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Creating wheelchair-controlled video games: Challenges and opportunities when involving young people with mobility impairments and game design experts ☆

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ABSTRACT

Although participatory design (PD) is currently the most acceptable and respectful process we have for designing technology, recent discussions suggest that there may be two barriers to the successful application of PD to the design of digital games: First, the involvement of audiences with special needs can introduce new practical and ethical challenges to the design process. Second, the use of non-experts in game design roles has been criticised in that participants lack skills necessary to create games of appropriate quality. To explore how domain knowledge and user involvement influence game design, we present results from two projects that addressed the creation of movement-based wheelchair-controlled video games from different perspectives. The first project was carried out together with a local school that provides education for young people with special needs, where we invited students who use wheelchairs to take part in design sessions. The second project involved university students on a game development course, who do not use wheelchairs, taking on the role of expert designers. They were asked to design concepts for wheelchair-controlled games as part of a final-year course on game design. Our results show that concepts developed by both groups were generally suitable examples of wheelchair-controlled motion-based video games, but we observed differences regarding level of detail of game concepts, and ideas of disability. Additionally, our results show that the design exercise exposed vulnerabilities in both groups, outlining that the risk of practical and emotional vulnerability needs to be considered when working with the target audience as well as expert designers.

1. Introduction

Creating interactive technologies for people with disabilities can be challenging for designers: apart from ensuring accessibility, a crucial point in the design process is to anticipate needs and preferences of the target audience to create engaging experiences. To address this issue, research in Human-Computer Interaction (HCI) commonly applies participatory design (PD) as a means of directly involving end-users in the development process (Muller and Druin, 2009). Although PD has been widely adopted in the HCI community, and has been successfully applied to design assistive technology (Williams et al., 2014), recent discussions suggest that there may be two barriers to the successful application of PD to the design of digital games (Khaled et al., 2014).

First, the involvement of audiences with special needs can introduce new practical and ethical challenges to the design process. Because games must provide challenges to players in order to engender player motivation (Sweetser and Wyeth, 2005), designers of games for vulnerable user groups must gain an understanding of the types of activities that provide acceptable and interesting challenges to that group. Player abilities must be explored in order to create engaging experiences. However, when working with young people with disabilities, this may mean there is a necessity to explore attitudes around their disability, together with their sense of embodied self, potentially exposing vulnerability (Gerling and Linehan, 2014; Flintoff et al., 2008; Waddington et al., 2015). Yet, a lack of involvement of the target audience may lead to the development of technologies that do not meet their needs and preferences (Newell et al., 2011). Therefore,

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despite the risks it may introduce into the design process (Gerling et al., 2015b), PD is currently the most acceptable and respectful process we have for designing technology (Wright and McCarthy, 2008).

Second, there has been much criticism of the direct involvement of non-game design experts in game design roles (Khaled et al., 2014; Wyeth et al., 2014). For example, the relative lack of success of educational games has often been attributed to the reliance on pedagogical rather than game design expertise in designing those games (Bruckman 1999; Habgood and Ainsworth, 2011). Products and services that have been augmented with game-like features (Deterding et al., 2011), by designers who have no expertise in designing games, have been similarly criticised in the literature (i.e., Hamari et al., 2014). However, when working with game design experts on projects intended for people with disabilities, many will have limited experience of working with those groups (Porter and Kientz, 2013), increasing the risk of introducing implicit biases about disability into the design process (Foley and Ferri, 2012). In order to develop empowering experiences for this audience, it is important to not only understand players' perspectives on video games, but also to explore their perceived embodied identities, and how these relate to their wheelchair.

To explore how domain knowledge and user involvement influence game design, we present results from two projects that addressed the creation of movement-based wheelchair-controlled video games from different perspectives. The first project was carried out together with a local school that provides education for young people with special needs, where we invited students who use wheelchairs to take part in design sessions exploring their self-perception, views on wheelchairs, and gaming preferences. The second project involved game development university students who were asked to design concepts for wheelchair-controlled games as part of a final-year course on game design. None of these students used wheelchairs. Through a comparison of both projects, we explore perspectives on disability, the suitability of resulting game concepts for the target audience, and whether the design process exposed instances of vulnerability. Our paper makes the following three main contributions: (1) We provide the first qualitative enquiry into design processes addressing the development of games for audiences with special needs that compares outcomes achieved by potential players – young people who use wheelchairs – and game design experts. Our results show that concepts developed by both groups were generally appropriate and feasible examples of wheelchair-controlled motion-based video games. (2) We explore the representation of mobility disability in games from the perspective of game developers, and that of players with mobility impairment who use wheelchairs on a daily basis, providing insights into future avenues for game developers and games research. (3) We reflect upon how vulnerability of both the target users and the game development experts was exposed throughout the development process, providing insights into the emotional risks of participatory game design when working with and for audiences with special needs.

Developing empowering and engaging playful experiences for young people with disabilities is an important step toward a more inclusive game development community. Our work provides insights into the involvement of young people with disabilities and non-disabled experts in the process of game design, and contributes to a better understanding of PD for audiences with special needs.

2. Related work

This section summarizes perspective on participatory design in Human–Computer Interaction, participatory approaches when working with people with disabilities, and the involvement of players in the design of video games.

2.1. Participatory design in Human–Computer Interaction

An increasing number of projects in HCI introduce participatory design as a means of directly involving end-users in the development process (Muller and Druin, 2009). This is in contrast to user-centred design (UCD), the dominant contemporary approach to design, which defines a set of practices that places the end user as the focus of all design work, but often the end users are engaged in a way that is held separate from the creative design work. For example, users may be studied from an ethnographic perspective, or interviewed, or asked to evaluate various iterations of prototype solutions, or all of the above. Participatory design is a type of user-centred design that involves end users directly in the creative process of generating design solutions. Aside from being an effective method for meeting the needs of those users (Wright and McCarthy, 2008), the participatory process is intended to be an inherently empowering experience (Stewart and Bhagwanjee, 1999), especially for marginalised audiences such as children with special needs (Malinverni et al., 2014), who otherwise struggle to have their voices and stories heard. Indeed, past research has demonstrated the importance of the involvement of people with disabilities in the technology design process (Williams et al., 2014).

2.2. Involving people with disabilities in design

Newell et al. (2011) have suggested the adoption of *User-Sensitive Inclusive Design* in order to create technology that is not only accessible, but also useful. To this end, they outline the importance of improving empathy among designers to ensure resulting systems represent the interests of the intended target audience. Guha et al. (2008) propose a more differentiated view on user involvement when working with children with special needs, outlining that depending on the severity of disability, different levels of involvement (e.g., designing, or testing) need to be considered. Along these lines, Holone and Herstad (2013) reflect upon inclusion and participatory design, and identify challenges regarding user involvement and time constraints, participants' potential lack of experience of taking on an active role in the design process, and communication barriers that may be the result of complex needs.

While issues around communicating with persons with complex needs have been addressed through the development of alternative methods, e.g., facilitating participation and design through interaction (Larsen and Hedvall, 2012; O'Connor et al., 2006), other challenges such as empowering individuals to take an active role in the development process remain.

2.3. Participatory game design

Various attempts have been made to establish participatory design processes in the context of serious games (Khaled et al., 2014). For example, Khaled and Vasalou (2014) report on the design of Village Voices, a game for conflict resolution that was created with children as co-designers. In their work, the authors propose novel approaches to PD to facilitate the participation of young people, and demonstrate that children's input was most valuable during the middle stages of the development. Particularly addressing the design of interactive applications for young people with special needs, Anthony et al. (2012) explore the value of participatory design workshops to engage young people with learning difficulties. Findings highlight the importance of considering how participants communicate with one another, being aware of participants' individual backgrounds, and fostering inclusion through choice of accessible workshop materials. Along

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