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LONG PAPER

Audio description in video games? Persons with visual disabilities weigh in

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Abstract
In recent years, important advances have taken place to improve game accessibility for all types of players. However, audio description (AD), the access service that translates images into words, is yet to be widely implemented in mainstream games. This paper presents part of the results of the Researching Audio Description Project: Translation, Delivery and New Scenarios (RAD). One of the main objectives of the project is to investigate the potential inclusion of AD in video games in order to improve their accessibility and to contribute to a more enjoyable experience for persons with visual disabilities. First, the evolution of game accessibility is discussed, including the latest developments in the field, both from the industry and research perspectives. Secondly, the RAD Project is presented. Thirdly, the data collected from a survey addressed to blind and low vision persons in Spain is described, for which 106 valid answers were received. Survey topics include the game accessibility barriers encountered by participants, their desired solutions, and their interest in the potential application of AD. Finally, results are discussed regarding similar studies, limitations, and future research. Survey participants are interested in including AD in video games, particularly in non-interactive sections such as cutscenes. Other pressing issues for the game industry regarding accessibility are improving screen reader compatibility, enhancing sounds, and exploring the technical feasibility of game AD in real-time action.

Keywords Audio description · Game accessibility · Survey · Visual disability

1 Introduction

Video games have become a worldwide phenomenon, generating 196.8 billion dollars in revenue in 2022 [1]. People play video games for very different reasons, such as to feel new emotions and escape their everyday life, to face challenges, to interact and compete with others, and to relax and enjoy themselves [2]. Video games are also increasingly being used for purposes beyond entertainment, such as learning, training, and rehabilitation [3]. However, not everybody can enjoy the benefits associated to playing video games, as most mainstream commercial games are not fully accessible. In particular, persons with visual disabilities are the ones who encounter more accessibility barriers due to the interactive and visual nature of the video game medium [4].

The ultimate goal of game accessibility is to ensure access to gaming to the widest possible population. It has been bourgeoning in recent years, as developers are becoming more aware of the need to make their games more accessible, and (dis)abled players are becoming more vocal about their interest in games. Important advances have taken place to improve game accessibility for persons with visual disabilities, such as the integration of audio cues and text-to-speech technology. However, audio description (AD), the access service that translates images into words, is yet to be widely implemented in mainstream games.

In this paper, we present part of the research carried out in the Researching Audio Description Project: Translation, Delivery and New Scenarios (RAD) [PGC2018-096566-B-I00 (MCIU/AEI/FEDER, UE)]. One of its main objectives is to investigate the potential inclusion of AD in video games in order to improve their accessibility and to contribute to a more enjoyable experience for persons with visual disabilities. First, we present a definition of game accessibility and

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the latest advancements in this field, both from the industry and research perspectives. Secondly, we present the RAD project and its main objectives regarding game accessibility. Thirdly, we describe the research methods and analyse the data collected from a survey addressed to blind and low vision persons in Spain, for which 106 valid answers were received. Survey topics include the game accessibility barriers encountered by participants, their desired solutions, and their interest in the potential application of AD. Finally, results are discussed regarding similar studies, limitations, and future research. The article concludes highlighting the interest by persons with visual disabilities in including AD in video games, where applicable, and pointing at other pressing issues for the game industry regarding accessibility, such as improving screen reader compatibility, enhancing sounds, and exploring the technical feasibility of game AD in real-time action.

2 Defining game accessibility

Interest in game accessibility has been present since the onset of the video game industry [5], although in the early days it was mainly the pursuit of committed advocates in the industry and interested academics, often separate from mainstream commercial games [6]. In recent years, game accessibility has been gaining traction due to several factors, such as the rising popularity of games and the increasing number of players with disabilities who play or would like to play games and who have an important market potential [7]. Users are also becoming more vocal about their needs, and they are expressing their opinion in forums and reviewing games on specialised blogs and websites, as well as on YouTube and Twitch, where they play a game while analysing its accessibility features.

In addition, there is a growing social and moral awareness of the need to make games more accessible to all, in order to allow all types of users to enjoy the benefits associated to gaming, such as cognitive (e.g., improving concentration and attention), motivational (e.g., resilience in the face of failure), emotional (e.g., managing emotions), and social benefits (e.g., developing social and cooperative skills) [8].

Legislation has also played an important role in promoting game accessibility. For example, the 21st Century Communications and Video Accessibility Act 2010 (CVAA) in the US requires that all advanced communications services, such as voice chat, text chat, and video chat, including those in game software, gameplay, and consoles, should be accessible for people with disabilities, as well as information and communications technology. As legislation becomes enforced, games can be expected to include more accessibility features in order to become more accessible to all sorts of users.

Similarly to what has happened to accessibility in other areas, game accessibility has moved from a medical model, which views disability as a personal problem due to an impairment [9], to a social model, which views accessibility as a social construct [9]. In 2004, game accessibility was defined in a white paper by the members of the Game Accessibility Special Interest Group at the International Game Developers' Association (IGDA GA-SIG) 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" [10]. Such a definition followed a more medical approach to accessibility, but the IGDA GA-SIG subsequently moved to a social model, stating that game accessibility aims at avoiding the unnecessary barriers users encounter due to a mismatch between their abilities and the unintended barriers in the game they are interacting with [11]. This shift to a social model of game accessibility can be observed in the IGDA GA-SIG's website as of October 2019, when a new version of their website was made available.[1] However, members of the group had been advocating for a social model of game accessibility in earlier publications, such as Hamilton in 2012 [12] or Westin and Dupire in 2016 [13].

Due to the wide variety of games and users with different (dis)abilities, a "one-size-fits-all" approach to game accessibility does not seem feasible. An inclusive and diverse model that advocates for customisation, based on usability and adaptability, seems the best way forward [14]. It is also important to keep in mind that games are designed to be challenging and that game accessibility does not intend to make games easier or provide a lesser version of the game, but rather to make games usable by the widest possible population while preserving the intended gameplay experience and providing enjoyable and accessible experiences to all [7].

3 Latest developments in the industry

Several initiatives are taking place in the video game industry in order to make gaming more accessible to all. There are currently numerous guidelines addressed to game developers to help them become aware of how to include more accessibility options in their games, such as the *Game Accessibility Guidelines* [15], developed by several members of the

[1] The Internet Archive Wayback Machine site has been used to determine when the design of the IGDA GA SIG website was changed, and the new approach to game accessibility was included. For more information, see http://web.archive.org/web/20220000000000*/https://igda-gasig.org/.

IGDA GA-SIG, the *Xbox Accessibility Guidelines* [16] by Microsoft, and the guidelines available in the website *Can I Play That?*, created by and for players with disabilities [17], which also provides game reviews focusing on accessibility.

In 2012, the AbleGamers Foundation also released a game accessibility checklist for game developers called *Includification* [18]. In 2018, they changed their approach to focus on design patterns, that is, providing solutions to recurring software problems. The result was the *Accessible Player Experiences* (APX) [19]. In order to ensure APX, the first step is to guarantee that players can access the game and interact with it. Only then will they be enabled to meet the challenges of the game [7]. Therefore, developers should design a game adapting its challenges to different types of users, so that all players can have an engaging and accessible experience that matches their needs [19]. For each pattern, they identify the design problem, provide information on the context where the problem can occur, and offer design solutions. For example, the access pattern "Clear text" is related to the design problem "Players cannot reliably read the text in the game or its interface". The design solution is to allow players to change the way text is presented to them so that it can be read reliably [19].

The above-mentioned are some examples of the wide array of available guidelines for improving game accessibility and illustrate the increasing interest in this area by academics and the industry. Although they may approach the issue from different angles and using different terminology, such as *guidelines* and *design patterns*, they all cover similar issues and provide similar solutions, which are contributing to widening access to video games to players with different needs. In the future, it may be useful to try to standardise and unify all these guidelines, so that developers can have one single source of reference.

It is also important to highlight that all guidelines agree on the need for consulting with users when designing accessible solutions and when testing accessibility features. This was the case of *The Last of Us II*, by Naughty Dog, released in 2020 [20], which was developed with game accessibility consultants of different disability backgrounds [21]. The game contains over sixty accessibility features and includes three accessibility pre-sets with recommended settings for hearing, vision, and motor accessibility [22], and has been labelled as the most accessible game ever [23].

In addition to software guidelines, other interesting developments regarding hardware have happened in the industry in recent years, such as the release in 2019 of the Xbox Adaptive Controller to facilitate access to the Xbox console to users with reduced mobility. This controller has two large programmable buttons and 19 ports where external switches, buttons, mounts, and joysticks can be connected [24]. It was designed in consultation with disabled gamers' associations and community members, who provided feedback about its design, functionality, and packaging [24]. In 2019, Microsoft also filed a patent for a controller with Braille inputs and outputs for blind and visually impaired players [25]. Although it is still unknown whether the device is going to be fully developed or not, it shows interest by one of the major gaming companies in promoting accessibility.

As regards AD, since 2020 the French company Ubisoft started to include AD in their game trailers, such as the trailer for *Assassin's Creed Valhalla* [26]. The Canadian company Descriptive Video Works, who specialises in AD and created the AD for the trailer, consulted blind users in order to find out what they would like to be described and in what level of detail [27]. In September 2022, the remake of *The Last of Us I* was the first mainstream game ever to include AD for cutscenes [28]. The ultimate goal of game accessibility should be to include AD throughout the game, in both interactive and non-interactive sections. These include cutscenes, scenarios, characters, real-time game action, and interactive objects. Nonetheless, audio describing cutscenes in *The Last of Us I* are a very important step in the right direction.

Another industry development is the inclusion of an Innovation and Accessibility Award at The Game Awards in 2020, which illustrates the growing importance the game industry is placing on accessibility. The first award was granted to *The Last of Us II*, as recognition of its contribution to enhancing game accessibility. It can be expected that more developers will soon follow suit and games will include more accessibility options that can be beneficial to all sorts of players.

4 Research in game accessibility

Research in game accessibility has also been thriving in recent years. There are several studies focusing on players' needs and preferences and on the industry's approach to accessibility. For example, the French company Be Player One conducted a survey addressed to disabled players in 2020, which received 330 responses, mainly from French-speaking participants [29]. They also carried out a survey addressed to game developers to gain insights into their approaches to game accessibility [30]. Another survey was designed and distributed in 2020 by the British charity Scope, in which 812 disabled players participated [31].

Other projects focus on accessibility for persons with visual disabilities. For example, Columbia University developed the Racing Auditory Display, an audio interface for car racing games that allows blind users to play with the same speed and control as sighted players [32]. They also built a prototype racing game, which was tested by 15 blind users, who enjoyed the experience and felt that they could compete on the same level with sighted players [32].

In 2020, a survey was carried out in Spain amongst blind and low vision players as part of the Researching Audio Description Project (RAD), which is the main focus of this paper and will be further described in the following sections, comparing its main results to those of some of the studies mentioned here.

In 2021, the University of Bristol launched the AD4Games project. A video game was developed, *Before I Forget* [33], and then live AD of the gameplay was provided [34]. Users' opinions are being collected through an online survey.

In 2022, the Royal National Institute for the Blind (RNIB), the largest non-profit organisation for people with sight loss in the UK, published the preliminary results of a survey to over 500 persons with visual disabilities in Britain to assess how accessible gaming is for them [35]. The RNIB also interviewed several companies to find out the importance they place on accessible gaming [35]. The findings of the different projects all highlight the fact that games are still not accessible enough and the need to keep improving game accessibility, as the disabled community enjoy playing games and would like to have the opportunity to play more.

5 The RAD project

Researching Audio Description (RAD): Translation, Delivery and New Scenarios is a project funded by the Spanish Ministry of Science, Innovation and Universities, the Spanish Agency for National Innovation, and the European Regional Development Fund. The project ran from January 2019 to September 2022, and one of its main objectives was to research game accessibility for blind and low vision players. The presence and potential application of AD in video games was analysed, identifying user needs and requirements. The methodology of the project combined descriptive research and experimental tests with users by means of surveys and interviews.

After researching the state of the art in game accessibility, a two-step model for assessing game accessibility was created by designing a quantitative and qualitative analysis tool. The tool consists of a checklist of accessibility solutions based on the four guidelines and recommendations mentioned in Sect. 2 of this paper and a qualitative analysis of users' reviews [36]. Then, the model was applied to analyse how accessible the five bestselling games in Spain in 2020 were. The next step of the project consisted of gathering information about the players. In order to do so, a survey was designed and distributed, followed by a series of interviews to 15 people who volunteered to further participate in the study. In the following sections, we present the methods and the results of the survey, followed by a discussion in which we compare the results with those from other studies.

6 Methods

A self-administered online survey was conducted to explore game accessibility preferences of persons with visual disabilities. Participation requirements, derived from the RAD Project's scope, were to be a blind person or a person with low vision over the age of 18 years and living in Spain. Three topics were addressed: game accessibility barriers, desired accessibility solutions, and interest in the potential application of AD in video games. Sociodemographic information was also collected. It was approved by the Ethics Committee on Animal and Human Experimentation (CEEAH) at the Autonomous University of Barcelona, Spain, in April 2020.

The survey was structured as follows. It started with an information sheet explaining the RAD Project and participation requirements. If participants gave informed consent, they proceeded to a filter question asking them to self-identify as *players* (persons who regularly play video games) and *non-players* (persons who do not regularly play video games). Players were asked about their gaming habits and their preferred accessibility solutions, while non-players were only asked about their desired solutions. Finally, both players and non-players completed a set of demographical questions about their gender, age, highest educational level, self-reported digital competence, and type of visual disability. The survey was created and distributed through Microsoft Forms, because it is accessible for persons with visual disabilities. It is compatible with screen readers and keyboard navigation, and it offers contrast options [37].

It was not possible to determine the size of the addressed population, that is, the number of persons who met the participation requirements and could potentially answer the survey, because of mismatching methodologies and results among previous studies. For example, the latest data about disability in Spain collected by the Spanish National Statistics Institute (INE) is from 2008, which estimates that there are 797,600 persons with visual disabilities over the age of six [38]. According to a survey from 2017 by the Spanish Ministry of Health, there are 5,228,300 persons over the age of 15 years living in Spain with visual disabilities [39]. In 2020, when the survey was distributed, the Spanish National Organisation of the Blind (ONCE) had 67,252 affiliates over the age of 18 years [40].

As a result of this lack of definitive data about the size of the population, non-probability sampling methods were chosen for the survey. They are recommended for exploratory

research [41], particularly when the lack of information on the target population prevents the creation of a sampling frame [42]. However, they entail validity threats, mainly the lack of representativeness of the sample [43]. Therefore, results are not generalised beyond the survey's participants.

Convenience sampling was used for the pilot. Three participants, who were personal contacts of the researchers, completed the survey and gave feedback in September 2020. No changes were made to the content. The format of a few questions was modified to improve readability with a screen reader. Then, the survey was distributed online through purposive sampling. A total of 71 associations, organisations, publishers, websites, and online forums by and for persons with visual disabilities were contacted in October 2020 by email and asked to distribute the survey among their members, readers, or contacts. Of them, 28 agreed and sent out the survey, which was open for two months, between October 15th and December 15th, 2020. The last screen of the survey was a message that thanked participants for their collaboration and encouraged them to distribute the study among their personal contacts, thus generating a snowball sampling.

Some 124 answers were received, of which 106 were considered valid, as 18 respondents did not meet the participation requirements, i.e. having a visual disability, being over the age of 18 years, and living in Spain. Qualitative variables were coded and analysed quantitatively. Answers to open questions were coded through thematic analysis. Data were analysed with 1.4.1. GNU PSPP software for Windows [44] and using descriptive statistics, namely measures of central tendency and contingency tables. This method is suitable for summarising results in exploratory studies [45].

To guarantee anonymity, every set of answers was randomly assigned a number. In quotes, participants are identified using a number between 1 and 58 for players (P), and 59 and 106 for non-players (NP). For example, *P31* means that the quoted participant regularly plays video games. The datasets analysed during the current study are available from the corresponding author upon reasonable request.

7 Results

Participants were divided into two groups according to their self-reported gaming habits. *Players* regularly play video games ($n=58$) and *non-players* do not ($n=48$) (Table 1). The typical participant was male (69.8%), aged between 25 and 34 years old (30.2%), a university degree holder (57.5%), with advanced digital competencies (40.6%), and blind (54.7%).

As mentioned, the survey addressed three main topics: accessibility barriers in video games faced by persons with visual disabilities, desired game accessibility options to overcome them (also referred to as *features*), and the potential of integrating audio description (AD) as a game accessibility solution. Participants' opinions are presented hereafter.

Players ($N=58$) were asked if they had ever not been able to play a video game because of a lack of accessibility. Those who answered "Yes" ($n=47$; 81.0%) were then asked about which accessibility barriers had prevented them from playing. Their answers were coded through thematic analysis, and then classified according to the design vocabulary developed by Cairns et al. [7]. This vocabulary is based on *Accessible Player Experiences* by AbleGamers [19], which divides accessibility features into *access design patterns* (addressing the interaction between the player and the game), and *challenge design patterns* (addressing the ability of the player to overcome the game's challenges). Cairns et al. expand on this classification by adding input, control, presentation, and output options within the access design pattern; and performance, training, progress, social, and moderation options within the challenge design pattern.[2] In this study, a third category (*General lack of accessibility*) was added to include answers where participants did not point to a specific issue, but to accessibility barriers in general, as the reason why they were not able to play.

The most often quoted accessibility barriers are part of the access design pattern (Table 2). Participants find that there is a lack of presentation options (42.5%), that is, features to customise the content or format of the game's stimuli. For example, some games are incompatible with screen readers (P31: "In *Minecraft* [46], the screen reader does not work and there are very few sounds[3]") or do not offer enough sound signals for navigation or object localisation (P7: "In *Slime Rancher* [47], there are no sound signals to find objects"). Participants also point to input barriers (5.0%), such as not being able to play with an alternative controller (P5: "Some controllers are not accessible, because they have too many keys or are not logical"), and output barriers (P6: "Some screen resolutions are only suitable for above-average vision, and they are uncomfortable for everyone").

A general lack of game accessibility is the second issue that was most often cited as a barrier (30.0%). In P25's words: "I can't play *Grand Theft Auto V* [48] or any other

[2] On the one hand, input options customise the input device; control options customise the controls or buttons of the input device; presentation options customise the content or format of the information presented to the player; and output options customise the output device. On the other hand, performance options customise the game mechanics; training options customise the learning of the game's mechanics, such as tutorials; progress options customise the progress within the game, such as bypassing obstacles; social options customise the interactions with other players; and moderation options customise sensitive content.

[3] All quotes are translated from Spanish by the authors.

Table 1 Sociodemographic characteristics of survey participants

Sociodemographic characteristic	Player		Non-player		Full sample	
	n	%	*n*	%	*n*	%
Gender						
Female	12	20.7	20	41.7	32	30.2
Male	46	79.3	28	58.3	74	69.8
Age category (years)[a]						
18–24	17	29.3	14	29.2	31	29.2
25–34	21	36.2	11	22.9	32	30.2
35–44	13	22.4	8	16.7	21	19.8
45 and over	7	12.1	15	31.3	22	20.8
Highest educational level						
No formal schooling	0	0	1	100	1	0.9
Primary education	2	100	0	0	2	1.9
Secondary education	9	56.3	7	43.8	16	15.1
Vocational training	14	53.8	12	46.2	26	24.5
University degree	33	54.1	28	45.9	61	57.5
Self-reported digital competence						
Basic	4	6.9	3	6.3	7	6.6
Intermediate	12	20.7	18	37.5	30	28.3
Advanced	24	41.4	19	39.6	43	40.6
Expert	18	31	8	16.7	26	24.5
Type of visual disability						
Blindness	30	51.7	28	58.3	58	54.7
Low vision	28	48.3	20	41.7	48	45.3

[a]With the aim of comparing results, age categories were set to match those in the 2020 report about the profile of players in Spain by the Spanish Association of Video Games (AEVI) [59]. In the report, age categories are 6–10, 11–14, 15–24, 25–34, 35–44, and 45–64 years. In the survey, the first category starts at 18 years old, as it was the minimum age required to participate. The last category is 45 and over to include a 70-year-old participant

$N = 106$ ($n = 58$ players; $n = 48$ non-players). Participants were on average 33.3 years old ($SD = 11.8$). The average age for players was 31 years old, and 36.1 years old for non-players

Table 2 Game accessibility barriers faced by players

Game accessibility barrier	Frequency, *n* (%)
Access design patterns	
Input	2 (5.0)
Presentation	17 (42.5)
Output	1 (2.5)
Challenge design patterns	
Performance	4 (10.0)
Progress	4 (10.0)
General lack of accessibility	12 (30.0)

$N = 40$, as some participants mentioned more than one barrier in their answers. Not every category proposed by Cairns et al. [7] is included in the table, only the barriers mentioned by participants

game because they are not accessible, and developers don't care". Regarding challenge design patterns, players mentioned performance barriers, such as the lack of difficulty levels (P26: "Some fights or actions are too difficult"), and progress barriers, like customising game mechanics (P12: "I can't play any games where there is friendly fire[4]").

To prevent or overcome accessibility barriers, such as the ones mentioned by survey participants, video games may offer accessibility options. Both players and non-players were asked which ones they would like to use if they were available. As it was an open question, answers were coded through thematic analysis following Cairns et al.'s [7] vocabulary. A new category was added (*More accessibility options*) for players who would like to benefit from a greater number of features.

Presentation options were the most mentioned by both players and non-players (84.9%) (Table 3). Participants reported that the following features would improve their access to video games:

[4] *Friendly fire* is a game mechanic where a player can inflict damage on their teammates, and vice versa. It increases difficulty and may prevent players from progressing in the game.

Table 3 Desired accessibility options of survey participants

Desired accessibility option	Player		Non-player		Full sample	
	n	%	*n*	%	*n*	%
Access design patterns						
Input	5	4.1	4	6.3	9	4.9
Control	2	1.7	0	0.0	2	1.1
Presentation	100	82.7	57	89.0	157	84.9
Output	1	0.8	0	0.0	1	0.5
Challenge design patterns						
Performance	2	1.6	1	1.6	3	1.6
Training	0	0.0	2	3.1	2	1.1
Progress	6	5.0	0	0.0	6	3.2
More accessibility options	5	4.1	0	0.0	5	2.7

$N = 185$ ($n = 121$ for players; $n = 64$ for non-players), as some participants mentioned more than one barrier in their answers. Not every category proposed by Cairns et al. [7] is included in the table, only the desired accessibility options mentioned by participants

Table 4 Interest in game AD according to regular AD use

Interest in game AD	AD user		Non-user of AD		Full sample	
	n	%	*n*	%	*n*	%
Interest	71	94.7	24	77.4	95	89.6
Lack of interest	4	5.3	7	22.6	11	10.4

$N = 106$ ($n = 75$ for AD users; $n = 31$ for non-users of AD)

- *Screen reader*: "The bare minimum would be to have a screen reader that reads the game's menu, so that I can navigate and select the characters, the teams, the preferred options, etc." (P5);
- *AD*: "Audio description [is necessary] to describe scenes, new scenarios, objects, etc. [AD could be triggered] when you first encounter these elements or on demand" (P32);
- *Sound signals*: "[Video games] should have sound signals for orientation" (NP61).

Regarding input options, participants would like to play with alternative devices (P48: "I would like to control video games with a keyboard"). They would also like to remap controls (NP70: "When playing on the computer, it should be possible to perform everything with commands") and customise the output device (P9: "Increasing the screen's brightness and changing the contrast should be possible").

Challenge design patterns were less frequently mentioned. They include the following:

- *Progress options*: "I would like to make the characters do certain missions by themselves" (P40);
- *Performance options*: "Adjusting the difficulty for players with low vision should be possible" (P44);
- *Training options*: "I would like to have more information about the game's functionalities" (NP69).

The wish for more accessibility options in general was only mentioned on five occasions (2.7%), such as in the following quote: "I would like to have any technology that improves game accessibility for every disability profile" (P11).

The last topic addressed in the survey was the potential application of AD to video games. Players and non-players alike had already mentioned this service as a desired game accessibility option. The only reference to AD in the survey up until that point was in the information sheet. Through a Yes/No question, participants were asked if they would be interested in including AD in video games, hereafter referred to as *game AD*. Their answers were then compared to their self-reported use of AD in other contexts, such as films, TV, theatre, or opera, and to their gaming habits, that is, if they regularly play video games or not.

The vast majority of survey participants were interested in game AD (89.6% of the sample). Among AD users, there was a clear preference for AD in video games (70.8%) (Table 4). Regarding gaming habits, both players (86.2%) and non-players (93.8%) would like AD to be included in video games (Table 5).

Participants who reported to be interested in game AD answered an open question about its potential benefits.

Table 5 Interest in game AD according to gaming habits

Interest in Game AD	Player		Non-player		Full sample	
	n	%	*n*	%	*n*	%
Interest	50	86.2	45	93.8	95	89.6
Lack of interest	8	13.8	3	6.3	11	10.4

$N = 106$ ($n = 58$ for players; $n = 48$ for non-players)

Table 6 Benefits of game AD

Benefit of game AD	Example quote	Frequency, *n* (%)
Comprehension	"We miss many gestures and situations because we do not have audio description. Current video games are like interactive films. So, I think AD is quite necessary". (NP90)	42 (42.2)
	"Currently, AD is the best way of knowing what is going on in a visual environment". (P33)	
Socialisation	"AD would allow me to socialise better with sighted persons who are close to me, have something to talk about, and forget about my health problems". (P40)	24 (26.4)
Interaction	"AD would make things easier, as I would be able to receive the information I need to properly interact with the game and without some else's help". (P10)	12 (13.1)
Immersion	"In games where the environment is highly visual, [AD] would help us to get into the story and enjoy the game more". (P46)	7 (7.7)
Orientation	"[I would like to have game AD] because, in addition to playing, it is also important to know where we are moving, where we are, what we have in front of us, and things like that". (P11)	6 (6.6)

$N = 91$, as not every participant interested in game AD ($N = 95$) mentioned its benefits in their answers. Instead, they made a general comment, such as "I find this question interesting. I would like to know how audio description would be implemented and what would be described" (NP94)

Answers were coded through thematic analysis. Five themes were identified: comprehension, socialisation, interaction, immersion, and orientation (Table 6). The most cited benefit of game AD is that it would improve the users' comprehension of the action, scenarios, and characters (42.2%). The social aspect of video games was also mentioned (26.4%), followed by AD's potential to improve the interaction between the player and the game (13.1%), the player's immersion (7.7%), and orientation (6.6%).

In addition to the potential benefits, some participants gave more details about how they imagine game AD. Cutscenes are eligible to be the first step towards game AD, as mentioned in the following quotes:

- *P13*: "AD is already used in films, so it could at least be implemented in cutscenes. It would be a way for people with visual disabilities to play with sighted persons".
- *P56*: "AD is needed in cutscenes to follow the plot in adventure games and action sequences".

Regarding the content of the AD, some participants would like it to be succinct: "I would like AD to only describe what is most relevant. It should only include the necessary information for the player" (NP88). Others would prefer a more detailed AD: "In *The Last of Us II* [20], for example, if you touch the touchpad, the game tells you your position and health. This could be more descriptive, as it could tell you what is in front of and behind you, to your right and to your left, if there is something in your hand, or if you have equipped something" (P3).

Lastly, participants suggest that AD should be paired with other accessibility options, particularly, a screen reader for texts: "AD, combined with a screen reader that reads all texts, would improve the experience for players without sight" (P25).

8 Discussion

The purpose of the survey was to explore the experience of persons with visual disabilities with video games, focusing on three main issues: current game accessibility barriers, desired game accessibility options, and the potential of integrating AD in games. Reported results are now discussed.

Accessing video games themselves is the main barrier for players with visual disabilities (Table 2), that is, receiving the game's input and providing output to complete the interaction [19]. This result is in line with previous studies. According to Yuan et al. [49], players who are blind or have low vision face difficulties when receiving the game's stimuli, particularly visual elements, thus hindering interaction, as they may not be able to determine the response required by the game.

The second most-cited barrier by survey participants is a general lack of accessibility, a common issue voiced by persons with disabilities in other studies on the topic. The international survey addressed to players with disabilities conducted by Be Player One [29] found that participants with visual disabilities do not play as much as they would like due to the lack of accessibility options. Similarly, in the RNIB's survey [35], blind and low vision participants argue that "video games do not have enough accessibility features".

To overcome these barriers, persons with visual disabilities would welcome more presentation features that allow for the customisation of the content or formatting of the game's stimuli (Table 3). Both players and non-players demand screen readers and AD, which are also the top priorities for participants with visual disabilities in the RNIB's study [35].

Screen readers are a common solution for accessing video games [50–52], but their availability is not guaranteed. For example, ninth generation consoles (PlayStation 5 and Xbox Series X/S) offer screen readers that recognise the platforms' on-screen text, menus, icons, and user interface [53, 54]. However, this does not mean that every game played on these consoles is compatible with a screen reader. To offer this feature, games must correctly identify the text so that it may be recognised and read by the screen reader. Likewise, when developing the game, developers should avoid using the same keys to activate the screen reader and perform actions within the game and include punctuation when needed [55].

As stated in the *Game Accessibility Guidelines* [15], screen reader compatibility would be extremely beneficial for players with visual disabilities, although it may be complicated to achieve. However, game engines for video game development are starting to implement it. For example, Unreal Engine offers screen reader compatibility by default [56], and there is a third-party accessibility plugin for Unity that supports this feature [57].

AD was the second-most popular desired option for survey participants. In the specific question about game AD, an overwhelming majority of the sample was interested in its potential, regardless of their regular use of AD (Table 4) or gaming habits (Table 5). Participants argue that game AD would improve their comprehension of the action, scenarios, and characters, as well as facilitate socialisation with friends or other players.

The potential of game AD has been documented in game accessibility guidelines. *Xbox Accessibility Guidelines V3.0* encourage its use in cutscenes, advertisements, tutorials, and full-motion videos [16]. Similarly, the *Game Accessibility Guidelines* suggest audio describing cutscenes as a starting point for game AD [15]. Players with disabilities support the same idea. For example, in the *Blind and Low-Vision Accessibility Guide*, published on the website *Can I Play That?*, Smith [58] demands AD in cutscenes, as it would improve their gaming experience. Research also makes the case for AD in cutscenes [59], to which this study adds to. In practice, as mentioned in Sect. 3, game AD is only present in trailers [26], research games [34], and one mainstream game, *The Last of Us I* [28]. For the time being, the focus is still on the non-interactive sections, instead of real-time action. This dynamic AD could be triggered when players interact with the objects, and it is therefore more complex to program from the game developing perspective. However, this should be the ultimate goal in order to improve game accessibility for players with visual disabilities.

In short, results are in line with other studies about game accessibility preferences of persons with visual disabilities [29, 35]. The main contribution of this paper is its focus on AD, documenting a widespread interest for game AD among survey participants, including AD users, non-users, players, and non-players. Participants suggest including AD not only in cutscenes, but also during gameplay, to provide information about scenarios, objects, and characters. This dynamic AD could be triggered when the players interact with the objects and it is therefore more complex to program, but it would greatly improve game accessibility for blind players. Another possibility would be to include audio introductions in games, which would describe the main characters and scenarios and could be accessed via the game settings or the game website [59].

Despite the study's promising results, it is important to note that their generalisability is limited due to the non-probability sampling methods used to recruit participants. Males, university degree holders, and digitally competent persons were overrepresented in the sample. In Spain in 2020, 45.9% of players were female, which is not reflected in the survey's sample [60]. However, the average age of Spain's players is the same as the survey's, 31 years old [61]. Moreover, most Spanish players were between 25 and 34 years old [60], which corresponds to the age group of the majority of the survey's players. The high level of education and digital competencies of the sample is in line with the common respondent profile of self-administered online surveys [62], but there are no known studies that compare these variables with gaming habits.

Response rate cannot be determined, as there is no data on how many people the survey reached. However, the number of participants was quite high, particularly compared to other self-administered online surveys about game accessibility for persons with visual disabilities. For example, in a survey about gaming habits, Porter and Kientz [63] received 6 answers from persons with visual disabilities. Andrade et al. [64] collected 17 responses on preferences from players with visual disabilities, and Cairns et al. [65], who explored motivations for gaming, gathered 123 answers.

Besides low generalisability, this study has other limitations of note. First, only persons with access to the internet and within reach of the contacts who distributed the survey could respond, which excludes part of the target population that would meet the participation requirements. Future research may establish a sampling frame to carry out probability sampling. Second, although the number of responses was quite high for a survey of this scope, greater participation would be needed in order to formulate more definitive results and conduct inferential statistics. Finally, there may be response bias, but no identical sets of answers or incomplete surveys were received. Responses that seemed to not meet participation requirements were rejected, and participants were informed of the social impact of the research in an attempt to encourage honest answers.

9 Conclusions

Game accessibility is currently bourgeoning, with important advances taking place at industry, academic, legal, and social levels. Stakeholders are becoming aware of the multiple benefits of playing video games and the importance of granting access to all players, regardless of their (dis)abilities, in order to advance towards a more equal and inclusive society. However, accessibility for persons with visual disabilities still has not widely implemented existing solutions such as AD and screen readers.

In this paper, after providing an overview of the state-of-the-art in game accessibility, we have presented the results of a survey carried out within the framework of the RAD project. One of its main objectives is to study the needs and preferences of blind and low vision users in Spain regarding game accessibility and the potential application of AD. The survey was conducted in Spain in late 2020 and it gathered 106 valid replies, both by players and non-players.

Results suggest that AD for graphics and screen readers for text would improve game accessibility for persons with visual disabilities. They also hint at pressing issues for the game industry, such as improving screen reader compatibility, enhancing sounds, and exploring AD in real-time game action. Future research includes replicating the survey with a probability sample and in other contexts, such as international participants of all ages, integrating AD in cutscenes and object-based AD in scenarios for real-time gameplay and then testing it with users through reception studies, and developing a set of guidelines for game AD.

Ultimately, as one participant claims, "The first step to improving game accessibility for persons with visual disabilities is to ask us how it could be improved and how we have managed so far. The second would be for players with visual disabilities to test game accessibility features" (P12). User involvement in every step of the way towards better accessibility is key to providing a wide range of solutions for diverse preferences and needs, so that truly everyone may play video games. The more companies engage users in the design and the testing of video games and their accessibility options, the wider and more inclusive gaming will become.

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Declarations

Conflict of interest On behalf of all authors, the corresponding author states that there is no conflict of interest.

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