Audiological rehabilitation is more than amplification

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Communication is More than Hearing

The audiogram (audibility, hearing) only accounts for approx. 50% of the performance in difficult situations.

For successful communication in difficult situations besides audibility additional skills are required, e.g. attention and dynamic binaural processing.
Recent research (e.g. Sweetow, Wright, Moore, Tyler, Tremblay) indicates that auditory training is able to improve:

- Basic auditory skills
- Cognitive skills
- Speech understanding in noise
- Quality of life
- Satisfaction with hearing aid
- Return for credit

However: not often used, because time consuming and inefficient

Efficient and effective training method necessary
eARena – Hearing by Doing

“e” stands for modern electronics – in this case a computer-assisted training program.

“eAR” is the organ we rely most on for communications.

“AR” stands for auditory rehabilitation, which refers to the retraining of listening and communicating.

“ARena” represents the range of freedom and enjoyment of life that is regained.
Open Topics

- How many patients are willing to spend time and money for auditory training?

- Do PC-based training and personal training with hearing care professional provide the same benefit for the patient?

- Does auditory training facilitate the habituation to hearing aids (Acclimatisation)?

- Does auditory training improve enjoyment of life?
Audiological rehabilitation is more than amplification

- Introduction
- Methods
  - Study protocol
  - Auditory training
    - Personal training
    - PC-based training
- Results
  - Start interview
  - GHABP
  - SSQ
  - KAI
  - Quality of Life
  - Training questionnaire
- Conclusions
Methods – Study protocol

Subjects
- Group 1 (personal AT): 40
- Group 2 (PC based AT): 40
- Group 3 (control, no AT): 40
- 50% experienced / 50% first-time users
- Bilateral hearing loss and fitting
- Hearing loss:
  - 50% mild-to-moderate („Open“)
  - 50% moderate-to-severe („1-2 mm vent“)
- Data collected by 5 german dispensers (real world!)

Fitting
- all subjects were equipped with the same technology (Centra) and the most appropriate model (BTE only)
- NAL-NL1 acclimatization level 2 (~ NAL-NL1 -3 dB)
**Methods – Study protocol**

**Personal training**
- Start interview
  - OLSA (S0N90)
  - Freiburger (quiet)
- KAI
- SSQ*
- GPHAB*
- Quality of Life*

**PC-based training**
- OLSA (S0N90)
- Freiburger (quiet)
- KAI
- SSQ*
- GPHAB*
- Quality of Life*

**Control**
- Exit interview
  - OLSA (S0N90)
  - Freiburger (quiet)
  - KAI
  - SSQ*
  - GPHAB*
  - Quality of Life*

* Hand out to patients

**Timeline**
- Session 1: Pre-measures
- Session 2: Post-measures
- Session 3: Longterm effects
Who is KAI?

Kurzverfahren für allgemeine Basisgrößen der Informationsverarbeitung
(Quick assessment of basic parameters of information processing)

- Speed of processing (bits/s):
  - Time D required to read 20 independent letters
  - 1 letter = 5 bit → Information content = 100 bits
  - Processing speed = 100/D bit/s

- Memory span (seconds)
  - Number of characters (letters & digits) one can remember
  - Experimenter reads aloud 1 character per second

- Based on the concept of „fluid intelligence“
- Extensively evaluated
- Easy to administer (paper, pen, stopwatch). Takes 5 – 10 minutes

Methods – Personal Training

- Method used in this study is a structured approach developed by P. Speth and is applied by many German dispensers since years
- Four sessions (1 hour, 1 per week)
- Components:
  - Information about hearing and hearing loss
  - Exercises to increase awareness and motivation
  - Exercises to improve discrimination of everyday sounds with hearing aids („Hear memory“)
  - Exercises to train speech understanding
  - Practice communication tactics
  - Homework (speech understanding, detection, hear memory, communication tactics)
eARena Overview

- movies
  - Hearing and hearing loss
  - Benefits of modern hearing aids
  - Multimedia user guide

- auditory training
  - 20-day training curriculum
  - 5 days short version (trial phase)
  - extension >20 days possible
  - 30 minutes / day

- for end consumers at home

- or with assistance of the hearing care professional

- available on hybrid DVD-Rom
  - DVD player / TV
  - Computer

- currently available in English, French, German, Italian, Spanish
eARena Overview

- based on experiences from science and practice (Wright, Speth, LACE, Gatehouse, Tyler, Lehrl, Gebhardt, Moore)

- dynamic
  Difficulty level is user adaptive
  70% of all trials are correct

- easy to use
  No installation needed
  No special computer knowledge necessary

- relevant
  only everyday sounds are used
Methods – PC-based training (eARena)

Exercise types

- Loudness scaling
- Perception of everyday sounds
- Basic auditory skills
- Word recognition
- Timbre discrimination
- Speech in noise
- Cognitive skills
- Homework
- Tip of the day

Dynamic & individual

- Difficulty level is user adaptive
Audiological rehabilitation is more than amplification

- Introduction ✓
- Methods ✓
  - Study protocol ✓
  - Auditory training ✓
    - Personal training ✓
    - PC-based training ✓
- Results
  - Start interview
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## Methods – Study protocol

<table>
<thead>
<tr>
<th>Personal training</th>
<th>PC-based training</th>
<th>Control</th>
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<tbody>
<tr>
<td>Start interview OLSA (S0N90)</td>
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<th>Session 2: Post-measures</th>
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<tbody>
<tr>
<td>start</td>
<td>4 weeks</td>
<td>3 months</td>
</tr>
<tr>
<td>40</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>33</td>
<td>28</td>
<td>6</td>
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<td>27</td>
<td>25</td>
<td>4</td>
</tr>
<tr>
<td>25</td>
<td>24</td>
<td>3</td>
</tr>
</tbody>
</table>

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Comparability of subject groups

- very many open fittings (Life/Active)
- groups similar regarding hearing loss
- more experienced users in control group
85% are willing to spend time for an auditory training – as long as it is for free

45% are willing to pay for a personal training

29% are willing to pay for a PC-based training

Subjects with access to a PC with loudspeakers:
Female: 42%. Male: 58%
GHABP (Gatehouse 1997)
Glasgow Hearing Aid Benefit Profile

GHABP Start:
- Disability before intervention (initial disability)
- Impact on life before intervention (initial handicap)

Training groups with slightly higher initial disability and handicap
GHABP (Gatehouse 1997)
Glasgow Hearing Aid Benefit Profile

GHABP
after 4 weeks

Slight improvement of satisfaction with hearing aid for training groups
SSQ (Gatehouse and Noble 2004)
Speech, Spatial and Qualities of Hearing Scale

Improvement for control group!
- new hearing aids
- participation in study

Auditory training significantly improves hearing aid benefit with regards to subjective speech intelligibility
SSQ (Gatehouse and Noble 2004)
Speech, Spatial and Qualities of Hearing Scale

- Even more improvement for control group
- Personal training somewhat more beneficial for experienced users

![Bar Chart]

Improvement in SSQ score (CU)

- No training
- Personal training
- PC-based training

Experienced subjects

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SSQ (Gatehouse and Noble 2004)
Speech, Spatial and Qualities of Hearing Scale

- No improvement without training!
- Auditory training important in habituation phase
- PC-based training somewhat more beneficial for first time users
KAI (Lehrl, Fischer 1988): Processing speed

- slight improvement without training and with personal training
- clear improvement with PC-based training (due to dedicated exercises)
Improved quality of life more likely after auditory training.

- Personal training and PC-based training address different aspects of quality of life.

→ Consider combining both approaches.
Time is adequate for both training methods for the majority of subjects. Personal training too short for ~20% combination with PC-based training.
Training questionnaire
Thanks to the training, the habituation to the hearing aids was...

Auditory training facilitates habituation to new hearing aids
Considering everything, how much has your new hearing aid(s) changed your enjoyment of life? (IOI-HA)

Auditory training improves enjoyment of life!
Audiological rehabilitation is more than amplification

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<table>
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<tr>
<th>Use case</th>
<th>MIN</th>
<th>MED</th>
<th>MAX</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hand out eARena to customer for home training</td>
<td>• effective for many patients</td>
<td>• little additional effort</td>
<td>• value added service (premium products)</td>
</tr>
<tr>
<td></td>
<td>• no additional effort ➔ very efficient</td>
<td>• customer loyalty (additional sales / 2nd purchase)</td>
<td>• business opportunity (charge for training)</td>
</tr>
<tr>
<td>eARena home training &amp; monitoring of progress</td>
<td></td>
<td></td>
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<tr>
<td>Offer eARena-based training at shop</td>
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</table>
**eARena progress report**

**May 08**

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**eARena Hearing Exercises - Score**

Mrs. Ms. Sapp Chalupper - 10/01/2007 (Day 2)

The eARena hearing exercises have been designed so that you can use them on your own. This score is intended to help your hearing instrument professional judge your progress with the exercises.

<table>
<thead>
<tr>
<th>Exercise</th>
<th>SNR (dB)</th>
<th>Distinguishing similar words</th>
<th>Comparing duration</th>
<th>Comparing loudness</th>
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### Speech in noise

- **SNR (dB)**: Graph comparing SNR in quiet vs. in noise.
- **Distinguishing similar words**: Graph comparing performance.
- **Comparing duration**: Graph comparing duration.
- **Comparing loudness**: Graph comparing loudness.

### Comparing treble

- **Difference in timbre (dB)**: Graph comparing timbre.

### Comparing pitch

- **Difference in pitch (cent)**: Graph comparing pitch.

### Localization comparison (ITD)

- **ITD (ms)**: Graph comparing ITD.

### Localization comparison (ILD)

- **ILD (ms)**: Graph comparing ILD.

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Audiological rehabilitation is more than amplification

- How many patients are willing to spend time and money for auditory training?
  ➞ 85%

- Do PC-based training and personal training with hearing care professional provide the same benefit for the patient?
  ➞ Both training methods have positive effects on subjective speech understanding in difficult situations and enjoyment of life
  ➞ Effectiveness of methods depends on experience and varies for different aspects of quality of life

- Does auditory training facilitate the habituation to hearing aids (Acclimatisation)?
  ➞ Yes
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- Does auditory training improve enjoyment of life?
  ➔ Yes – but only with hearing aids

What you should take home:

- Communication is more than hearing
- New hearing aids and participation in a scientific study improve hearing aid benefit
- Combination of personal and PC-based training might be optimal

➔ Audiological rehabilitation is more than amplification