83	65	
All	170	340	520	690	860	1k	1k2	1k4	1k6	1k7	2k	2k3	2k7	3k	3k4	4k	4k8	5k9	7k5	9k6	
G80	0	0	-1	-1	1	4	6	6	6	6	6	6	6	6	10	11	10	11	11	7	8
G65	0	0	-1	1	6	10	12	12	12	13	14	14	14	19	20	21	21	21	18	19	
G50	0	0	0	6	11	15	18	18	19	21	21	21	27	29	29	30	30	26	19		
CR	1.4	1.4	1.3	1.4	1.5	1.7	1.7	1.8	1.8	2.1	2.1	2.2	2.6	2.8	>3	>3	>3	>3	>3	>3	>3



Conventional Fitting versus Collaborative Fitting

Conventional



Collaborative Fitting



- A part of the fitting happens in real life
- User will earlier take over more ownership
- Shorter duration

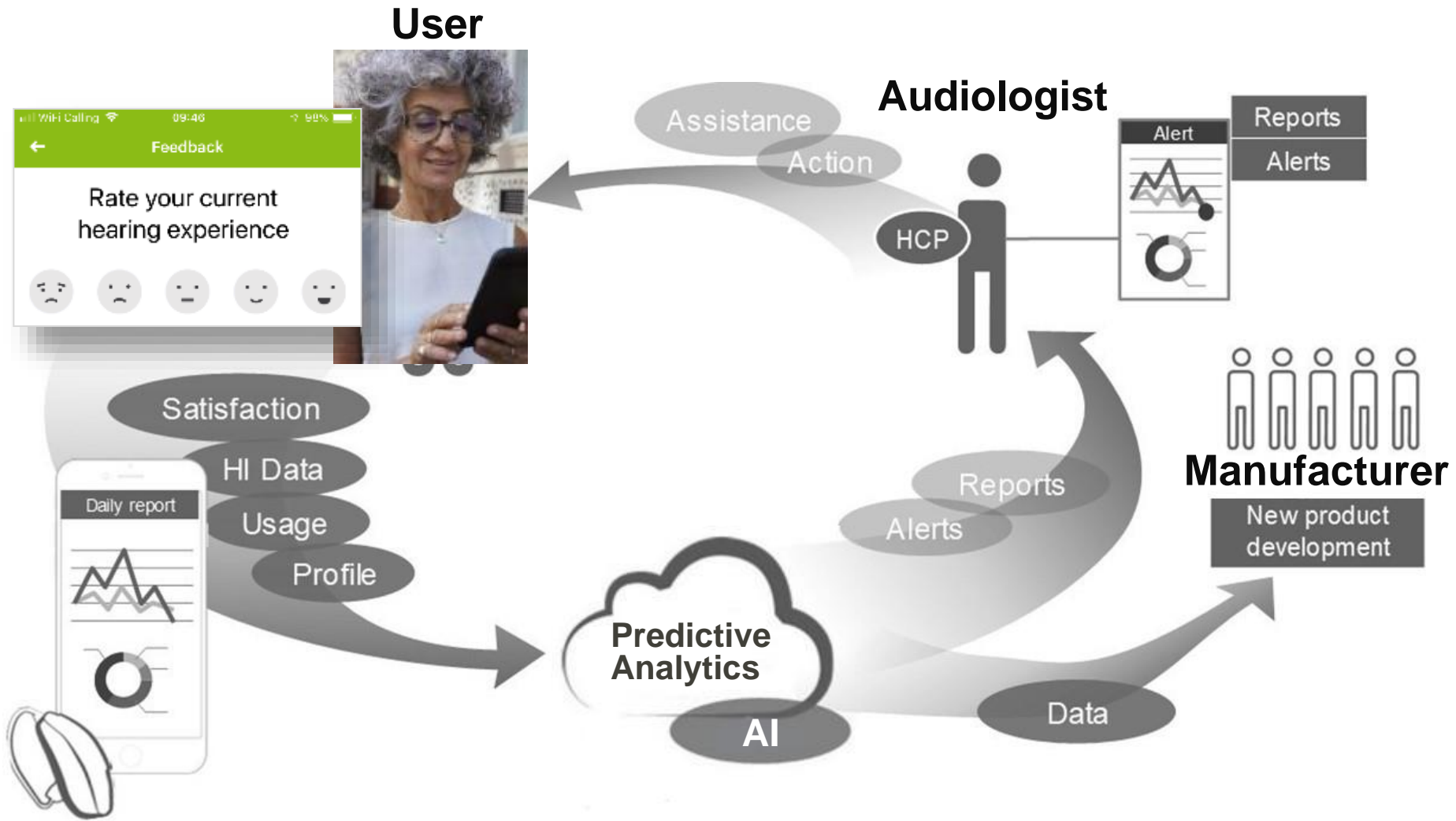
Collaborative Fitting in Pediatric Audiological Care

- Teenagers?
- ...



Predictive Analytics

Predictive Analytics for Better Hearing – Structure and Application



Predictive Analytics for Better Hearing – User Community

Users

- Hearing impaired users
- Audiologists
- Manufacturer

Success factors

- Understanding the purpose
- Willingness to share data
- Compliant usage of data
- Productive analytics



Predictive Analytics in Pediatric Audiological Care

- Evaluation of solutions?
- Sharing best practice?
- Quality management?
- ...

How to Use E-Technologies for Progress in Better Hearing – Summary

1. Better Hearing
 2. Remote Support by Audiologist
 3. Ecological Momentary Assessment by User
 4. Collaborative Fitting by Audiologist and User
 5. Big Data and Predictive Analytics
-

Thanks a lot for your attention!