HEARING EVALUATION OF AUDITORY REHABILITATION DEVICES

hEARd IN CHILDREN

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BACKGROUND

The main goal of the project “Hearing Evaluation of Auditory Rehabilitation Devices (hEARd)” was to assess normative and comparative data on speech perception performances of children with hearing aids and children with CI.
Collected data should give an indication, from which level of hearing loss onwards a CI offers better speech perception and up to which level a child benefits adequately from hearing aids.

METHOD

TEST BATTERY

- Adaptive Auditory Speech Test (**AAST**) to assess auditory speech perception skills in children:
  - SRT in quiet
  - SNR in noise
  - SRT in high frequency phonemic test set
- Battery for the evaluation of listening and language skills (**BELLS**) to assess further auditory skills
- **Questionnaire** to assess participant’s audiological and personal information, most importantly unaided PTA values referring to WHO grading system of degree of hearing impairment

PARTICIPANTS

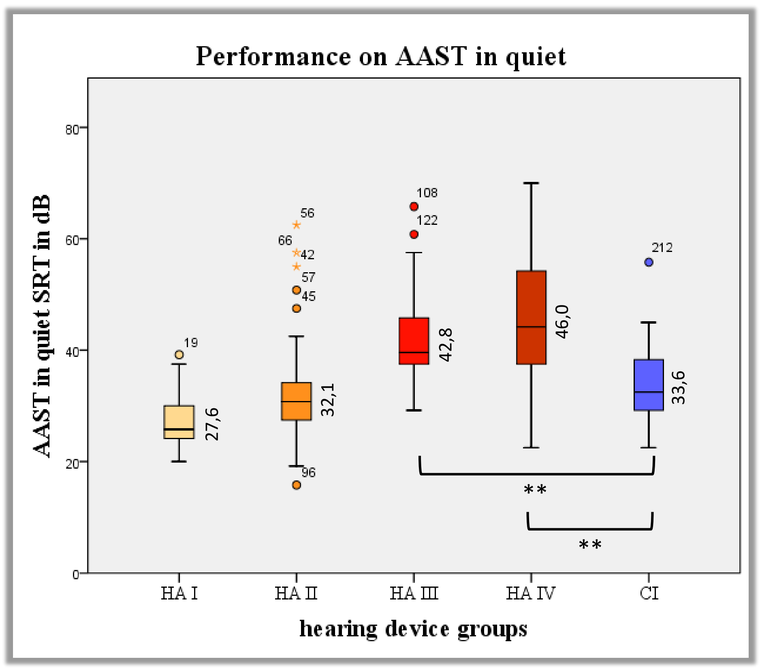
- Bilaterally hearing impaired children mainly at kindergarten and school age (AVG 8 years, SD 2 years) with hearing loss acquired within their first year of life
- No additional handicap that could influence test results
- Auditory communication environment

Group	PTA	HI	N
HA	<25 dB HL		2
HA I	25–40 dB HL	mild	21
HA II	41–60 dB HL	moderate	58
HA III	61–80 dB HL	severe	21
HA IV	>80 dB HL	profound	11
			113
CI	profound HI/deafness		107
			220

PARTNERS

- CIC Wilhelm Hirte, Hannover (CI center)
- Johannes-Vatter-Schule, Friedberg (school for the hearing impaired)
- Radboud UMC, Nijmegen (audiological center and CI center)
- Institut für Audiopädagogik/ Praxis der Ohrwurm, Solingen (auditory rehabilitation practice)
- Landesförderzentrum Hören und Sprache, Schleswig (school and rehabilitation center for the hearing impaired)
- Centrum voor Ambulante Revalidatie Sint-Lievenspoort, Gent (rehabilitation center for the hearing impaired)
- Audiologisch Centrum, Eindhoven (audiological center)
- Köttgen Hörakustik, Köln (hearing aid acoustician)
- Deutsche HörZentrum Hannover (DHZ) der HNO-Klinik der MHH, Hannover (ENT clinic)

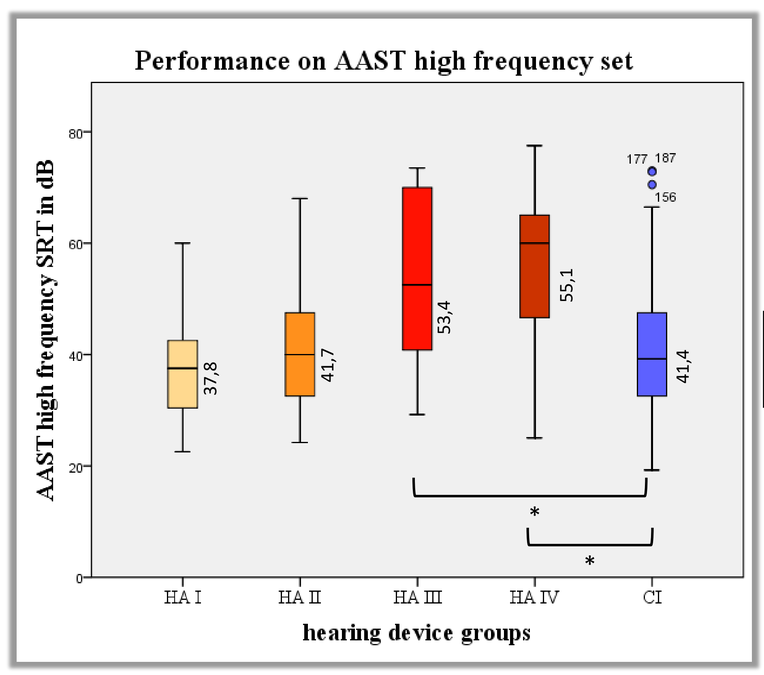
RESULTS OF UNILATERAL TESTINGS



Significant difference between CI group and HA groups III. and IV.

Better performance of CI group in comparison to group of hearing aid users with hearing losses greater than 60 dB.

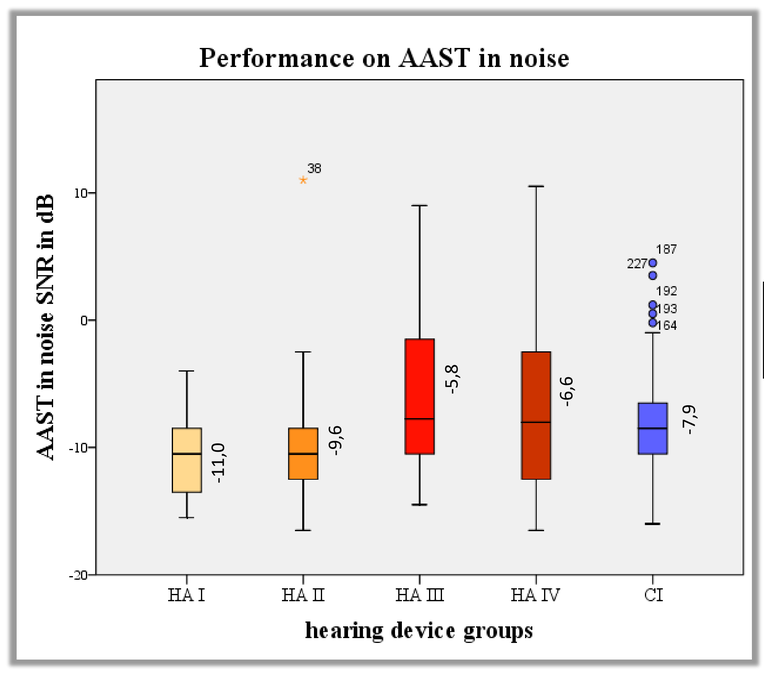
Figure 3: Comparison of SRT results of hearing aid groups and CI group for the AAST in quiet



Significant difference between CI group and HA groups III. and IV.

Better performance of CI group in comparison to group of hearing aid users with hearing losses greater than 60 dB.

Figure 4: Comparison of SRT results of hearing aid groups and CI group for the AAST high frequency set



No significant difference between CI group and HA groups III. or IV.

No significant advantage of unilateral CI use in comparison to groups of hearing aid users with hearing losses greater than 60 dB.

Figure 5: Comparison of SNR results of hearing aid groups and CI group for the AAST in noise

DISCUSSION

Outcome after CI in terms of auditory gain especially speech perception skills is not only beneficial in cases of profound hearing loss.

Results give prospect on possible outcome within decision making process for optimal technical hearing device.

Awareness of difficulty for unilateral CI users in noisy environment!

FURTHER ANALYSIS SHOULD INCLUDE

- Comparison of **unilaterally** assessed results to **bilaterally** assessed test results
- Comparison of results to speech perception skills on **“more complex” language level** (e.g. open set, sentences)
- Effect of **early intervention** and influence of **educational setting**

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Hearing Devices in Adults aged 50-90y with 50-90 dBHL

HD5090 in Adults

Frans Coninx

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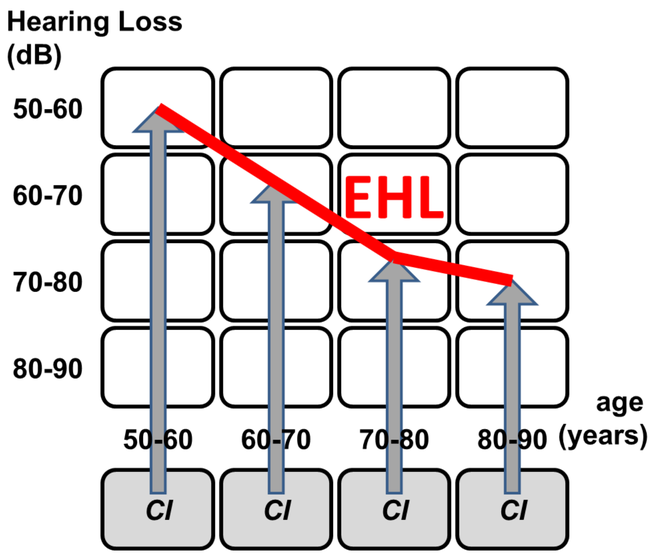
Background and Research Target

For persons with a hearing loss below 50 dBHL the acoustical hearing aid is the preferred Hearing Device. For hearing loss more than 90 dBHL this is in most cases the cochlear implant.
For the HL-range between 50 and 90 dBHL evidence-based reference data are needed.
The primary goal of the HD5090 project is to collect these reference data and compare the performance of hearing aid users with the performance of CI users.
The age range of these hearing device (HD) users is between 50 and 90 years; their Hearing Loss between 50 and 90 dB.

Equivalent Hearing Loss (EHL)

As in the hEARd project for children (Nekes et al, 2016) one practical outcome of the study is that the collected data will provide an evidence-based indication, above what degree of Hearing Loss (in dBHL) Cochlear Implants statistically are offering better speech perception as compared to hearing aids.



The degree of HL where CI offers the same or better hearing skills, is referred to as Equivalent Hearing Loss, or EHL (Snik et al, 1996).

Participants – 4 groups

The two main participants groups (1 and 2) are the hearing aid and CI users. For additional and “external” reference, data for the HD5090 test profile are also collected with participants from two additional groups (3 and 4), who are not using any Hearing Device.

Group 1 CI	Group 2 HA	Group 3 HI	Group 4 NH
Cochlear Implant user	Hearing Aid user	Hearing Loss but non-user	Normal Hearing
	50<HL<90 dB	30<HL<90 dB	0<HL<20 dB
acquired, bilateral hearing loss			---
Freefield testing		Headphone testing	
For all groups: • 50<age<90 years • no clear additional handicap or impairments			

Methods – Test Battery

The assessment of speech perception skills is focusing mainly on peripheral auditory skills. As a consequence, selected tests primarily measure on the word and phoneme level. Test procedures are also selected or adapted to be appropriate for daily use in practice.

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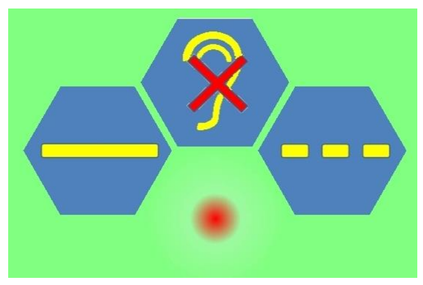
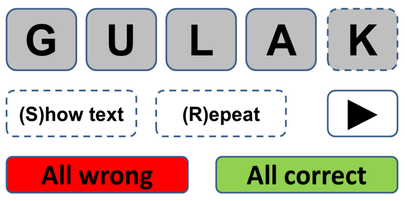
- **duoTone®** test for PTA Thresholds at 4 frequencies.
  Two PTA thresholds in an automatic adaptive procedure, total test duration < 2 minutes.



- the Adaptive Auditory Speech Test **AAST** in quiet and in noise. Also a high-frequency sensitive AAST version is included.
  Testduration 1 minute per condition (Qt, CN, IFFM, HF).
  Different language versions of AAST are being used.

- The **NAMES** test, measuring phoneme identification in meaningless word constructions.
  Results not only present a total score of correctly repeated phonemes, but also performance levels for selected subgroups of phonemes. f.i. friciatives.



- The **TRAAST** test, a Text Recognition version of the AAST test and based on the TRT test (Besser, Zekveld, Kramer et al, 2012).
  Besser et al report “TRTs and SRTs are robustly associated, nearly independent of age.” – creating options to isolate any central, cognitive-linguistic factors responsible for low performance in word recognition tasks like AAST.

- A **Questionnaire** to assess participant’s audiological and personal information.

Methods – BELLSbox

The BELLSbox is a plug&play unit for win8/10 systems, containing a high-quality soundcard, memory device with calibration files, BELLS software including AAST, duotone etc, storage of data in a database and ID-codes for software activation.

The full HD5090 test profile will be available within the BELLSbox and largely reduce calibration problems in (international) multi center studies, like HD5090.

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