Game Not Over: Accessibility Issues in Video Games

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Abstract

An issue that has been facing the game industry recently is the need to provide accessible games. There are various legal, financial, and ethical reasons for wanting more accessible games. This paper will examine the scope of the problem by reviewing the need for accessibility, the current state of the industry, and some proposed initiatives that we feel should start to occur in the near future. We also will look at case studies of several commercial games that have provided accessibility features.

1 Introduction

Bobby is a 14 year old boy with cerebral palsy. To play video games he uses a specially adapted controller with two or three head switches positioned on his wheelchair headrest. Like most boys of his age, he loves to play video games, but his choices are severely restricted. At times, he can only watch others play the games he would love to try, due to their inaccessible design.

His problems start in game shops, and that's not just getting about the aisles and high shelves. Game packaging gives no indication of accessibility features. For many disabled gamers, the odds of selecting a playable game are daunting and often not in their favor.

Bobby chooses a game titled, "Virtua Generic" and takes it home. His enabler sets about fixing up his controls, hoping to give him some independence when playing. The next frustration is an unfriendly menu system that needs six separate buttons to negotiate, and has tiny fonts on all text. Game play is the biggest problem. With no training mode, no speed control, no useful variation in difficulty levels and no option to alter or simplify the controls, the game is returned to the shop.

Sam is a 42 year old learning disabled man. He adores modern games, but has a short attention span when games are too difficult, too childish or require too many controls. Problems again start in the shop, with staff unable to help answer his questions regarding accessibility. Crossing his fingers he purchases "Virtua Generic". Finding reading difficult, Sam is further hindered by reams of game options he'll probably never use, but will frequently get lost in. Where there is speech, it is often too wordy and fast for him to follow. Using a digital arcade stick, as hand held controllers are too difficult to control; he is frustrated to find the game can only be played using an analog joystick. The game is returned to the shop.

While specific needs vary from person to person, the common issue is the same. The need to address accessibility in gaming is real. The number of people interested in gaming transcends age, gender, income, and disability. The disabled are often misunderstood and underestimated in terms of potential and participation. By better understanding the needs of the disabled, in relation to gaming, and assistive technology solutions, developers can better understand part of the gaming population (their customers).

2 Accessibility

Since 1998, many organizations became familiar with the need to make their websites accessible to the disabled. Section 508 originated in the Rehabilitation Act of 1973, but was later strengthened by the US Congress in the

Workforce Investment Act of 1998. For the first time, accessibility truly garnered national attention. Section 508 is associated with the requirement that Federal websites be accessible to the disabled. However Section 508 also requires access to electronic and information technology procured by Federal agencies. (The Access Board, 2000) In response to Section 508, the W3C (World Wide Web Consortium) developed standards for accessible web sites and related technologies (Brewer, 2005)

Video games, regardless of platform, are a natural branch of accessibility in a similar vein as other entertainment and even educational systems. Disabled gamers are consumers, and access to gaming is a quality of life issue. Gamers play games for entertainment, not to experience a sense of frustration. Unfortunately, once a player gets shot for the tenth time because they can't hear the footsteps of someone coming up behind them, they are not likely to be entertained. It's more likely that they are angry or confused. Table 1 presents some common problems disabled gamers may encounter in current games:

Table 1: Common Problems for Disabled Gamers

Problem	**Reason**
Inability to follow a storyline	• No subtext available, story is advanced by cut scenes. (Auditory) • Story is very complex and difficult to follow. (Cognitive)
Unable to complete a puzzle or task	• Vital clues given in cut scenes with no text available. (Auditory) • All clues are given as text. (Visual) • Requires precise timing with controller. (Mobility) • Requires the ability to position a cursor accurately (Mobility)
Unable to determine how game is played	• Lack of a tutorial mode • Poor documentation • Documentation written at too high a level for intended audience
Inability to use adaptive hardware	• Game only supports limited set of devices
Player's character gets killed/injured repeatedly in game	• Not recognizing audio clues. (Auditory) • No indication of dangerous situation • Inability to respond quickly with controller (Mobility) • Unable to alter game speed. (Mobility)

Some issues in Table 1 demonstrate commonalities between disabled and the rest of the gaming population while other issues are specific to gamers with certain disabilities. Accessibility is a quality of life issue, since equal access is not being provided to a portion of our population. In some cases, this could be a legal issue, particularly in places where full accessibility to services is required by law. For example, there is ongoing discussion as to whether massively multiplayer games are a service and fall under the accessibility requirements. As games move from merely entertainment value to educational value, public schools need games to be accessible to all students. Regardless of the existence of a disability, accessibility benefits all players through the reduction in frustration levels.

2.1 Types of Disabilities

The different types of disability affecting a person's ability to play video games can be broken down into four groups: Visual, Auditory, Mobility and Cognitive. A disabled gamer may span any number of these groups. While each group represents a diverse group of people with varying needs, each of the four groups is summarized below in order .

2.1.1 Visual Disabilities

Visual disabilities Are represented by various conditions that impact vision to varying degrees. Generally visual impairments are can be categorized in terms of blindness, low vision, and color blindness. Blindness can be defined

as “the loss of vision, not correctable with lenses”. People who are totally blind cannot play games that rely on visual cues to prompt a player. They must rely on sounds, speech and in some circumstances special hardware such as force feedback to indicate when they need to act. A person with low vision can detect light, and perhaps motion, but is very limited as to what they can distinguish. Color blindness is an inability to detect certain colors. It ranges from total color blindness, where the person perceives the world as shades of gray, to more common types where a person does not perceive the differences between red and green or yellow and blue correctly.

2.1.2 Auditory Disabilities

Auditory disabilities are also known as deafness and hard of hearing. Deafness is an inability to understand speech or recognize environmental sounds. Deaf people generally communicate using sign language, of which there are several dialects. Unlike other disabilities, hearing loss is categorized as a continuous spectrum of loss, from mild to profound. People with mild hearing loss have some difficulties keeping up with conversations, especially in noisy surrounding. For example, in-game dialogue can be rendered unintelligible due to intrusive background music.

2.1.3 Mobility Disabilities

Impaired mobility can be caused through injury, illness, genetics and old age. Barriers to effective gaming may range through being unable to press FIRE rapidly, or being restricted to using a single head-mounted switch to play.

2.1.4 Cognitive Disabilities

These represent a diverse population. Examples of cognitive disabilities include learning disabilities, memory loss, and dyslexia. Where a gamer has slow reaction times, games can be rendered impossible without a speed control or wide difficulty level adjustment. If a gamer is unable to read text, due to dyslexia, learning disability, or it being in a foreign language, many games become impenetrable. Spoken instructions, with adjustable speed and pitch would help to overcome many problems alongside meaningful menu icons or photos for menu navigation.

The inability to retain information can also make certain types of games more difficult. An action game with a complex storyline or an adventure game with a complex map can be difficult for people who have memory problems or learning disabilities. Providing built in maps, help, or training options would make life much easier.

2.2 Statistics

Census data presents the magnitude of the disabled population. Their economic power and quality of life speak louder with such a notable portion of the population being represented. The data is based on the US Census Bureau’s data from 1997 for people 15 years old or older. Table 2 shows a breakdown of the disability types and the representation within the US population.

Table 2: Population by Disability Type, based on US Census Data from 1997

Disability Type	Number of Individuals	Percentage of the Population
Visual	7,672,000	3.6
Auditory	7,966,000	3.8
Mobility	25,139,000	12.1
Learning Disability	3,451,000	1.7
Other Mental Disability	6,657,000	3.2
Other Disabilities	2,270,000	1.1
Total	53,155,000	25.5

The total is larger than the 23% measurement presented in US Census data. The discrepancy is due to the fact that some people fall under multiple categories and will be counted for each category. Based on the above table, it’s clear the group with mobility issues is the largest, followed by auditory, visual and learning disabilities. Also notable is the size of the group that could have potential accessibility issues with games. In addition to the data cited above, there are a variety of studies compiled by the United Nations (United Nations, 2004). Based on the data, between

10% and 20% of the people in a country can be considered disabled. Information from the W3C seems to confirm this conclusion. In Sweden for instance, two sources say 20 percent of the working population (16 to 64 years old) have a disability or limiting condition. A third source says 10 percent of the total population is disabled. Sweden has a population of 9 million people.

3 IGDA Games Accessibility Special Interest Group

Based on the need to address accessibility in games, the IGDA formed the Game Accessibility Special Interest Group (SIG). The Game Accessibility SIG of the IGDA is intended to provide support for making games universally accessible to all gamers, regardless of disability. In order to accomplish this task, we have the following goals:

- Creation of a community of people interested in furthering game accessibility.
- Definition of the needs raised by various disabilities and game genres.
- Development of accessibility methods and education of the developer community in the use of those methods. This includes the use of accessibility research and methods from related areas, such as web accessibility.
- Support for research into new methods for providing accessibility. This includes defining what is possible today and what is needed for the future.
- Revisions of the stated goals to take into account the evolution of the game industry over time.

From 2003 to 2004, the IGDA Games Accessibility SIG was focused on producing a whitepaper to determine the current state of accessibility within the game industry.

3.1 IGDA Games Accessibility SIG Survey

To facilitate the process of gauging the current state of accessibility, an online survey was developed for game developers to complete regarding accessibility features within current games. A total of 20 responses were received. Most responses were very detailed and contained information about the approaches taken to provide accessibility.

The only game genre that was absent from the responses was the simulation game. Based on the amount of information that these games must present, often in real time, this is not really surprising.
Table 3 shows the categories identified in the survey. Note some games fell under multiple categories.

Table 3: Game Genre

Type	**Count**
Action	7
Fighting	4
Racing	1
Shooter	5
Simulation	0
Strategy	4
Role-Playing	2
Family Entertainment	5
Edutainment	1
Sports	1
Other (Adventure, Gambling, Arcade, Puzzle & Exploration)	7

Single player was the most common mode of operation. Only 2 of the games could be classified as multiplayer.

Most games addressed a specific class of disability, such as visual or auditory. Some were more ambitious and attempted to address a wider range of disabilities. The sample games tended to focus more on visual accessibility rather than addressing other types of disabilities. The disproportionate attention to visual disability may be traced to the small sample size. Table 4 shows the survey breakdown.

Table 4: Game Genre Breakdown

Disability	**Count**
Blind	16
Low Vision	16
Deaf	4
Low Hearing	4
Mobility Impairment	4
Other: Color blind option	2

3.2 Assistive Technology Solutions

In order to more effectively develop accessible games, developers should be aware of the types of assistive technology solutions available today that could also being used with games. Some are designed for disabilities but not for games while others are designed for games but not disabilities. By developing an awareness of which accessibility technologies are commonly used, it is possible to make a game accessible with relatively minor adjustments to the game play itself. The following subsections highlight some of the types of assistive technologies currently being used:

3.2.1 Software

3.2.1.1 Alternative Pointing Devices

These devices allow individuals to control their computers through means other than a standard pointing device. Examples include head and eye-tracking systems (NaturalPoint, 2005), specialized joysticks or gloves such as the P5 Glove (Essential Reality, 2002), and even exotic systems such as the Cyberlink controller that uses a combination of body, eye and brain signals for control (Brain Actuated Technologies, Inc., 2002). These systems can be used in conjunction with on-screen keyboards. A switch is normally used to do the equivalent of a mouse click. Some of these systems allow you to move the mouse cursor very quickly but not very accurately while other systems allow you to move a cursor very accurately but very slowly.

3.2.1.2 On-Screen Keyboards

People who are unable to use a standard keyboard use this tool. An on-screen keyboard using a pointing method such as pointing devices, switches or Morse code input systems. It is usually difficult to perform complicated key sequences quickly using an on-screen keyboard, so keyboard intensive games can be very hard if not impossible to play using this type of technology.

3.2.1.3 Speech Recognition

People with mobility impairments primarily use speech recognition programs. These utilities enable people to control computers with their voice instead of a mouse or keyboard. Speech recognition can be used for text entry, mapping commands to keyboard macros with a system like Game Commander (Game Commander, 2003), and verbally to position a mouse cursor.

3.2.1.4 Screen Readers

These utilities are primarily useful for people who are blind. These aids make on-screen information available as synthesized speech or a refreshable Braille display. They can only translate text-based information and are often used with text intensive programs such as web browsers, email, and document viewers.

3.2.1.5 Screen Magnifiers

This type of software helps people with low vision by allowing them to zoom in or enlarge portions of the computer screen so they are easier to see. This works well with applications that tend to display static data such as text or diagrams. Screen magnifiers may have problems coping with games displays that are animation intensive or use full-screen modes.

3.2.2 Hardware

In addition to the software approaches listed above, certain hardware approaches already exist. There are varieties of devices already on the market that can be used to control games:

- Gloves, such as the P5 Glove (Essential Reality, 2002)
- Voice recognition systems, like Game Commander (Game Commander, 2003)
- Different types of mice such as wireless mice or a head mouse (NaturalPoint, 2005)
- External switch accessible Controllers (OneSwitch, 2005)

There are even more exotic devices, like the Cyberlink system (Brain Actuated Technologies, Inc., 2002), that allow you to control a game using thoughts. The problem with these devices is that mainstream games may not work very well with them. By providing support for a wider range of devices, more games will become accessible to the disabled gamer. Support comprises of both technical support as game balance/content oriented support. Although the Cyberlink is a great tool, it is hard to get the same speed and precision of a regular mouse.

4 Commercial Game Case Studies

Within the last two years, three games have garnered attention within the game accessibility area. It's interesting that they all fall within the same "first person" genre. One of the major features of first person games is their reliance on a variety of sensory input in order to be successful playing the game. Players need to respond to motion seen in dimly lit corners and to auditory cues such as footsteps and gunfire. In addition, most first person games have an underlying plot that is advanced through the use of scenes. These scenes often contain critical information necessary to complete the next mission or in some case, the entire game.

Unfortunately, not all gamers can use the available information. Deaf gamers will miss all of the auditory cues and a lack of closed captioning support makes often makes information from scenes found between missions useless. Visually impaired gamers miss motion cues if they cannot control the lighting used in a game.

Fortunately, this situation is starting to change. The following examples illustrate the advances being made in accessible gaming. In one case, the developers responded to requests from deaf gamers. In the second case, an independent group of gamers worked on providing a modification of an existing game. The third case involves a game deliberately designed to be accessible to widest group of gamers possible. The final two cases illustrate examples where features added to help novice gamers actually provided accessibility for disabled gamers.

4.1 Half Life 2

Half Life 2 is a sequel to the popular game "Half Life". After "Half Life" came out in November 1998, deaf gamers contacted the developers, Valve Software, about the need for a closed captioning feature. In the original game, some necessary information required to finish the game was provided in cut scenes that were uncaptioned. Valve Software addressed the initial requests by providing gamers with the script for the game. (Coomer, 2004)

Half Life 2 was released in late 2004. While the game was under development, Valve decided to address the accessibility issue as part of the main development effort. They built a closed captioning system into their game engine and used the existing script of the game to caption the game.

The developers also performed thorough play testing on this feature. Deaf gamers had input in the initial development and were used as testers after the feature was added to the game. Because Valve built the captioning ability into the game engine, it will be available to developers outside of Valve who wish to make modifications to the game. In addition, other games using the Valve game engine will automatically have support for closed captioning. Hopefully companies using the engine will take advantage of this feature.

One concern that many developers have when looking at accessibility issues is the effect of added features on the product schedule. Valve found that the impact was minimal. The text had to be created in any case when they were writing a script for the game. The additional files required for the feature did not significantly increase the overall size of the game. Gamer response to Valve's work has been very favourable. (Deaf Gamers, 2005) Deaf gamers are delighted with the level of support the developers provided.

4.2 Doom 3 [CC]

Doom 3 was another highly anticipated first person shooter game that was released in 2004. Unlike Half Life 2, Doom3 does not provide a closed captioning feature. However, the developers did provide a set of tools for making modifications to the game.

The idea of allowing users to modify game content has been around for quite a while. Many game publishers release the modification tools along with the game. In some cases, the modifications created by gamers have become successful games. (Examples are "CounterStrike" and "Day of Defeat", both of which were modifications of the original Half Life game.) The ability to use the modification tools usually requires significant programming ability, since the tools are often released as software development kits. This means that programmers need to investigate the tool's code in order to determine how use the tools.

Once Doom3 was released, deaf and hard of hearing gamers posted comments on some of the game related forums regarding the fact the game was not closed-captioned. The response by other gamers posting to the forums was less than sympathetic. (For a sample of the responses, see Doom3[CC] site.(Sefton, 2005)) As a result of those responses, Matt Sefton proposed getting transcriptions of the dialog in the game. A variety of people came forward to help with the work.

Doom3 has a GUI system that is defined mainly as a set of text files. Because of this, creating a closed captioning mod for the game did not require large amounts of programming. Most of the required functionality to display text was already a part of the code. The major problem the developers had was learning how all of the game code fit together. They were able to figure out much it on their own or by relying on information from other members of the Doom3 modding community.

Id Software provided significant support to the project, providing scripts to the game and information about the sound files used within the game. They also assisted later by providing files to support multiple languages. The feedback on this game modification has been positive, with gamers comparing it to the level of closed captioning support seen in Half Life 2. It is a remarkable achievement, considering that volunteers who had full time employment or school obligations to meet did all the work. (Kimball, 2005)

4.3 Terraformers

Terraformers is a first person adventure game. (Terraformers, 2003) Unlike the other games, it was designed from the beginning for the visually impaired. The game can be played like a standard graphics based game, but can also run in a mode where the graphics are turned off. In the non-graphics mode, the game uses a sonar system to indicate distance to objects in front of the player. In addition the object is identified for the player. The player will also be told if the object is dangerous. Orientation can be a problem in a non-visual setting, so two systems provide

directional help to the player. A “sound compass” will identify the current direction the player is facing. In addition, a set of keys on the number pad can be used to change the player’s orientation to a specific direction.

The actual interaction with the player occurs through a personal digital assistant (PDA) that they are supposedly carrying through out the game. In addition to helping with movement and location, the PDA handles inventory issues such as what you are carrying in your pack or what you are carrying in your hand. Movement through locked doors is accomplished by entering codes, which must match a specific sound pitch or by using “sound keys” that must match the corresponding keyhole in the door, again using pitch.

This game was the winner of the “Innovation in Audio” award at the Independent Games Festival in 2003. (Independent Games Festival, 2003)

4.4 Driving Games

Certain games have accessibility features, that although not designed with disabled gamers in mind, can make play possible and enjoyable. There are two driving games that demonstrate this factor well:

4.4.1 “F355 Ferrari Challenge” (Sega Dreamcast and Sony Playstation2)

Players in this game race around an oval track. Because of the simplicity of the track, players with mobility issues can easily play the game with a single switch to control the car. There is an “Intelligent Braking System” that will automatically slow the car prior to entering a corner. This feature makes it easier for players with slower reaction times to drive the cars.

In addition to assistance with driving, the game features a training mode. In this mode, players are shown a red line that represents the best path to follow when racing. In addition, players are alerted to corners by flashing symbols and spoken prompts.

Many of the game features like the controls and music can be configured by the user. The menu system used is simple. The track can be viewed from overhead, allowing players to track their progress against their opponents.

4.4.2 “Destruction Derby” (Psygnosis/Sony – Playstation One, Sega Saturn and PC)

This game has many of features covered in “F355 Ferrari Challenge”. In addition it has a simple picture based menu system that can be used by players with reading difficulties.

Two additional features seen in this game are self correcting steering on certain levels and crash barriers. The self correcting steering feature is available on the “rookie” difficulty level. In the event of a crash or spin out, this feature helps the player get the car pointed back in the right direction. Crash barriers prevent annoying crashes into ditches or other obstacles.

Both of these games demonstrate desirable features that can help both novice players and disabled players. The same feature set can assist both users, although in different ways.

5 Conclusion and Future Directions

Since return on investment is crucial for any game development, it goes without saying that the efforts of game accessibility must have a realistic financial grounding, otherwise they risk not become implemented in mainstream games. In order to achieve the goal of game accessibility we need to work on several levels.

Efforts of individuals or small companies to create accessible games are important and interesting from many perspectives. However, to get mainstream games to be accessible to as many as possible we need first to resolve the financial issues, which are related to the time and effort accessibility development takes, and the increased number of sales you get by doing it.

To evaluate the possible increased sales, we first need to examine the size and scope of accessibility in games. How many people have problems playing mainstream games and what types of problems are there? What types of games are an issue for what person? Next we need to evaluate what technical problems there are in resolving the issues experienced? When we know where the break even point of game accessibility is, we will have a realistic ground on which to start making mainstream games accessible. We then also have the concrete arguments for lobbying for tax incentives and similar community / government support to companies working to make their games accessible.

This paper is a starting point, to both educate and start a dialogue. This paper is not an all inclusive description of the field in any way. At this point, there are a variety of questions we need to ask ourselves about accessibility in games. Hopefully these questions can be the basis for taking additional action in providing more accessible games to a wider audience.

1. What is best way to educate developers about accessibility? Online tutorials, books, a better website, Game Developers Conference roundtables? Or online communities where disabled and able can play and discuss? (E.g. a game of chess or other game server-client that is accessible?)

2. Could we develop frameworks that could be used in game development to make creating accessible games easier?

3. How can we go about gaining tax incentives to companies that create accessible games?

4. How could we make existing technologies like DirectX work better together with special software like screen readers?

5. How can we help disabled developers get into the mainstream game industry and develop accessibility features they like in these games?

6. How could we define a minimum accessibility standard that is easy enough to implement for all game developers? Compare this with including alternative text for all images on a website – a technically easy thing to do, if you just remember to do it! It will make games better for more users, work as a good-will factor for the game company and ultimately sell more games. This should also be the basis for getting an accessibility rating label on the game cover, guiding buyers for what groups of users is the game accessible.

7. How can we get support from human factor advocates and researchers? Part of the interest in this area is that so little research is being done so it's an open field.

8. How can we make this into a truly international effort and reach out to gamers and developers in South America, Africa, and Asia? Today, the SIG consists of residents in Europe and the USA.

9. How can we build relationships with disability organizations, such as RNIB in the UK. They have and continue to spend a lot of their resources promoting accessible games and their development.

10. How can we better include gamers (end-users) in the process of developing accessibility standards?

11. How could we go ahead and create an “IGDA Game Accessibility Initiative”, similar to the “W3C Web Accessibility Initiative” (w3.org/wai)? This initiative should be
    - funded by both corporations and governments
    - end-user oriented, i.e. disabled gamers must have a central role

12. How can we help governments understand the possibilities and benefits of games, especially as tools for learning and literacy. In this context, games need to be as accessible as possible to provide equal opportunity. This is an important selling-point for getting government funding. There are many projects and efforts going on in the field of game based learning today:
    - the Serious Games Summit (www.seriousgames.com)
    - Prof. James Paul Gee has also written an excellent book called "What videogames have to teach us about learning and literacy", explaining the learning principles built into good games.
    - A project in Sweden, the "Digital Room" project uses mainstream games (e.g. Counterstrike, World of Warcraft etc) to teach pupils regular curriculum subjects, e.g. english language.
    - The Sony Eye-Toy has many such gesture activities and is a good model for an accessible game as it appeals to a broad range of abilities.

If you would like to contribute to this discussion, please join the Game Accessibility forum at www.igda.com/accessibility and/or drop an e-mail to accessibility@igda.org if you would like to join the IGDA Game Accessibility SIG to work in an active way for game accessibility.

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