3D-Tune-In: 3D sound, visuals and gamification to facilitate the use of hearing aids

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Abstract
This is a short paper introducing an innovative approach using 3D sound, visuals and gamification techniques to support people with hearing devices to understand their many features and how to calibrate them in different real world situations (e.g. at a concert, in a restaurant, on a street, at a train station, in a classroom). 3D-Tune-In brings together the relevant stakeholders from traditional gaming industries (Reactify, UK; Vianet, Italy; XTeam, Italy; Nerlaska, Spain); academic institutions (Imperial College London, UK; De Montfort University, UK; the University of Nottingham, UK; University of Malaga, Spain); a large European hearing aid manufacturer (GN Hearing, Italy); and hearing Associations (Extra Care, UK; Hearing Link, UK; Action Deafness, UK; Accesibilidad y Personas Sordas, Spain and Ente Nazionale Sordi, Italy) to create 3D environments which will greatly improve people’s quality of life, generate new markets and create job opportunities.

Categories and Subject Descriptors (according to ACM CCS): 3D, sound, visualisation, virtual environments, digital games, gamification

1. Introduction
3D Tune-In “3D-games for TUNing and lEarnINg about hearing aids” is a three-year European project funded under the Horizon 2020 ICT work programme. Coordinated by the recently established Dyson School of Design Engineering of Imperial College, UK, it has nine university and industry partners from Italy, Spain and the UK, and began on 1 May, 2015.

2. Background to the project
Over 90 million people in Europe currently suffer from hearing loss, and due to an ageing population this number is likely to continue to increase. While hearing aid technologies have dramatically advanced in the last 25 years, people’s perception and use of these devices have changed very little. Hearing aids are now sensibly smaller, but incorporate several functions that go far beyond the simple amplification and equalization operation performed by the analogue devices (see Figure 1 below).

Nevertheless, this technological advancement is not always accessible or accessed by the hearing impaired population. The majority of individuals with hearing aids use the device as if it was a standard analogue hearing aid, i.e. only for its amplification and equalisation features, and new algorithms are under-used or not exploited to their full potential. Hearing impairment in older adults can lead to frustration, low esteem, withdrawal and social inclusion [W99]. Furthermore, in children hearing loss affects speech and language development that impacts on academic achievement and future vocational choices [Y03].

![Figure 1: Miniaturization from an analogue hearing aid (on the left) to a modern digital one (on the right)](image)

Traditional gaming technologies have been successfully employed in non-leisure scenarios for learning and skill acquisition, empowerment and social inclusion [DDD12]. In these scenarios, mechanisms such as game dynamics to ensure an adequate level of competition among the players, an effective reward system and a captivating storyline have proven to be effective elements to engage and motivate users [MG11]. The challenge is to facilitate the successful exploitation of existing, overlooked or neglected functionalities of hearing devices to optimize their potential thus greatly improving people’s quality of life, and their interactions with other people and their surrounding environment.

¹ Image from [www.hearinglink.org](http://www.hearinglink.org), last accessed 06/2015
3. The 3D Tune-In Project

The 3D Tune-In project will create an innovative toolkit based on 3D sound, visuals and gamification techniques tailored to different target audiences (e.g. older users and children). The consortium consists of relevant stakeholders from traditional gaming industries (Reactiv8, UK; Vianet, Italy; XTeam, Italy; Nerlaska, Spain); academic institutions (Imperial College London, De Montfort University and the University of Nottingham, UK; University of Malaga, Spain); a large European hearing aid manufacturer (GN Hearing; Italy); and hearing Associations (Extra Care, UK; Hearing Link, UK; Action Deafness, UK; Accesibilidad y Personas Sordas, Spain; and Ente Nazionale Sordi, Italy).

A participatory approach will be adopted to create virtual auditory and visual scenes that will:

- Enable end users to explore, review and customize hearing aid devices for different scenarios (e.g. at a concert, in a restaurant, on a street, at a train station, in a classroom, see Figure 2 below)

- Enable individuals with no hearing impairment to understand how hearing loss can compromise everyday activities, and how a hearing aid can improve this situation
- Enable Small-Medium-Enterprises (SMEs) in digital gaming to explore new non-leisure applications in the area of hearing loss and hearing aid technology with support from the scientific community
- Enable hearing aid providers to evaluate and demonstrate the various functionalities of their products using 3D technologies to improve their services and increase sales

The expected outcomes include: (i) Technology transfer between traditional SME game developers and broader research and industrial communities in 3D sound and virtual reality; (ii) 3D Tune-In Toolkit for development of further hearing aid-related technologies; (iii) 3D game applications; and (iv) Guidelines on the effectiveness of 3D and digital games on hearing loss and hearing aid technologies.

4. 3D Tune-In and VR

The 3D Tune-In project will employ acoustic and visual VR technologies in the attempt to transform the approach towards HA technologies of both stakeholders and manufacturers/sellers. A custom binaural 3D audio engine will be developed and implemented, including functionalities such as binaural reverberation, Head Related Transfer Function selection and hearing loss and hearing aid simulation. The 3D Tune-In binaural engine will be released with an open source license.

5. Preliminary results

The project kick-off took place at Imperial College London on 11-12 May, 2015 [WP15]. The project consortium discussed the state of the art in hearing devices and the potential 3D technologies and challenges within the project. In addition to the 24 participants from the project consortium an initial ‘User Requirements Workshop’ was organised by the University of Nottingham with representatives from the UK and Italian Hearing Associations. This workshop enabled us to identify relevant contacts, user groups and appropriate tools to select for the initial phase of requirements capture. The next 6 months will include questionnaires, interviews and focus groups with relevant stakeholders to support the appropriate design of the 3D-Tune-In.

6. Conclusion

3D-Tune-In provides a great opportunity, not only to make a real difference to many people’s lives now and in the future, but also opens up new markets to the virtual reality community. For more information please contact the 3D Tune-In coordinator Dr Lorenzo Picinali (l.picinali@imperial.ac.uk), or visit: www.3d-tune-in.eu.

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References


