Inclusion in Games, Extended Reality and Actual Reality
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Introduction

This essay summarises our current research regarding game accessibility and related issues, as input for the ICEC 2024 hybrid workshop. Thomas is a Senior lecturer (PhD), with two overarching directions of research. First, how to design games and related extended reality (XR) to be accessible and inclusive. Second, how to design game and XR technologies to make daily life activities in actual reality, accessible and inclusive. Marzia is a PhD student who recently started her studies within the second direction of research.

Inclusive and accessible game and XR design

Research about inclusive game design processes [1] explores ways to achieve inclusive co-design of games within the game industry, which is a challenge on many levels, both from an industry and a disability perspective. The paper is clearly related to games but as extended reality (XR) is often developed with game tools or by game companies, there is a clear connection to XR as well. Also, the paper overlaps between both directions outlined above, as it is both about making the work environment as well as games more inclusive. Below, three more studies focusing on the first direction only are presented.

An early activity in inclusive design processes can be to apply guidelines to avoid common pitfalls. Westin et al. [2] analysed the gap between accessibility guidelines for the web and for games. There was a clear gap found, which means that guidelines for both the web and games need to be considered for inclusive designs web-based games and XR.

Furthermore, to achieve inclusive design processes where people are involved in co-design, the tools to create XR and game content must also be made more accessible. One example of content creation, is free hand drawing tools with gaze control via eye tracking, which is explored in [3] for motor disabled people. The paper presents a novel way to achieve precise control with gaze interaction for drawing. Gaze control can also be used as a completely alternative input to control games e.g., EyeMine[1]. The solution in this paper, created by PhD student Lida Huang, opens up many new applications for more precise analogue gaze control, including games beyond the so-called dwell-click used in EyeMine.

Additionally, Westin et al. [4] focused on challenges and opportunities for DHH children in augmented reality games for educational purposes. The main result was a five-dimensional model of challenges with sign languages: cultural, multimodal, psycho-social, semantic and educational. The model explicates the need for international efforts with expertise in local sign languages, to enable a co-creation process with both DHH people and experts to enable inclusive game design, appreciated by both DHH and non-DHH people.

Inclusive and accessible daily life with game and XR technologies

Within the second direction of research, Mishra et al. (2023) presents a framework of challenges for motor disabled people for selecting solutions to address them. By using off-the-shelf inclusive gaming hardware and free software for remapping input in Microsoft Windows, it was possible to making visual tools used in education accessible for a severely motor disabled student. This raises awareness of how relatively low-cost and common

[1] https://www.specialeffect.org.uk/how-we-can-help/eyemine

hardware (consumer gaming controllers) can be utilized for inclusive education, but can be used also for selecting solutions for games.

A current project is called Platform for Smart People (PSP)[2], with results so far described in Westin et al (2024a, 2024b). The idea is to design and develop an inclusive platform with mobile augmented reality (AR) as assistive technology for adults on the autism spectrum and with medium-level intellectual disability (ID). With AR the real (actual) world can be augmented with information via personalised modalities (mainly visual, but also auditory, haptic), to make more sense of the actual world for people with ID/Autism. The solutions from this project can also be applied for AR games, for instance. with support to navigate indoors.

A related current project focus on non-visual interfaces, where eXtended Reality (XR) applications are particularly promising, offering immersive experiences that can facilitate social interactions where visual cues are replaced with other modalities such as tactile, auditory (adaptive music, binaural sound, physical audio), and even olfactory and gustatory feedback modalities. We are currently exploring integrating tactile and auditory feedback for the indoor navigation in the PSP platform, and how this can be applied to AR games.

Methodology

Design Science provides a framework where the solution to the research problems are new artifacts. Our research focus on design for all, with base in universal design principles and the 5P people-centred AT model to ensure our artifact is inclusive and accessible to the broadest range of users. By incorporating these frameworks, we are committed to creating solutions that accommodate diverse needs and capabilities, enhancing usability, accessibilty and inclusion for everyone in games and XR.

From a more technical perspective, developing accessible XR technology for disabled people, we pursue the requirements described in XR Accessibility User Requirements (XAUR). XR input modalities considered are e.g., voice command, voice dictation, touch, keyboard, switch, gesture, and/or brain-computer interface (BCI). For accessible outputs , we consider modalities of audio (e.g., music, positioned 3D) and different variations of tactile, force feedback, and vibration.

References

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[2] https://www.digitalfutures.kth.se/research/diversity-and-inclusion/platform-for-smart-people-psp-understanding-inclusion-challenges-to-design-and-develop-an-independent-living-platform-in-a-smart-society-for-and-with-people-with-autism/