D1.1 Requirements analysis and current and future scenarios of digital games for hearing aids
30/11/2015

3D-games for TUNing and lEarnINg about hearing aids

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Abbreviations and Acronyms

3DTI	3D Tune-In
HA	Hearing Aid
WP	Work Package

Executive Summary

This is the public deliverable D1.1 of the H2020 project 3D Tune-In (3DTI - 644051). This work was carried out as part of WP1 Stakeholders' requirements, system concept and specification and in particular, tasks T1.1 Stakeholder engagement and T1.2 Requirements analysis and selection of use case scenarios.

These tasks aimed to engage with, and capture the experiences of, hearing aid (HA) users and the challenges they face in their everyday lives, as well as their experiences with their audiologist. Audiologists were also consulted to describe the processes by which they select and adjust HAs for their clients, and the effectiveness of these processes as well as the potential for improvement with the introduction of 3D Tune-In technologies and applications.

Following an introduction to the deliverable in Section 1, **Error! Reference source not found.** begins with a description of the first stakeholder group: eighteen people took part in a study to elicit the difficulties and issues they face in everyday situations due to their hearing loss. They also described how well their HAs perform in these different situations. Two methods were used in this study: questionnaires and paired interviews. These are both described, including the main types of information they collected. Each participant was asked to bring one friend or family member to the interview to account for the fact that communication does not happen in isolation; therefore the effectiveness and challenges of communication were examined from two different perspectives. The results from the study are summarised, describing the characteristics of participants in terms of their hearing loss; the frequency of their experience of specific contexts (and the importance of those contexts); their satisfaction with their HAs' performance in these contexts; communication problems they experience; their ability to hear sounds other than speech; and the frequency of, and reasons for, HA use in different contexts.

Section **Error! Reference source not found.** details the findings from the first study. The HA users most frequently wear their HAs in contexts with background noise (e.g. cafés or restaurants or walking along a busy road) in order to improve their chances of following a conversation in these contexts. They also use their HAs in quieter contexts in order to pick up quieter sounds and to more accurately follow a conversation. By far, background noise (i.e. understanding speech in noisy environments) is the biggest issue that HA users face, and they use many non-verbal strategies in order to overcome this issue. Their family and friends (without hearing impairments) tend to adapt to the HA users' needs by using strategies such as positioning, raising their voice and mediating conversations. Overall, it seems that HAs go some way towards improving hearing, however users were not satisfied with their performance in all situations, either because the HAs were not powerful enough, or because they did not know enough about how to use the different features in order to optimise the performance of their HAs.

Audiologists are the project's second stakeholder group and are the focus of Section 3. A questionnaire study was conducted with 20 audiologists to elicit information about processes and issues during the HA selection phase with clients and during sessions to adjust these HAs. The questionnaire results are presented to describe the selection and adjustment of HAs, checking the proper setting of HAs, connecting HAs to different devices, the potential for supporting HA fitting sessions using the 3D Tune-In concepts and technologies, and feedback from clients. Overall the audiologists were positive about the potential use of 3D Tune-In technologies to support the calibration of HAs; however they were most comfortable with clients using the technologies under their supervision.

Error! Reference source not found. presents the main themes and findings from the studies with the two stakeholder groups, represented as a set of six personas and eleven scenarios to describe the 'as is' or current experiences of these groups. The personas are descriptions of (fictional) typical users, such as adults and children with hearing difficulties, as well as their communication partners (who do not have hearing difficulties) and an audiologist, which are based on real stakeholder characteristics. The scenarios are descriptions of a user's typical daily activities and challenges in different environmental and social contexts, their HA use, and so on. The scenario representing an audiologist details typical activities (e.g. selection and adjustment of HAs) during appointments with clients. Personas and scenarios help designers and developers to understand typical users and their daily requirements and keep them in mind whilst developing technologies to better support these requirements.

Error! Reference source not found. presents five future scenarios which provide an initial description of how the 3D Tune-In applications/games could potentially help different stakeholders (that is, adults and children with hearing difficulties and audiologists) to fulfil their respective goals and needs, in terms of learning how and when to use different HA functionalities, or how digital games could be used to support HA calibration as part of, or following on from, sessions with an audiologist.

The future scenarios describe the initial ideas behind each of the five applications, including gamification elements, user interface requirements, interaction tools, game design and the different acoustic environments which could be represented in the games. The scenarios also detail the age group that each game is aimed at, the training goals of each game, a preliminary description of the tasks users will need to perform in the games, and how playing the games will help them achieve transferable benefits.

Future Scenario 1: 'Calibration/assessment for children' describes a main game with a series of mini-games which aim to teach children with hearing loss how to calibrate their HAs in specific contexts. This game could be played at home, with or without the guidance of an audiologist. If played as part of a scheduled training programme, a child's progress through the different levels of the game and their changing audio profile over time can be tracked by the audiologist.

Future Scenario 2: 'Listening to music' describes a game designed to be used at home, providing an exploratory landscape using binaural sounds to represent a multi-venue music festival. The aim of the game is to teach players that correctly using the different modes of their HAs could improve their hearing in everyday life.

Future Scenario 3: 'Calibration for the elderly - Hearing Aid Tuner' describes a game which can be played at home to enable people with hearing loss to understand the basic parameters that influence the quality of sound in different contextual situations (e.g. a restaurant with lots of people or a noisy street). In addition, the game can be used under the guidance of an audiologist in order to support discussions with clients and to help facilitate sessions on adjusting HAs.

Future Scenario 4 'Hearing loss education – Fallen Angel' aims to educate people without hearing impairments about hearing loss, raising awareness and empathy for people who do experience difficulties. The game simulates hearing loss and requires players to complete tasks based on their ability to hear sounds and instructions in different acoustic environments.

Future Scenario 5 'Calibration/demonstration of hearing devices using smart phones' describes an application that is specifically designed to link with HAs developed by GN-Resound. The application will allow GN to demonstrate specific functionalities of their HAs through a series of video games

and enable them to support end users in understanding the impact of these functionalities in their everyday life. It will also allow the end-user to help the audiologist to optimise the calibration of certain functions of the HA using a gaming approach.

Section 6 concludes the deliverable with a discussion of the results from the studies, challenges and next steps for the project.

For more information about the additional content included in this Deliverable, please email the project Coordinator, Lorenzo Picinali (l.picinali@imperial.ac.uk).