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

<table>
<thead>
<tr>
<th>Audible</th>
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<th>Localizable</th>
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! = Quality kept  + = Performance improved
Making hearing better: Prescriptive Fitting, Validation, Managing Trade-Offs

Audible ✗
Distinguishable ✗
Localizable ✗
Recognizable ✗
Familiar ✓
Not too loud ✓
Patient Journey – Today and Tomorrow

Fitting distributed across roles, tasks, places

### Awareness
- Cloud & Mobile
- Hearing World

### Counselling
- CLINIC
- Screening and appointments

### Fitting
- Cloud & Mobile
- Mobile Evaluation
- Collaborative Fitting
- Remote Support
- Advanced Fitting by Audiologist

### Trial
- Use

**Hearing World**
Remote Support by Audiologist
Remote Support
Remote Support

Oklahoma City – San Antonio: 470 miles
Duration with car: 7 hours
Duration with public transport: 13.5 hours
Remote Support

User

MyPhonak App

Real-time

Audiologist

Fitting Software
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


- 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

Anne Smith is calling

- Accept
- Decline
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**

**User**

**Real-time approach**

Remote Support App

**Audiologist**

100% of fitting capability

**User**

**Asynchronous approach**

Self-Adjust App

No Real-time

Very limited fitting capability a/o additional tool for HCP. No direct response of user possible.
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

<table>
<thead>
<tr>
<th>Question</th>
<th>Without hearing aid</th>
<th>With hearing aid</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. When I am in the supermarket, talking to the cashier, I can follow the conversation.</td>
<td>ABCDEFG</td>
<td>ABCDEFG</td>
</tr>
<tr>
<td>2. I miss information when I attend classes, courses or talks.</td>
<td>ABCDEFG</td>
<td>ABCDEFG</td>
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<tr>
<td>3. Unexpected sounds such as car alarms are uncomfortable.</td>
<td>ABCDEFG</td>
<td>ABCDEFG</td>
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<tr>
<td>4. I have difficulties in hearing the conversation with my family at home.</td>
<td>ABCDEFG</td>
<td>ABCDEFG</td>
</tr>
<tr>
<td>5. I have difficulties to understand a dialogue in the cinema or in the theater.</td>
<td>ABCDEFG</td>
<td>ABCDEFG</td>
</tr>
<tr>
<td>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.</td>
<td>ABCDEFG</td>
<td>ABCDEFG</td>
</tr>
<tr>
<td>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.</td>
<td>ABCDEFG</td>
<td>ABCDEFG</td>
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<tr>
<td>8. Sounds from traffic are very intense.</td>
<td>ABCDEFG</td>
<td>ABCDEFG</td>
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<tr>
<td>9. When I am talking to someone in a large empty room, I understand the words.</td>
<td>ABCDEFG</td>
<td>ABCDEFG</td>
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<tr>
<td>10. When I am in a small room, asking or answering questions, I have difficulties to follow on the conversation.</td>
<td>ABCDEFG</td>
<td>ABCDEFG</td>
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<tr>
<td>11. When I am in a theater or at the cinema watching a play or a movie, people around me are whispering or crunching.</td>
<td>ABCDEFG</td>
<td>ABCDEFG</td>
</tr>
<tr>
<td>12. When I am talking in a low voice with a friend, I have difficulties to understand.</td>
<td>ABCDEFG</td>
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<tr>
<td>13. The sounds of running water, such as from the kitchen tap, in the bathroom are uncomfortable or intense.</td>
<td>ABCDEFG</td>
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<tr>
<td>14. When a speaker addresses a small group of people and I have to strain myself in order to understand.</td>
<td>ABCDEFG</td>
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<tr>
<td>15. When I am talking with my physician in the examination room, I can understand the conversation.</td>
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<tr>
<td>16. I can understand the conversation even when many people are talking.</td>
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<td>17. Construction work noise is uncomfortably loud.</td>
<td>ABCDEFG</td>
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<td>18. It is difficult for me to understand what the instructor is talking about.</td>
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<td>19. I can communicate with others while eating.</td>
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<td>20. The sound of a nearby TV interferes with my speech.</td>
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<td>ABCDEFG</td>
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<tr>
<td>21. I can follow the conversation on television.</td>
<td>ABCDEFG</td>
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<tr>
<td>22. The sound of the television is not too loud.</td>
<td>ABCDEFG</td>
<td>ABCDEFG</td>
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Ecological Momentary Assessment – Mobile Evaluation of Aided Hearing

Systematic hearing performance sampling using a mobile device
HearingDiary – Rating Hearing Experience
HearingDiary – Rating Hearing Experience

Rate your current hearing experience

Speech understanding
Choose the situation

Send
HearingDiary – Rating Hearing Experience
HearingDiary – Rating Hearing Experience
HearingDiary – Rated Topics

Newest feedback

Speech understanding
Watching TV

Sound quality
Music

Speech understanding
Workplace

Older than a month

Speech understanding
Watching TV
HearingDiary – Communicating with Audiologist

Speech understanding
Workplace
Today

Me
Can you help?

Me
Cannot understand in Bistromax

Reply
Hearing Diary – Communicating with Audiologist

Mibo, Environment...

Other

Speech understanding
Workplace

Speech understanding
Watching TV

Sound quality
Music

Speech understanding

Rating: Bad
Situation: Workplace
Created: 29.4.2019 - 9:47

Mibo, Environmental Optimization 29.4.2019 - 9:47
Cannot understand in Bistromax

Mibo, Environmental Optimization 29.4.2019 - 9:50
Can you help?

Let us do a remote support session for fixing the problem!
HearingDiary – Communicating with Audiologist
HearingDiary – Communicating with Audiologist

Audiologist
Let us do a remote support session for fixing the problem!

Me
Can you help?

Reply
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

![Remote Control](image)
Extended Remote Control

This is one of the prototypes!
Collaborative Fitting – with Extended Remote Control
Collaborative Fitting – with Extended Remote Control - Prototype

Situation specific adjustment of
- Loudness
- Timbre
- Noise Suppression
- ...
Collaborative Fitting – Collaborative Optimization of Real Life Hearing

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<th>Music</th>
<th>Loud music</th>
<th>Birds singing</th>
<th>Traffic noise</th>
<th>Construction noise</th>
<th>Alarm signals</th>
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<td>Audible</td>
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Collaborative Fitting – Giving Feedback on Aided Hearing

- Real life metric
- Documentation
- Trigger for audiological care
Collaborative Fitting – Connected Tools
Conventional Fitting versus Collaborative Fitting

**Conventional**

1. Fitting
2. Trial
3. Fitting
4. Trial
5. Fitting
6. Trial
7. Fitting
8. Trial
9. Completion

**Collaborative Fitting**

1. Fitting & Instruction
2. Trial & Fitting
3. Review & Fitting
4. Trial & Fitting
5. Completion

- 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

User

Predictive Analytics

Audiologist

Manufacturer

AI

Data

New product development

Reports
Alerts

HCP

Action
Assistance

Satisfaction
HI Data
Usage
Profile

Daily report

Feedback

Rate your current hearing experience

Report
Alerts

Daily report

PHONAK
life is on
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!