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Disabled people's needs in virtual reality

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Abstract

We designed an online survey in order to question disabled people about their needs in virtual reality. The results of this study will be presented at the conference and discussed in light of the current state of research on this topic.

Keywords

virtual reality, human centered design, users needs, disabilities

Context

Recent research focuses on virtual reality as a new learning medium in higher education due to the development of immersive technologies and their decreasing cost [1]. However, if this technology represents new opportunities for learners, it also raises many questions about its usability, especially for users with disabilities.

In the literature, some studies are developing alternative adaptations to enable people with disabilities to use virtual reality. For example, Zhao et al. (2019) propose a set of 14 tools for low vision users allowing them to, among other things, modify contrasts or add text-to-speech [2], [3]. Agullo et al (2019) present in their paper a way to implement subtitles to 360° videos in virtual reality for people with hearing impairment [4]. Other studies propose accessibility guidelines applied to the design of games or systems in virtual reality [5], [6]. These various resources are essential but still insufficient for the design of accessible virtual reality systems because of the variety of interaction modalities and use among the disabled users population.

Furthermore, as far as we know, no study has directly studied the needs and uses of virtual reality by disabled people without focusing on a particular disorder (e.g. low vision).

Our research is part of the JENII project (Jumeaux d'Enseignement Numérique Immersifs et Interactifs – Digital Twin in Higher Education), funded by ANR (Agence Nationale de la Recherche – National Research Agency), which aims to develop a training offer via immersive and collaborative environments, by using virtual reality devices. We aim to include the diversity of users' abilities and preferences in the design of serious virtual reality

games. Our aim is to develop solutions that can be used by as many people as possible by proposing different interaction modalities and adapting the content.

In order to provide solutions adapted to the needs of as many people as possible, our design will not be oriented towards a particular disorder, but will aim to take into account the variety of forms of disability. In order to offer a solution that is as close as possible to the users' needs, we have oriented our methodology towards a user-centered approach [7], [8]. We will include users throughout the design process: from the needs assessment to final evaluation.

Our approach aims to detach ourselves from the deficit view of disability by asking the user about their usage preferences and needs, rather than basing the design on their impairments.

In line with user-centered design, the starting point of our approach is to identify the current uses of virtual reality users, in particular the disabled ones, and their needs in relation to possible usability issues of the system. This will allow us to guide the design of the system and to prioritize our actions.

Methodology

In order to ask people with disabilities about their needs we designed a survey that was distributed online (by email, social networks) to various associations and structures dedicated to people with disabilities. The distribution of an online survey will allow us to collect a larger number of responses than with other methods (e.g. focus groups or interviews) and thus obtain a broader representation of the population's needs. The survey was carried out with the software Limesurvey¹ which includes the necessary tools to ensure that the content was accessible (e.g. sufficient contrasts between text and background colors). In addition, questions were translated into FSL (French Sign Language) with videos.

This survey is composed of three distinct parts: (1) the respondent's life habits, (2) their current use of vir-

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¹<https://www.limesurvey.org/fr>

tual reality, and (3) their needs related to the usability of virtual reality.

The first part of this survey (1), will allow us to target the type of communication preferred by the respondents and some of the adaptations or technical aids they use on a daily basis (e.g. for travel or for the use of computer tools). This information will contribute to the definition of the different interaction modalities necessary for the use of virtual reality devices according to the user's preferences and abilities.

The second part of the survey (2) focuses on the adaptations or settings used by the respondents to optimize their use of virtual reality. This part will allow us to identify many of the functionalities that should be implemented in JENII.

Finally, the last part (3) will allow to identify the possible functionalities or adaptations currently missing in virtual reality. These results will guide the development of the necessary adaptation solutions to enable disabled people to participate in virtual spaces.

In order to facilitate the completion of the survey and the data processing, most questions are multiple choice questions. Some open-ended questions are included to allow respondents to specify concrete situations or to raise possible missed points.

The questionnaire is currently being disseminated, since may, for one month. At the end of the dissemination period, the responses will be analyzed. The answers will be studied jointly in order to formalize concrete problems and to answer them.

The definition of usage patterns, including the most used functionalities that should be integrated into the system, and the definition of missing functionalities will allow us to formulate recommendations adapted to our usage context.

Although the results obtained will allow us to orient the development of applications within the framework of JENII, the proposed approach is intended to be generic and adaptable to the various contexts of use of virtual reality.

The results of this study will be presented at the conference and discussed in light of the current state of research on this topic.

References

- [1] Radianti J, Majchrzak TA, Fromm J, Wohlgenannt I. A systematic review of immersive virtual reality applications for higher education: Design elements, lessons learned, and research agenda. *Computers & Education*. 2020;147:103778.
- [2] Zhao Y, Cutrell E, Holz C, Morris MR, Ofek E, Wilson AD. SeeingVR: A set of tools to make virtual reality more accessible to people with low vision. In: *Proceedings of the 2019 CHI conference on human factors in computing systems*; 2019. p. 1-14.
- [3] Zhao Y, Bennett CL, Benko H, Cutrell E, Holz C, Morris MR, et al. Enabling people with visual impairments to navigate virtual reality with a haptic and auditory cane simulation. In: *Proceedings of the 2018 CHI conference on human factors in computing systems*; 2018. p. 1-14.
- [4] Agulló B, Montagud M, Fraile I. Making interaction with virtual reality accessible: rendering and guiding methods for subtitles. *AI EDAM*. 2019;33(4):416-28.
- [5] Heilemann F, Zimmermann G, Münster P. Accessibility guidelines for VR games—a comparison and synthesis of a comprehensive set. *Frontiers in Virtual Reality*. 2021:119.
- [6] Mott M, Cutrell E, Franco MG, Holz C, Ofek E, Stoakley R, et al. Accessible by design: An opportunity for virtual reality. In: *2019 IEEE International Symposium on Mixed and Augmented Reality Adjunct (ISMAR-Adjunct)*. IEEE; 2019. p. 451-4.
- [7] Norman DA. *Cognitive engineering. User centered system design*. 1986;31(61):2.
- [8] ISO 9241-210, *Ergonomie de l'interaction homme-système – Partie 210: Conception centrée sur l'opérateur humain pour les systèmes interactifs*; 2019.