

Social aspects in game accessibility research: a literature review

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ABSTRACT

Games and game-based applications are part of entertainment, learning, socialization, and many other daily life activities. They have become a key part of the social fabric of our societies, nonetheless, social aspects in games and game-based applications have received little attention, meaning that these game technologies often remain inaccessible to people with disabilities, especially within social use contexts. This study is a literature review of research on game accessibility (2016 -2020 inclusive) to investigate social aspects in game accessibility literature, The findings indicate the scarcity of research primarily investigating social themes. Individuals with disabilities differ in their social accessibility challenges and needs based on the type of disability they have. The lack of conscious research on social aspects of game accessibility threatens to further the exclusion of people with disabilities from gaming and related activities and this study provides directions for further research of social themes.

Keywords

Games, gamification, serious games, accessibility, disability, social aspects

INTRODUCTION

There are approximately 2.5 to 3 billion gamers in the world, i.e., half the world's population, according to relatively recent statistics (Nast, 2019). Of these individuals, at least a third experiences a disability that affects or fully hinders their use of games and game-based applications, (Moss, 2014). Paradoxically, however, games are becoming prime means of entertainment and a considerable part of many non-game activities such as learning, exercise or health management, through gamification, serious games, gameful design and many other game-based designs (Landers et al., 2016; 2018). While estimates of the number of users of these game-based applications are hard to come by, we can expect that they significantly increase the number of individuals, with or without disabilities, interacting with game design and its (in)accessibility through said game-based applications.

Consequently, researchers and practitioners have explored different ways to facilitate game accessibility to individuals with disabilities. Recently, Microsoft released Xbox accessibility guidelines and dedicated accessibility testing panels (Daws, 2021). Formal organizations, such as the EU and the World Wide Web Consortium (W3C) released accessibility standards and guidelines (Moreno & Martinez 2019). New advocacy groups have also emerged, such as AbleGamers, Can I Play That?, and IGDA Game Accessibility SIG, and a few, but notable game developers have released

accessible games such as Naughty Dog, releasing *Last of Us 2* and Ubisoft releasing *Assassin's Creed Valhalla*.

Most of this work has focused on solitary (single player) experiences of games. Playing games, or the use of game-based applications, however, is often a social activity or a part of a social activity. People, with or without disabilities, often play with others (multiplayer modes) or share their gameplay with others outside of the game by inviting outsiders to watch them play offline, or by streaming their gameplay online. While the social aspect of games and play are well-acknowledged and reflected upon in game studies (Hughes 2009; Quandt & Kröger, 2013), they are not as often acknowledged in the design and tailoring of games to people with disabilities (Gonçalves et al., 2020). There is a prevalent assumption (a misconception, even) that accessible games are special, often single-player games, designed for people with disabilities to play by themselves. The same assumption perhaps prevails in the context of game-based applications. While that assumption might be true to a certain degree, with certain games or application genres (e.g., single player, audiogames), many people with disabilities wish to play mainstream games, and to play and discuss their play with others. Accessibility challenges ought not to exist as barriers between said players and inclusion in game communities. The lack of attention to these social aspects around games and game-based applications are of need for attention to facilitate equality, equity, and inclusion in our societies.

This study investigates the extent to which social aspects of gaming and the use of game-based applications are reflected upon in game accessibility research, for what purposes, and what are some of the challenges already reported on in the game accessibility literature with regards to social aspects of using games and game-based applications. This study employs literature reviews methods to answer these questions and provide directions for future research.

BACKGROUND

To better understand what we are referring to when discussing (social) accessibility in games, some basic concepts need to be defined. The coming sections shortly define disability, accessibility, and game accessibility within the context of this study.

Disability

Disability is often defined and examined through two different, perhaps opposing, models of disability: the medical model and the social model (Haegele and Hodge 2016). The medical model understands disability as a phenomenon that leads to impairments in body functions. The social model understands disability as a social construct. According to the medical model a person with a disability is seen as lacking and in need of medical attention to alleviate their disability. Within the social model, the person with a disability is unique and valuable as they are, and it is society that creates their experienced disability challenges. Within the medical model, the aim is to “fix” the person with a disability, for example with the use of some kind of an assistive technology. On the other hand, in the social model, the aim is to redesign society and activities, for example, redesign buildings to be

accessible through ramps, to empower and include people with disabilities as they are.

There are also multiple types of disabilities, the most common ones are: sensory (e.g., auditory, visual), physical (e.g., mobility, motor), and cognitive (e.g., learning, reading and emotional) (WHO 2001). Disability can be temporal, permanent, or situational, for example, breaking an arm, would make a person temporarily physically disabled, compared to a person without a limb who can be considered, at least relatively, permanently disabled. The level of disability also varies from person to person, for example, a visually impaired person can have low vision, or be legally blind, colorblind, etc. The severity and form of disability also varies within these subcategories. For example, people with low vision can experience, for example, tunnel vision or far-sightedness, or other types of visual impairments.

Within this study, we adopt the spirit of the social model of disability in the sense that we argue for the social inclusion of players with disabilities in games and game-based applications. We argue that everyone should have an equal opportunity to play games or use game-based applications. The means for facilitating such inclusion, however, are not clear yet, although they are getting clearer by the day thanks to the advocacy work of many disability groups in gaming. It is, however, important to note the difference of applying the social model of disability, for example, within city planning, which is a public activity, subject to regulations, and applying it in the game industry, a competitive, industry that primarily aims at revenue generation rather than inclusion or social good. How, hence, can we facilitate social inclusion in such an environment where revenue generation rely on mass design & marketing, and the creation of games that provide engaging challenges rather than accommodations to players? Answering such question is beyond the scope of this review, however, we lay the grounds for it by investigating what research exists on social aspects and gaming.

Game Accessibility

Accessibility, in general, can be defined in several ways. It can be understood as an umbrella term for human functioning parameters. (Iwarsson and Ståhl 2003). It can stand for physical accessibility to buildings or digital accessibility to online tools. Accessibility can also refer to anything in between or combining the digital and physical. Commercially, within the gaming scene, accessibility, according to Sony is “The extent to which a facility is readily approachable and usable by individuals with disabilities.” (Sony Interactive Entertainment 2021).

Since games, and game-based applications. are nowadays an essential part of society, in this study, accessibility is defined as offering all people, regardless of disabilities, an equal opportunity to participate in society. Game accessibility removes participation barriers facing people with disabilities, often but not exclusively, within the parameters of game rules (Westin et al., 2018). Game accessibility implementation differs based on the disability, which dictates how the game can be made accessible. IGDA (2004) also provides a similar conception of game accessibility, seeing it through the lens of disabilities and defining it as “the ability to play a game even when functioning under limiting conditions. Limiting conditions can be functional

limitations, or disabilities such as blindness, deafness, or mobility limitations.”

Some definitions of game accessibility do not highlight disabilities, instead, they focus on making gaming more accessible to everyone with and without disabilities. “Game accessibility is about adapting a game’s hardware and software (such as game controllers, difficulty level, or feedback modality) to individual needs, regardless of having a disability or not” (Westin et al., 2011). “The goal of games accessibility is to bring the idea of accessible games (or games designed for all) to the mainstream and show different approaches” (Archambault et al., 2007).

Games are important to people with disabilities for the same reasons they are important to people without disabilities: entertainment, escapism, immersion, education, and socialization amongst other reasons (Alfredsson Ågren et al., 2020). Some experiences of isolation or social exclusion that may result from a disability can be especially alleviated with differently designed games, game-based applications, and social tools at large (Johnson & Kane, 2020). Games and game-based application can and are used in rehabilitations programs as they help alleviate pains during these activities (Rizzo & Kim, 2005). They are also used for larger, educational, exercise, or non-gaming purposes, as games nowadays are (e.g., Mason et al., 2019; Ulisses et al., 2018). Therefore, games and disability are closely connected, hence the need for game accessibility in all its forms.

METHODOLOGY

The goal of this literature review is to examine the extent to which and how social aspects are reflected upon in the game and game-based applications accessibility literature. Accordingly, we utilized a summarization of knowledge literature review approach that aims to broadly describe and analyze the literature (Paré et al., 2015), using thematic review and coding. A thematic literature review is a type of systematic literature reviews, focused on analyzing the literature under study qualitatively, according to themes of interest (Grant & Booth, 2009), i.e., social aspects in game accessibility research.

The literature search was performed during January 2021. Initial exploratory searches were conducted to determine the possible keywords to be used. Unqualified search words such as “disability” and “accessibility” unsurprisingly led to hundreds of thousands of results. However, another key challenge encountered during this exploratory phase was that researchers used different terms to refer to disabilities, including, impairments, special needs, people with disabilities, disabled, differently abled and many other terms. It was difficult to account for all these possible terms as it new terms kept coming up as exploration continued. It was clear that, as with any literature review, the keywords selected will not lead to exhaustive results as some terms will inevitably be excluded from the search query. In the end, to keep the scope of the research manageable, the focus of the review was set on the accessibility literature, rather than disability. Furthermore, the scope of the search was narrowed on games and game-based applications and narrowed again through a focus on a timeframe of five years, 2016-2020 inclusive (and January 2021). The employed search query was:

(TITLE-ABS-KEY (accessibility) AND TITLE-ABS-KEY (gam*)) AND (LIMIT-TO (PUBYEAR , 2021) OR LIMIT-TO (PUBYEAR , 2020) OR LIMIT-TO (PUBYEAR , 2019) OR LIMIT-TO (PUBYEAR , 2018) OR LIMIT-TO (PUBYEAR , 2017) OR LIMIT-TO (PUBYEAR , 2016))

The use of * in the search query is to account for all variations of the word “gam” such as: games, gameful, gamification, and so on. We used SCOPUS as our main search engine as it is a technology-oriented database where many relevant journals and conference proceedings are indexed. The search query yielded 1,156 results. These hits were screened according to the following criteria: 1) Language of the manuscript is English, Arabic, or Finnish, the languages that the authors are competent in. 2) Studies focused on the accessibility of games or any type of game-based application. 3) Studies focused on a disability (visual, auditory, cognitive, or motor). 4) Full text of the manuscript is accessible through the libraries of the authors’ universities, ResearchGate, sci-hub, or through the authors of the manuscripts being reviewed. Manuscripts not fulfilling these criteria as well as, posters, workshop and conference proceedings’ introductions were excluded from further analyses. Figure 1 presents a summary of the screening process.

The screening was conducted by one of the co-authors, an experienced game researcher, according to the previously mentioned criteria. The selected manuscripts were, next, coded by said co-author, based on the game design-related technology the manuscript reports on, type of disability, research methodology employed, and accessibility guidelines employed or contributed by the research, if any. Furthermore, the accessibility challenges noted in the manuscripts, as well as its findings and contributions, were noted and summarized. Next, these papers were further screened, with the focus of this study in mind, to extract the papers discussing social aspects in the playing of games and use of game-based applications. This screening was done through the scanning of full manuscript bodies for mentions of social aspects of gaming.

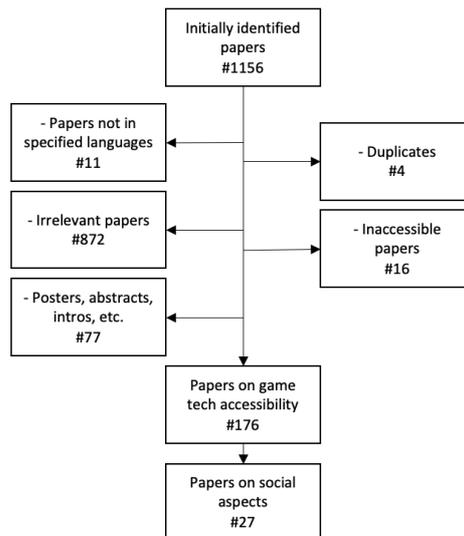


Figure 1: summary of the screening process

FINDINGS

Of the initially identified 1,156 manuscripts, 176 passed the outlined selection criteria in the methodology section and were further analyzed and coded. Of those, 27 manuscripts reflected on social aspects in games and game-based applications, whether as the main purpose of the research or as an emergent theme from the findings of research that was taking place. This, being an exploratory literature study, it did not focus on a certain definition for sociality or “social aspects” within the reviewed literature. Some of the literature reflected on social aspects of playing mainstream games with players without disabilities and the accessibility modifications to multiplayer games. Other research reflected on games especially made for people with disabilities, whether they play it with people with or without disabilities. Furthermore, this study also did not focus on a specific type, level or severity of disability but rather mapped existing research on the topic across all disabilities. The literature selected for further analysis is presented in Table 1, categorized by disability and social focus of the research.

Table 1: The reviewed manuscripts categorized by type of focus on social aspects and the disability examined

Disability type	Social interaction	
	Primary focus of study	Secondary focus of study
Cognitive disability	(Tzallas et al., 2019; Wasserman et al., 2019)	(Buzzi et al., 2019; Francillette et al., 2021; Sousa, 2020)
Visual disability	(Brusk & Engström, 2021; Gonçalves et al., 2020; Grabski et al., 2016; Johnson & Kane, 2020; Matsuo et al., 2017; Rocha & Escudeiro, 2018; da Rocha Tomé Filho et al., 2019; Ulisses et al., 2018)	(Andrade et al. 2019; Neto et al., 2019; 2020; Pereira et al., 2018; Schneider et al., 2018; Urbanek & Güldenpfennig, 2019)
Auditory disability	(Alvarez-Robles et al., 2020; Brusk & Engström, 2018; 2021; Ulisses et al., 2018)	
Mobility disability	(Graf et al., 2019; Mahdi et al., 2020)	(Mason et al., 2019)
Motor disability	(Bulgarelli et al., 2018)	
General	(Beckett et al., 2016; Cairns et al., 2019; Leite et al., 2019)	
Unique studies	17	10

The aims of these studies varied as presented in Table 2, with most of the manuscripts aiming at designing and evaluating an accessible game or a game-based application. A few of the manuscripts, as noted also by their authors, had more than one research aim, hence, some of the manuscripts appear more than once in Table 2.

Table 2: The research focus of the reviewed manuscripts

Focus of study	Studies	Total
Design and evaluate	(Brusk & Engström, 2021; Bulgarelli et al., 2018; Buzzi et al., 2019; Grabski et al., 2016; Graf et al., 2019; Johnson & Kane, 2020; Neto et al., 2019; 2020; da Rocha Tomé Filho et al., 2019; Schneider et al., 2018; Wasserman et al., 2019)	11
Provide accessibility recommendations / guidelines	(Beckett et al., 2016; Buzzi et al., 2019; Leite et al., 2019; Mason et al., 2019; Pereira et al., 2018; da Rocha Tomé Filho et al., 2019; Wasserman et al., 2019)	7
Design without evaluation	(Mahdi et al., 2020; Matsuo et al., 2017; Rocha & Escudeiro, 2018; Tzallas et al., 2019; Ulisses et al., 2018)	5
Understand the needs of people with disabilities	(Andrade et al. 2019; Cairns et al., 2019; Gonçalves et al., 2020; Mason et al., 2019)	4
Theoretical	(Alvarez-Robles et al., 2020; Leite et al., 2019)	2
Developers' studies	(Urbanek & Güldenpfennig, 2019)	1
Literature studies	(Sousa, 2020)	1

The types of games and game-based applications found in the reviewed literature were many as presented in Table 3. Digital games (focused on entertainment) are the most found game technology in the literature, followed by educational games. There, also, is an observed interest in play activities outside of the digital sphere, such as play, tabletop games, or sports.

Table 3: Types of games, game-based applications and play activities found in the reviewed manuscripts

Type	Studies	Total
Digital games	(Andrade et al. 2019; Bulgarelli et al., 2018; Cairns et al., 2019; Gonçalves et al., 2020; Grabski et al., 2016; Leite et al., 2019; Mason et al., 2019; Matsuo et al., 2017; Pereira et al., 2018; Schneider et al., 2018; Sousa, 2020)	11
Educational /learning games	(Alvarez-Robles et al., 2020; Beckett et al., 2016; Buzzi et al., 2019; Neto et al., 2019; 2020; Rocha & Escudeiro, 2018; Ulisses et al., 2018)	7
Tabletop games	(Gonçalves et al., 2020; Johnson & Kane, 2020; da Rocha Tomé Filho et al., 2019)	3
Mobile games	(Andrade et al. 2019; Brusk & Engström, 2021; Mason et al., 2019)	3
(Free) play	(Beckett et al., 2016; Mahdi et al., 2020; Graf et al., 2019)	3
Gamification	(Alvarez-Robles et al., 2020; Mason et al., 2019; Tzallas et al., 2019)	3

VR games	(Andrade et al. 2019; Wasserman et al., 2019)	2
Sports	(Graf et al., 2019; Mason et al., 2019)	1
AR games	(Andrade et al. 2019)	1
Audio games	(Urbanek & Güldenpfennig, 2019)	1
Exergames	(Mason et al., 2019)	1

DISCUSSION

Playing games, or engagement with game-based applications often involve social interaction, whether through direct interaction with other players and gamers or through sharing of game and play experiences with others inside or outside the digital sphere. The latter often manifests in discussions of the game or game-based activity and reflections on the experience with others. It is, hence, important to investigate how social aspects are considered when facilitating the accessibility of games and game-based applications to people with disabilities. While the number of identified manuscripts reflecting on social aspects in game accessibility is relatively small (27 manuscripts out of 176), more than half, almost two thirds, of these studies set out to purposefully investigate these social aspects. The observation that these themes also naturally emerged in research with another primary focus emphasizes the importance and intuitiveness of these themes for accessibility research.

Within the reviewed research, games are seen as a primary means of connecting with existing and new friends and families (Cairns et al., 2019; Johnson & Kane, 2020) and a means of facilitating physical health and activity (Mason et al., 2019)). They are used to develop the social skills of people with disabilities (Francillette et al., 2021; Mahdi et al., 2020) and to teach individuals without disabilities sign language for social inclusion purposes (Alvarez-Robles et al., 2020). Most of this research reflecting on social aspects in game accessibility was conducted with the aim of designing and evaluating an accessible game or game-based application. For example, Neto et al., (2019; 2020) designed and reported on the evaluation of an educational game designed for use by individuals with and without visual impairments. Implementing existing accessibility standards, in the case of said research, led to increased social inclusion and positive experiences amongst learners.

It is notable, however, that most of the research conducted with children with disabilities had the explicit aim of reflecting on social aspects in game accessibility (4 out of 6 studies with children in this review) (Brusk & Engström, 2021; Gonçalves et al., 2020; Mahdi et al., 2020; Wasserman et al., 2019). This is unsurprising given that play and games are considered one of the main means through which children are socialized, build friendships, learn, and develop into mature adults (Hughes 2009). Some of this research went so far as to emulated social interaction through robots to provide a level of simulated social interaction when children lack peers to physically play with (Mahdi et al., 2020). In one study, however, it was reported that children with down syndrome were more interested in social interaction with the researchers working with them, than in the game the researchers were evaluating (Buzzi et al., 2019), suggesting that perhaps human-to-human social interaction takes precedence over digitally or robot mediated play.

Contrary to research with children, social aspects were mostly emergent, rather than a primary focus, in research with adults with disabilities (e.g., Andrade et al. 2019; Mason et al., 2019; Neto et al., 2019; 2020; Urbanek & Güldenpfennig, 2019). Perhaps this age divide in the investigation of social aspects in game accessibility is due to a general difference in societal perceptions of the importance of play, games, and game-based applications between children and adults. For adults, play and gaming are sometimes, at least in some social circles, regarded negatively and mostly as an isolating, solitary activity. For some adults with disabilities, gaming has also been experienced as alienating due to the inaccessibility of most games and game-based applications (Anderson et al., 2021; Aguado-Delgado et al., 2020). It remains unclear whether it is that adults with disabilities who are not playing games socially, or whether it is research that is disinterested in investigating social gaming aspects with adults, compared to children, perhaps due to misconceptions about the importance of games and game-based applications to adults. Notable, however, is that research with adults without disabilities has long shown that games are a primary source of socialization for many (Quandt & Kröger, 2013), and that game-based applications are widespread and appreciated in adult education (Kapp, 2012), and even civic engagement (Hassan & Leigh 2021), which are “grown-up” social activities from which adults with disabilities should not be excluded. Research is, hence, encouraged to similarly reflect on social aspects of adults gaming with disabilities, whether the findings are positive or negative, and to provide recommendations that can facilitate equal access to services and experiences.

In terms of research on the different types of disabilities: games and applications for people with cognitive disabilities often involved designs that aim to reduce the cognitive complexity of these tools, making them relatively unattractive to neurotypicals. Accordingly, within the pool of available players on cognitively accessible games, there were reported difficulties in finding individuals at the same skill level, and with the same availability window to play with. Hence, adults with cognitive impairments often struggle with finding others to play with (Francillette et al., 2021). Hence, many games for people with cognitive impairments are designed for play with caregivers (Sousa, 2020). When well arranged, we see, e.g., a well-received game prototype where several children with cognitive impairments enjoyed social interaction with each other through a game, when they had an arranged peer group to play with (Wasserman et al., 2019).

People with visual impairments reported similar difficulties in playing with others, although for different reasons (Gonçalves et al., 2020). They reported interest in a large variety of mainstream games, nonetheless, the inaccessibility of these games, rather than the lack of players, is the challenge they face to using these games and to interacting with others through them. It is challenging for individuals with visual impairments to find games where they are at an equal playing field with other players. When such games are found, however, players with visual disabilities report feelings of enjoyment empowerment, and a leveled playing field with others in one aspect of life - playing of games (Cairns et al., 2019). These experiences are also reported with tabletop games, such as board games and card games (Gonçalves et al., 2020; Johnson & Kane, 2020; da Rocha Tomé Filho et al., 2019), although, within this context, the needs for inclusion are more pressing as these games

are more explicitly social. While digital games and game-based applications can be single-player, “multiplayer” is the inherent playing mode in most, if not all tabletop games.

People using wheelchairs reported a similar difficulty in finding especially AR and VR game-based applications that they could use for exercise purposes (Mason et al., 2019). They also reported, within the same study, that while some of the regular AR games are still playable with a wheelchair, they sometimes can be easily cheated on (e.g., by shaking your phone to mimic movements while sitting at home), which reduces enjoyment and shifts the focus of the gameplay from exercise when these tricks are discovered. Other times, gaming while using a wheelchair attracted unwanted attention and concern, which sometimes demotivated gamers from gaming outdoors. It, hence, remains difficult to find the balance across encouraging gamers using a wheelchair to go outdoors and exercise, finding solutions to prevent cheating on exergames, and allowing cheating when it suits the state the gamers are in (i.e., if they do not wish to go outside and deal with being constantly approached by strangers).

Finally, it is notable that this research was rarely conducted with developers and that it rarely acknowledged the game development side in examining social aspects in the accessibility of especially mainstream games. Only one study was conducted with developers (Leite et al., 2019). What is the developers’ perception of social aspects in gaming and how to make it accessible? What are some of the challenges developers face in designing and developing accessible multiplayer games? How could these challenges be alleviated? As such, it appears that a key stakeholder group in the process of developing accessible games and game-based applications is missing.

PRACTICAL IMPLICATIONS AND DIRECTIONS FOR FUTURE RESEARCH

Social aspects in gaming, e.g., the ability to play with existing friends, make new connections, or share gaming experiences with others outside of games, are important to people with disabilities, in the same way they are important to the larger community of players and gamers. In fact, it can be argued that for people with disabilities, who often experience social stigma, exclusion, and marginalization, social connection is of increased value, and games and game-based applications can be a major way to facilitate it. Hence, our examination of social aspects in game accessibility research.

Mainstream games and game-based applications should be made as accessible as possible to people with disabilities. We do recognize that some aspects of gaming and use of game-based applications do only happen in one modality, such as the playing of audio-based games or use of museum audio guides, nonetheless, every individual, with or without a disability should have an opportunity to decide for themselves whether they want to play a game or use an application rather than have that decision be made for them through exclusionary, inaccessible design that relies on single modality of play.

Commercially, social aspects in gaming have been considered, at least to a certain degree, in the newly published Xbox Accessibility Guidelines (2021), in the section titled “Communication experiences”. The guidelines focus heavily on one-to-one player interaction via chat and verbal

communication. The guidelines suggest that using speech-to-text or text-to-speech chat would solve some of the communication issues when it comes to deaf or hard-of-hearing, non-verbal, low-vision, or blind players (Xbox Accessibility Guidelines 2021). This recommendation appears sensible in line with the difficulties people with disabilities reported about social interaction in the reviewed literature. The guidelines are, however, solely focused on digital multiplayer games, ignoring a wider array of game genres and game-based designs.

On the research front, social, interpersonal aspects of playing together are relatively less reflected upon, as this literature review has shown. The focus of the accessibility literature largely remains on the design of accessible applications that fit the usability needs of people with disabilities, with relatively less consideration of the larger social contexts, within which people with disability are using these accessible games. For example, accessible educational games are important to maintain equal access to education, and we see research on designing accessible games (Buzzi et al., 2019; Neto et al., 2019; 2020), but it is relatively rare that this research would consider classrooms as social spaces. Would people with and without disabilities be able to play the same game with similar enjoyment and educational value? Or would people with disabilities be sentenced to play an accessible game alone, without their classmates if they are not to miss this on educational altogether?

This leads us to the discussion of another challenge reported on in the accessibility literature, which is that people with disabilities might struggle in finding people to play with, especially those who are at a similar skill level as one another (Francillette et al., 2021). This challenge perhaps exists due to, as previously mentioned, how accessible games are evaluated in terms of their fit for use to people with disabilities, but not in terms of their fit for use in a social context where people without disabilities are also present. Intuitively, for example, games with reduced graphics to suit people with a visual impairment might not appeal to individuals without visual impairments, creating this observed lack of a large player base on accessible games. Accordingly, we encourage future researchers to investigate accessible designs that appeal to both, people with and without disabilities simultaneously.

We also encourage the exploration of alternative methods to emulate the presence of human players on accessible games, for example through AI, as seen in e.g., chess games. AI also has the advantage of being able to automatically adjust gameplay difficulty levels based on the skill of the human player. AI can also be given a personality and quirky behaviors for increased realism. All of these are examples of avenues for investigating AI in game accessibility. Nonetheless, human presence in games and socialization would be of especially high value, that is hard to replace with an AI that players know is not real.

In the reviewed literature, we found very few studies reflecting on mainstream gaming and how players with disabilities experience playing a mainstream game, or the kind of adjustments they need to especially play multiplayer games on an equal ground to everyone. Social experiences, positive and negative, associated with mainstream gaming, such as feelings of increased accomplishments when beating a player without a disability, or experiences of bullying, are not largely discussed, at least in the reviewed research. Nonetheless, we wish to highlight that people with disabilities are,

arguably, bound to be present in social mainstream games and use mainstream game-based applications, given that a third of all gamers in the world experience a disability (Moss, 2014). Accordingly, we encourage future researchers to reflect on social gaming experiences for people with disabilities on mainstream games and game-based applications.

STUDY LIMITATIONS

This study is a literature review study. As such. It is inherently limited by the search query, keywords, and database employed in finding the literature to review. While we aimed to use as wide a search query as reasonable, the query was limited to publications within 2016 to 2020, inclusive (and January 2021). Even within this timeframe, it is inevitable that we failed to identify relevant research on social aspects in game accessibility research or made human errors in the screening and coding of the identified research. We encourage future researchers interested in using a similar literature review method, to investigate more databases, using different search strings, and within a larger timeframe. This research, like any other, is prone to human error. While the screening, analysis, and coding of the studied literature were performed by an experienced researcher, errors still could have occurred.

CONCLUSION

This research investigated social aspects in games and game-based applications accessibility research. It was conducted through a literature review that identified 27 papers on the subject within 2016 to 2020 inclusive. The literature indicates that social connection through games and game-based applications is essential to people with disabilities, however, there are different challenges in facilitating that type of interaction based on the type of disability that individuals have. Increased effort is needed in designing games and games-based applications that allow for social gaming and use, rather than developing accessible technologies to be used by people with disabilities in isolation. Such solutions are often being developed, mostly in the context of tabletop games, where the presence of disability in the room is relatively harder to ignore. Digital interaction hides disability and as such, more research is needed around the social implications of playing especially mainstream games with a disability, in terms of inclusion, bullying and other interpersonal aspects beyond the technical facilitation of access.

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