



Hearing Evaluation of Auditory Rehabilitation Devices

The hEARd project aimed to quantify speech perception skills of hearing impaired children with different hearing devices. With the availability of Cochlear Implants for deaf children these skills have dramatically improved. No clear evidence based indication criteria for device type are available yet in most European countries, however CI is an invasive surgical procedure. In Europe diverse audiological standards are used and different language-dependent assessment instruments are available. Furthermore the incidence of moderate and severe hearing impairment is low. Research on national bases therefore is on small groups. hEARd specifically aimed to address these issues by the development of an intra-European Equivalent Hearing Loss standard for the speech perception abilities of hearing impaired children. The project entailed test construction, test adaptation and implementation of the software. A computerized auditory speech perception test profile was developed and carried out in German, Dutch, Belgian and Polish centers in order to develop a standard that compactly describes the auditory speech perception skills of hard of hearing and deaf children with various types of devices, on a functional level.

Initial project phase: Preparation

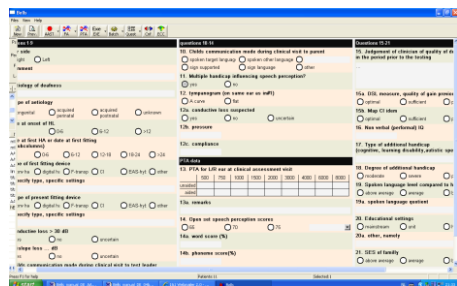
The preparation phase consisted of the recruitment of participating centers for the study. Audiological Centers at university medical centres, Speech- & language centers, schools for hearing impaired children, ENT clinics and Rehabilitation centers have been contacted, informed and requested for their participation in assessments (computerized listening games) in children. A kick-off workshop in Cologne has been organized in which 16 centers were represented. At this meeting new tests have been proposed, the test



protocol has been discussed and adapted to their ideas and requests. Furthermore, inclusion criteria (age range, type of hearing loss, type of hearing devices) for children were agreed upon. Finally the demographic data needed for post hoc analyses were determined. Based on the test protocol, the test construction and test adaptations were carried out. Word-material and pictures (language and culture specific) were selected or adapted when necessary and voice recordings for auditory stimuli have been made.

Adaptive Auditory Speechrecognition Test (AASST) screenshot

Software adaptations have been completed, a special network version of the software has been constructed and a data entry mask (see image) has been devised and programmed. This aimed to facilitate the collection of relevant demographical data by enabling swift entering. In this mask data of vocabulary, education, verbal reasoning skills, home language and much more has been included. This enabled the



Data entry mask screenshot

Main project phase: Implementation and assessment Project partners all have been visited several times, mostly by the researcher but occasionally (joined) by the project leader. During these visits staff was trained to run the assessments and to enter relevant data in the mask. In the centers the test software

construction of an elaborated database. Furthermore, the output of the information in the data mask allowed conversion to a spreadsheet program directly, which was beneficial for quick analyze purposes. Moreover, a procedure was incorporated in the software to ensure anonymous storage and transport of data (of participant and center). Based on these adaptations and agreements an English test manual was written. This has been translated into German and Dutch. A substantial calibration manual was made as this seemed a difficult procedure for audiologists/ technicians and other staff in the field.

was installed at computers for assessment. The software was calibrated on the speakers/audiometer of the specific setup in the center and the calibration procedure was explained. Concrete installation in situ led to several center specific requirements; Adaptation methods have been developed in order to establish hEARd test within existing audiological software programs. Adaptations of the software to enable testing with responses on tablets or touch screens, instead with a standard mouse, have been realized.

Final project phase: Data processing and analyses

Data comprising 250 assessments were available at the end of the project (31-08-13). The preliminary data have been presented end of May 2013, at the European Symposium on Pediatric Cochlear Implantation in Istanbul, Turkey.

The results show remarkable advantages for severely hearing impaired children with CI, as compared to those with moderate losses who use hearing aids. This seems to indicate that current indication criteria for CI (85 dB HL in Belgium and the Netherlands) are rather conservative. However variability is large. Furthermore, during the project data of speech perception in noise have been found to be closely associated with verbal reasoning skills.

Spin-off

A PhD student (Cologne) will carry out further analyses and continue to publish the obtained data. Several centers have incorporated AAST now as a standard instrument in their assessment protocols. Data that will be collected in the future will be made available for the hEARd database, hosted by the 'Institut für Audio Pedagogik' (IfAP), attached to Cologne University and will be processed by the PhD student. By the PhD student, based on the principles of the AAST, a Word Recognition in Sentences Test has been devised and preliminary norms for hearing children have been established.

A fixed level AAST (FLAST) has been developed that is used in 2 Dutch centers now.

MED-EL (Innsbruck, Austria) the only European CI company will start a project with AAST for adult hearing screening.

AAST has been considered for use in the Dutch National children's follow up system.

The data mask will be used in a study in Flanders, Belgium.

During the project two applications for EU projects in which the researcher and project leader were active, have been taking place (INTECHI and iCARE). Within this frame Educational Audiology (auditory based learning processes) has been focus of attention.

Impact and recommendations for auditory speech perception assessment in hearing impaired children in a European context.

A standard test protocol has been developed that was implemented in four European countries. Diverging types of centers (rehabilitation centers, universities and schools), such as Audiological centers, Centers for hearing, speech and language, Cochlear implant centers, ENT clinics, and schools for hearing impaired children contributed voluntarily. A large sample of children has been assessed. Relevant outcomes for CI candidacy have been found. Committed involvement in time and effort of many staff members supported this project achievement in a real European context.

In these different centers in Europe, and as well in each participating nation, little uniformity existed regarding audiological technical hardware, software and practice. Assessments and data storage were carried out in many different ways as well. Language differences (or knowledge of English as project language) were sometimes requiring a considerable extra effort. When one single person of a center was responsible for the project it sometimes led to vulnerability, which was not the case when the project had a broader support (of therapists/researchers) within a department.

As could be expected in a large multi-center project there were numerous different technical, procedural or personal factors involved in the assessments. These issues required creative and flexible solutions that were the result of a good cooperation between the center's staff, the researcher and project leader in a true exchange of knowledge and ideas between all European partners.