

# Games for rehabilitation: the voice of the players

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## ABSTRACT

The purpose of this study is to explore the use of video games from the perspective of the disabled player. Over 150 participants responded to an online survey exploring the use of video games for rehabilitation. The respondents represented nine countries throughout the world. The survey consisted of questions regarding subject demographics, living situation, activities of daily living assistance requirements, use of assistive devices, and computer use. Other questions addressed the responders' disability. Video game play experience, activity, game play, controller use and accessibility are addressed. Questions regarding the use of currently available off the shelf video games in rehabilitation are explored. Lastly, we surveyed the future of video games and how they can be improved for rehabilitation and leisure enjoyment. The results of this survey are presented. In general, individuals with disabilities enjoy playing video games and play video games often. However, players with disabilities would appreciate educating the game industry about disabilities and how to make games with a more "universal game design".

## 1. INTRODUCTION

From June 2009- June 2010 the authors conducted the first of its kind online survey to hear from individuals with disabilities and those undergoing rehabilitation regarding their opinions of using video games for rehabilitation purposes. This is the first of a series of studies, the results of which intend to address the needs of the disabled community and to better inform game design and user interface development so as to transform how video games are developed and designed.

The world population is estimated to be 6.7 billion and disability affects 15-20% of all people, in every country, worldwide (United Nations, 2007). Today's average gamer is 34 years old and has been playing for 12 years (ESA 2010). One can assume that millions and millions of people across the globe have disabilities and play games, or wish they could. Currently, 67% of American households play computer or video games (ESA 2010; [codi.buaffalo.edu](http://codi.buaffalo.edu)) with estimations that one in five cannot play or have limited playing ability due to disabilities (Atkinson et al., 2006; KQED.com 2010). Substantial progress has been made in making games more accessible and developing more accessible user interfaces. For example, keyboard short-cuts and closed captioning are frequently employed in contemporary games. Despite these staggering statistics, many unknowns regarding the use of video games for rehabilitation purposes still exist. With the exception of the Nintendo Wii's widespread adoption in clinics over the country, deploying these enhancements into a rehabilitation setting has moved at a glacial pace. Perhaps more importantly, games are not typically designed from the ground up with rehabilitation in mind. We believe a first step in changing this is to engage people with disabilities, now! At the time of this publication, no large-scale studies have investigated games for rehabilitation from the perspective of the end-user. Using video games during rehabilitation may be an essential adjunct to making rehabilitation more beneficial.

We believe that it is imperative for the game industry as a whole to better understand the wants and needs of those with disabilities and/or undergoing rehabilitation in order to design well-informed games for rehabilitation. Therefore, the purpose of this study was to conduct an online survey exploring how individuals with disabilities play video games, what characteristics they enjoy most about video games, how they feel about using video games for rehabilitation and how to improve video games for the disabled

population. The motivation behind the development of this survey came from a need to better understand the disabled gamer and to discover how their preferences could influence game design when developing games for rehabilitation in the future.

## 2. METHODS

### 2.1 Procedure

Many of the questions used in this survey were derived in part from the Pew Internet & American Life Project- Teens, Video Games, and Civics, September 2008. The questions were then modified or developed with consultation from a number of subject matter experts in the field of video games and disabilities. A number of avid video game players with disabilities offered their input regarding question clarity, question format and variance in responses. Fifteen participants preliminarily tested the survey; changes were made based on their feedback, and the survey was launched June 2009. The survey was conducted using Survey Monkey™ (surveymonkey.com). Only those who agreed to the informed consent were permitted to proceed to the survey. Participants under the age of 18 were required to have their parent's permission to participate in this study.

The survey began with the standard questions of location, country, gender, race/ethnicity, age, living situation, assistance required to perform activities of daily living, employment status, assistive devices, and computer/internet access at home. These questions were included so as to gain a broader perspective on gamers with disabilities worldwide. Next the survey asked about their disability: age at time of disability, descriptors of health condition, and accessibility rating scales for video games. The third page inquired about gaming experience and asked questions such as: do you consider yourself a hard-core gamer or a casual gamer?; How often do you play?; Which devices do you use?; What games do you play?; and What are your favorite games and why?. In the next phase of the survey, we were interested to explore how their health condition might affect their ability to play video games and how they interact with others while playing video games. On page five and six we explored video game enjoyment. Page seven of the survey asked for their perspective on improving video game design in general and for rehabilitation purposes and ways to improve interfaces for individuals with disabilities.

Due to the length of the survey, some questions required answers, while other questions could be skipped. Since some questions were not required, the response count varies accordingly and is listed in each table. Some questions provided space to add comments so that the participant could fully express their views regarding the question. These open-ended questions or additional comments were analyzed for themes the results of which are discussed below.

### 2.2 Host-websites

The survey was hosted on a number of international websites, for varying time frames, from June 2009 through June 2010. The Social Networks included Games For Rehabilitation (Games4rehab.com), Blue Marble Game Co (*bluemarblegameco.com*) Able Gamers (*ablegamers.org*), Pushrim (*pushrim.com*), LinkedIn (Games4Rehab Group, Exergame Fitness Group, The Exergame Network Group), Disability Resource Exchange (*disabilityresourceexchange.com*). Other internationally well-know websites include: Disaboom (*disaboom.com*), Paralyzed Veterans of America (*pva.org*), National Center on Physical Activity and Disability (*nepad.com*),

### 2.3 Missing Data

Survey responses were not considered if they had no data. Seventy-four surveys were deleted due to missing data. We suspect that the majority of these surveys were initiated by web-crawlers as there was no data on the survey responses, a few others offered their age and location but no data beyond that and were discarded.

### 2.4 Analysis

For the purposes of this paper, the data collected from the survey is presented as frequency distributions. No cross-tabulations or correlations have been conducted at this point but will be conducted and published in a follow up paper in the near future.

## 3. RESULTS

### 3.1 Descriptive Statistics

Over the course of one year, 152 individuals aged (10-15) through 71-80 years old responded to this survey. With the average age for gamers reported to be 35, it is not surprising that the majority (70%) of responders

were between 21 and 45 years old. Five participants reported that they were below the age of 18. See Table 1 for a complete description of the age distribution of this sample.

**Table 1.** Age Distribution of participants (n=152)

Age (years)	Percent Total (%)	Response Count (n)
10-15	2.0	3
16-18	1.3	2
19-20	2.6	4
21-25	13.2	20
26-30	15.8	24
31-35	15.1	23
36-40	12.5	19
41-45	13.2	20
46-50	8.6	13
51-55	7.2	11
56-60	3.3	5
61-65	2.6	4
66-70	0.7	1
71-80	2.0	3
81-90	0.0	0
> 90	0.0	0

Table 2 describes the age at which the participant became disabled. The vast majority became disabled between age 20-39 (29.4%) with the other largest group having sustained their disability before, during or at birth (19.6%). Interestingly, 29 participants indicated that they were not disabled, however in the follow-up question (Table 7) in which the subject was asked to describe their medical condition, only 23 indicated that they did not have a disability. This may be because some people with health conditions do not consider these conditions to be disabilities.

**Table 2.** Age at which the participant became disabled (response count = 149)

Age (years)	Percent Total (%)	Response Count (n)
I am not disabled	20.3	29
Before, during or at birth	19.6	28
0-4	9.1	13
5-9	3.5	5
10-19	9.8	14
20-39	29.4	42
40-59	11.2	16
60-79	1.4	2
> 80	0.0	0

As suspected given the distribution websites, the majority of responders reside in the United States (72%), with a number of participants from the UK (10.9%), Canada (7.5%) and Germany (5.4%) contributing as well. Other countries that were selected include Australia, Brazil, Mexico, Netherlands, and Turkey.

The participants who responded comprise a wide variety of race and ethnic backgrounds. Most of the responders reported themselves as Caucasian (55.3%) and Western European (23%) with Latino and European reported by 7.2% of the responders. Others reported Eastern European (4%), Native American or Alaskan Native (4%), Asian (4%), African American (2%), Pacific Islander (2%), Arabian (0.7%), Russian (0.7%) or other (Israeli, Native American, Jewish- 3.3%).

Next we asked about their living situation. Living situations could greatly influence if people can gain access to their computers/internet or if they can play video games that might benefit their physical/cognitive or psychological wellbeing. Of the 147 responders, 51% indicated that they live with spouse/significant other, while 23% live with their parents, 15% live alone, and 13% live with children. Other living situations included living with caregivers (10.2%), other family (1.4%), other adults (0.7%), group home (0.7%), foster home (0.7%) or hospital (0.7%). One respondent indicated that s/he lived in an RV behind their parent's home and considered this "basically homeless". These data indicate that many of the responders live with other people who *may* participate in assisting with game set-up or participating in game play with the person with the disability.

With regard to performing activities of daily living, 60% of the participants perform most activities of daily living independently, while the remaining 40% require a device, personal assistance or are unable to perform the activities at all (Table 3). Data in Table 4 describes use of assistive device. Twenty one percent of the participants do not use an assistive device. However, 80% use some sort of assistive device, many of which were power wheelchairs or manual wheelchair use. These data indicate that the participants' disability varies from extremely disabled to mildly impaired.

**Table 3.** Ability to perform activities of daily living (response count =145)

	Choose not to perform	Independent	With a device	With an assistant	Unable to perform
I feed myself	1	121	6	7	13
I bathe myself	1	99	3	31	13
I groom myself	1	106	6	23	13
I dress myself	1	101	1	33	14
I do my bowel routine	2	110	1	23	9
I do my bladder care	2	110	6	19	9
I use the toilet	3	110	2	15	17
I transfer from bed to chair	2	102	6	20	13
I am mobile on level surfaces	2	106	26	3	12
I am mobile on stairs	3	75	20	11	41

**Table 4.** Assistive device use (response count = 149)

Device	Percent Total (%)	Response Count (n)
Eyeglasses	48.3	72
Power wheelchair or scooter	24.8	37
I do not use any devices	21.5	32
Manual wheelchair	18.1	27
Cane	14.1	21
Walker	8.1	12
Lower extremity Brace (AFO, KAFO)	7.4	11
Service animal	5.4	8
Upper extremity brace (splint)	4.7	7
Hearing Aid	4.0	6
Screen reader	3.4	5
White cane	3.4	5
Crutches	2.7	4
Other: Chair seat lift	1.3	2
Other: Trackball	1.3	2
Sign language interpreter	1.3	2
Telephone or video relay service	1.3	2
TTY	1.3	2
Other: assistance from others	0.7	1
Other: assistive memory device	0.7	1
Other: Back brace	0.7	1
Other: Chin switch for w/c control	0.7	1
Other: phone amplifier	0.7	1
Other: Screen enlargement software	0.7	1
Other: shower/toilet chair	0.7	1
Other: Speech communication device	0.7	1
Other: Speech recognition device	0.7	1
Other: Tutors/job coach	0.7	1
Other: Upper extremity prosthesis	0.7	1

Despite their disability and mobility impairments, most responders have been playing video games for quite some time. Nineteen percent of the responders have had their disability since birth and thus have always played despite their health condition. As expected, 51% started playing before they acquired their health condition and only 21% began playing video games after acquiring their health condition. When asked how their health condition affects their ability to play, the responders indicated that their health condition limits the ability to play MOST games (25.4%), SOME games (21.2%), not at all (18%). Most, 68.9%, of the

responders do not need assistance to set up the controller for game play while 31% do require assistance. When playing games, most players use a standard mouse (48.6%) or standard keyboard (42.1%) when playing video games. Other creative controllers that the participants use are graphics pen, Joystick, QuadJoy, and put the Wii controller in the mouth and moving the head.

Many participants (26.6%) indicated that on-screen text improves game play while 19.3% indicate that it is not helpful. One responder commented that “the on-screen text is usually very small and difficult to read”. Another one wrote, “If I can read it before it goes away”. Another one commented “It would be helpful if the size was customizable so I could change it according to my daily needs”.

When asked what makes video games frustrating to play, the participants most frequently reported lack of accessible game controllers, inaccessible game play, inability to read text on screen fast enough before it goes away, inability to save, games that are time based, having to hit multiple buttons very quickly, and poor internet connections is frustrating.

### 3.2 Questions exploring game play

#### 3.2.1 Do you think having an “accessibility rating scale” on video games would be helpful?

Of the 124 participants who responded, 104 answered “Yes” while 18 responded “No”. This answer offered an opportunity to add comments. Sixty-one participants responded with comments falling into the following themes: An accessibility rating scale would be helpful because it would: Reduce stress, help determine if I should buy it before purchasing it, identify if it is designed/programmed for the visually impaired, would indicate if fast movements/reaction time is required to play, indicate the type of controller (keyboard+mouse, mouse only etc), length of time to complete (for focusing, memory and time sitting in wheelchair), offering information about what is challenging in the game (font size, colors, sound alerts, speed etc), information about playing with arms/legs/jumping would be useful, amount of buttons used, buying games you can't play hurts self-esteem, dexterity requirements would be useful,

Other comments opposing accessibility ratings suggested that it is impossible to create one scale that addresses all the demands of the many types of disabilities and diseases, there is no “Catch-All” criteria, perhaps a “this product has been tested on blind, deaf, and epileptic patients etc”, a scale is not helpful- however providing a downloadable pdf or audio review of accessibility features through a third party would be excellent, don't limit people based on capabilities- let them figure out if they can play, what is accessible for one is impossible for another, a scale would discourage people from buying a game when they may in fact be able to play it,

One compelling response indicated that “Having a accessibility rating scale will help more than just the people born with disabilities it will help the people like our soldiers that are coming home with one arm after fighting for our country and with the way video games are starting to turn towards having your entire body involved it is leaving those of us that do not have the ability to jump or stand etc out in the dust so to speak. A rating system would just let us know ahead of time that its possible to play the game one handed or its possible to play the game from your wheelchair etc

#### 3.2.2 What games do you play?

Of the choices provided, the games played daily include puzzle games (30%), MMOGs (22.3%), Role Playing (12.9%), Action Role Playing (11%). Most participants play games with either E-Everyone (35.7%), M(17+) Mature (30.2%), or T-Teen (27.2%) daily. When asked what were the top 3 favorite games, the two most popular games were Wii Fit (21.8%) and Solitaire (20%). Other very popular games the participants offered in the comments section included puzzle games (such as Bejeweled), first person shooter games (such as Call of Duty and Quake), strategy games (such as Civilization), console role playing games (such as Final Fantasy and Legend of Zelda), massively multiplayer online role-playing games (MMORPGs) (such as EveOnline and Warhammer), social networking games (such as Farmville), life simulation games (such as Harvest Moon and SimCity), adventure games (such as Uncharted and Tomb Raider), and music based games (such as Rock Band). Others suggested Second Life as their favorite game. The most frequently reported favorite game was Nintendo Wii Sports. When asked, “What is your favorite game of all time”, a completely open ended question, the game with the most frequent response was Super Mario Brothers and World of Warcraft.

#### 3.2.3 What do you think makes a good video game? (select all that apply)

The responders as a whole indicated that Fun Game Play (74.3%), User Friendly (69.3) and Controls were easy to use (58.4%) and Interaction from the game environment (58%) were the top 3 characteristics of a good game. Other frequently cited characteristics that more than 50% of the participants responded to include accessibility (57%), creative game play (55.4%), entertaining story line (55.4%) and entertainment value of

playing game more than once (52%). Characteristics that fell in the bottom of the list included online game play statistics tracking (8.9%), cartoon-like graphics (11.9%), closed captioning (13.9%), graphic visuals (21.8%). Other comments suggested by the participants include physical feedback-enabled devices, ability to talk with other players, good storyline, and minimal typing requirements.

When asked about their least favorite game, the responders had much to say. The open-ended responses included: Horror, gory and gross games; games that don't let you save levels; dance games because I can't move my legs; shooting games and games where you blow things up are not fun; changing camera perspectives makes me dizzy; fast paced games because I can't keep up due to my cognitive impairment.

### 3.2.4 Why do you play video games?(select all that apply)

**Table 5.** Why do you play video games?

Answer Options	Response Percent (%)	Response Count (n)
Games are fun	76.8	76
It helps me to pass the time	63.6	63
I like the brain challenge	59.6	59
I like to solve puzzles	57.6	57
I enjoy escaping reality	51.5	52
Games are distracting	46.5	46
I can play with my friends	46.5	46
I like the fantasy	46.5	46
I enjoy the competition	43.4	43
I can play with my family	39.4	39
I can learn things from games	34.3	34
I enjoy the physical challenge	30.3	30
I like to put myself into the character in the game	30.3	30
I like to imagine myself in the game	28.3	28
For exercise	26.3	26
For physical rehabilitation	24.2	24
For psychological or social rehabilitation	24.2	24
I love to destroy stuff	24.2	24
To help me with my balance	28.2	18
Other	10.0	10

Additional comments offered by the participants include “I can forget that I have a disability for a while”, “Video games have helped me think around the problems or issues I come across. They are also good for distracting me from needing too many pain meds because I am staying busy but not too hard physically”, “[They] take focus away from my pain”.

### 3.2.5 Do you think video games have a place in a rehabilitation setting (hospital, outpatient clinic or home)? Explain your answer.

Amazingly, 100% of the participants indicated that they believe video games have a place in rehabilitation. The main themes obtained from this question include making rehabilitation more fun, it is distracting, helps with coordination, relieves pain, increases social interaction, offers ways to improve confidence, improves cognitive function, helps with seizure disorder, depression and PTSD; and can motivate unsighted to interact with computers more.

Below are excerpts from 63 responders: “It can make rehabilitation more fun.”, “Because they are fun, distracting, help pass the time, and can stimulate the mind and be therapeutic in many cases”, “Yes, boring movements will be fun, its like exergaming, you have fun, you want to move. You don't feel like it is a workout or hard to do”, “I know they do, I recently went to play Wii games with my friend in hospital (who is in "lockdown" can't move much of her body but her eyes, mouth occasionally and sometimes her head) we were playing hand over hand and she was enjoying it a lot, was the most animated in weeks that I have seen and I visit her daily”, “Many rehabilitation exercises and activities are excessively boring. Video games can make repetitive actions much more interesting”, “It takes away the boredom of hospitals and has a positive impact on rehabilitation”, “anything that helps you past the time and works you brain is good”, “Is a way to do some necessary Rehab that's is entertaining instead boring. Also, because one can do Rehab relating with other people”, “They provide a much more entertaining context and more tangible rewards than ordinary physical therapy”, “Helps coordination and adapting to disability”, “I believe video games can help reaction speed, coordination, critical thinking skills and in some cases, physical strength and balance”, “They can help

people improve hand eye coordination and over come social fears”, “It would REALLY help me right now to have an engaging game that could help me get stronger without overdoing it in one sitting/standing”, Games can provide occupational therapy. ...one of my customers needed a gaming computer for her Autistic grandson -- it was the only thing he could interact with. I've always used games for improving hand-eye coordination to train when I was a hockey goaltender”, “Helps with balance, rec. therapy. coordination, stress, depression etc.”, “Helps with developing coordination, brain power, and physical stamina plus being enjoyable”, “It relieves PAIN playing”, “Also hand / eye coordination. Or as for me.. a kind of physical therapy to lengthen my hand muscles and give me less pain”, “They distract from pain (when the control doesn't cause any) and it gives me at least some form of social interaction”, “amongst other things - when I am in a lot of pain, yet bored and in need of something to do but unable to really just sit and watch a tv show (too restless) a video game can distract me and actually seems to lower my pain levels - or at least keep me from focusing on them long enough for the pain meds to work”, “Distraction from pain. With the right positioning I can do them even when I can't sit up. They give me something I can do with my partner. Gaming can be used to help with visual skills and hand skills”, “Depending on the individual's circumstances, I think that game-playing can provide motivation, distraction, social interaction and even physio and OT, to name but a few. It can also give an individual back a great deal of confidence in themselves and their abilities”, “gets them engaged SOCIALLY, helps BUILD MUSCLE in part of the body that functions, builds SELF-CONFIDENCE, engages their MIND”, “Help the brain to think”, “Yes, Especially in the areas of mental & physical rehab.” “I can't run anymore, or practice archery like before I got sick. I can do these things in games. I think games let people experience things they can't do IRL”. I think games are especially helpful to disabled children (though age is not a factor!) do some things they can't”, “4 years ago I had spine surgery & was recovering from a serious accident. at the first place it was like physical therapy boot camp but the second place encouraged recreation and losing yourself in activities finding things that you enjoy to not only help you relax a bit but to help your mind heal as well. The games were simple memory games and puzzle games but it was still fun and made the rehab center not so bad the 4 months I was their unable to go home and be with family & friends”, “as a combat vet of Afghanistan war, I find escaping the realities and the media and playing games is a way of distraction, and also to help with the mind, eye, and hand coordination, memory, try to improve on those skills which are hidden because of the PTSD”, “Sure they are important. People need the distraction and something to do while sitting. It is engaging”, “Video games can provide a way for individuals to practice all sorts of skills. The wii can be used for physical therapy, a standard video game console for OT, and the Sims for social skills training”, “Anything is possible with software. It provides a safe environment for learning, therapy, and exploring ideas as much or as little as you need. Software can grow with your need, and be accessed locally”, “Sometimes they can help with seizure control.” “especially the Wii because of the purposeful movement factor”, “Games can help with depression; can also help people gain social skills; can also help people with stress. Can even help educate people of diseases or even help medical staff further their skills within their career”, “Video games can be an enjoyable adjunct to assist with physical and mental therapy. They can help PTSD sufferers distract their minds away from their trauma. They can help those that are normally cut off from society to become a part of society without the stigmas that come with their disabilities”, “They could help motivate newly unsighted people to interact with computers, something they will need to do well in the 21st century”, “Physical Therapy, Occupational Therapy, Speech Therapy, Recreational Therapy”,

*“It gives people incentive to want to be rehabilitated & gives them the will to continue to live”*

Sixty-five percent of participants have never used a video game for rehabilitation purposes. Of the 35% who have, they indicated that they have used the Wii Fit, Wii Sports, Interactive Metronome, Wii Sports Resort, Balance games, Solitaire, and EA Sports Active. When asked which game was their favorite to use in rehabilitation, they responded with Wii Fit, Football, Wii Boxing, Bowling, Wii Tennis, Tilt Table, YourSelf Fitness, Wii Baseball, Dance Dance Revolution.

### 3.2.6 Why do you play video games in Rehabilitation? (Select all that apply).

Lastly when asked why do you play video games in rehabilitation the most frequent response was “Because they are fun” (see Table 6 for full response count).

We've used all kinds of games, from old Atari systems and the retro joy stick plug and plays to the XB360 and anything in between. With many great results reported from the Recreational therapy crew. The most impressive are the guys in for brain surgery who couldn't talk and while playing games have beat a buddy and pumped a fist into the air saying "Yes!" in triumph and not realizing that they had spoken.

**Table 6.** *Why do you play video games in Rehabilitation?*

<b>Answer Options</b>	<b>Response Percent (%)</b>	<b>Response Count (n)</b>
Games are fun	42.6	40
For exercise	35.1	33
To help me to forget about my disability for a while	35.1	33
Games are distracting	27.7	26
I like the brain challenge	27.7	26
They motivate me to move more	26.6	25
I enjoy escaping reality	25.5	24
I enjoy the physical challenge	23.4	22
I can play with my family	21.3	20
Time seems to fly when I'm playing games	21.3	20
To help me with my balance	20.2	19
I can learn things from games	19.1	18
I like the fantasy	19.1	18
I like to solve puzzles	19.1	18
I feel less pain when I am having procedures done	18.1	17
Rehabilitation seems to fly when I'm playing games	17.0	16
I like to imagine myself in the game	16.0	15
I enjoy the competition	16.0	15
I can play with my friends	14.9	14
I love to destroy stuff	13.8	13
I like to put myself into the character in the game	8.5	8

### 3.2.6 Games would be more enjoyable if:

The purpose of asking this question was to understand how to improve upon the design and development of video games for individuals with disabilities and for those undergoing rehabilitation. The response that garnered the most responses was “Game developers better understood the needs of people with disabilities (63.5%). The next most frequently selected response was “The controllers were more accessible” (57.3%). Other answers selected by nearly a third of the responders included “I could use them during my rehabilitation” (31.3%), “I could use them for my daily home gym exercise routine” (31.3%), “They moved a bit more slowly so that I could achieve the goal set at each level” (30.2%), and “Scores could be equalized across disabilities so that players with different skill sets could play together while not being penalized for their impairments” (29.2%).

### 3.2.7. How can we make games for rehabilitation more fun?

Themes that emerged from this question included: increasing reward factor, improving accessibility, free accessible game controllers for disabled players, providing real-time data, closed captioning, remove annoying AVI toons between moves, simplify system requirements, makes games slower, offer a variety of game play speeds, add levels of difficulty/ adaptive levels, adapt more buttons, remove “judgment” from scores, make the funnier, add “cool” reinforcements for doing well, many games feel like they were created for kids- need to make some adult games for rehabilitation, improved key mapping, encourage more physical movement, use happier themes- not so much violence, provide interactivity and online competition to everyone- so that everyone could play against anyone from anywhere, maybe incorporate peoples own music likes into the games, or their own pictures as backgrounds for the games...that would make some people very happy, provide speed cheats for people with poor coordination, provide customizable control schemes so users can compensate for the hindrances of their various conditions, universal acceptance for customizable controller layouts, and finally, slow them down.

Some excerpts from these comments include:

*“Design with thought that not all disabilities are equal”*

*“More AAA titles used in rehab settings, not just ‘special’ games”*

*“What about waving your arms to cast a spell to fight a demon? (slip the exercise into the game)”*

*“Make them accessible to anyone, inexpensive (being disabled leaves us with limited income and we often must decide between food, medical needs, or entertainment...entertainment comes last when you need to pay a medical bill”*



3.2.8 Please provide any further comments you have regarding games for rehabilitation and how game designers/developers can meet your wants and needs (game design, game mechanics, game interfaces, game activities etc)

This item garnered 51 responses. In general the comments focused on the following areas: better understand the disabled community through focus groups with users/caregivers/and professionals, include disabled people in the design process, increasing game accessibility, improving controllers such as sip and puff, increase size of controller buttons, make voice use easier, increase ease of moving characters on screen, customizable text, built in magnifier, making a soft controller for painful hands, create more reasonably priced motion sensors and wearable video/audio control mechanisms, make more games voice activated

*“I think that game designers should get a research group of disabled people that have different forms and severity of disabilities so that they can at least understand better what we all need..and perhaps they can't please all of us in one game but they can make add-ons to help the visually impaired play easier or they could offer captioning or make a list of things and then let the player choose what button they want to do what task in their own game. I mean if I'm having a tough day and can't use the stick on the right side..then let me change it to the left..would that be so difficult to do???”*

*“over all - there are parts of some games I love that I can't do. when my friend moved away, I have no choice but to stop playing the game.”*

*“Even if we had to play 10 bucks more per game, having some kind of a 'cheat code' or switch that would let us skip certain difficult (stupid) parts of the game that require coordination or speed that we just do not have to be able to progress in a game (Resident Evil 4 - i just gave up - could not do the boulder part, so the rest of the game was a waste) would be great. Even if it says 'stage skipped' or something so people don't think we got through without a hitch, just being able to bypass parts to get on with the story would be great. I \*liked\* everything else but that mini game killed the whole rest of the game for me. Literally - i couldn't finish it.”*

Some responders offered a “Thanks” to the authors of the survey saying “this survey is a welcome addition to making gaming accessible and inclusive”, “Thanks for doing this for us”, “I appreciate the fact that anyone is looking at the need for games which do help with rehabilitation and thinking skills”.

## 4. CONCLUSIONS

The results of this survey indicate that individuals with disabilities enjoy playing games and are very passionate about game accessibility and game design. While many participants had never used video games during rehabilitation, all could see their potential use and suggest that rehabilitation experts and game designers work together to improve the ways games are developed and designed to optimize use by individuals with disabilities and for rehabilitation purposes.

Future analyses of these data will assess responses based on age, gender and health condition to elucidate trends for differing health conditions or other factors that could better influence game design.

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Choose all of the words that describe your health condition						
Back Pain	14.0%	20	Lupus	1.4%	2	
Mobility Impairment	14.0%	20	Agoraphobia	1.4%	2	
Other (please specify)	14.0%	20	Asperger Syndrome	1.4%	2	
Paralysis	14.0%	20	Bipolar Disorder	1.4%	2	
Chronic Illnesses	12.6%	18	Blurred Vision	1.4%	2	
Spinal Cord Injury (neck/cervical C1-C8)	12.6%	18	Developmental Disabilities	1.4%	2	
Depression	11.2%	16	Dwarfism	1.4%	2	
Anxiety Disorder	9.1%	13	Mental Disabilities	1.4%	2	
Arthritis	9.1%	13	Multiple Sclerosis (MS)	1.4%	2	
Spinal Cord Injury Incomplete	9.1%	13	Obsessive Compulsive Disorder (OCD)	1.4%	2	
Cerebral Palsy	7.7%	11	RSD (Reflex Sympathetic Dystrophy)	1.4%	2	
Urinary Incontinence	7.7%	11	Behavioral Addiction	0.7%	1	
Asthma	7.0%	10	Diverticulosis	0.7%	1	
Diabetes	7.0%	10	Endometriosis	0.7%	1	
Muscular Dystrophy (MD)	7.0%	10	Epilepsy	0.7%	1	
Visual Impairment	7.0%	10	Familial Hemiplegic Migraines	0.7%	1	
Nicotine Addiction	6.3%	9	Full Quadriplegia	0.7%	1	
Pain Syndrome	6.3%	9	GERD	0.7%	1	
Rheumatoid Arthritis (RA)	6.3%	9	High Cholesterol	0.7%	1	
Spinal Cord Injury (Back/Thoracic T1-T12)	6.3%	9	General clumsiness/ lack of coordination!	0.7%	1	
ADD/ADHD	5.6%	8	Hypertension	0.7%	1	
Fibromyalgia	5.6%	8	Lyme Disease	0.7%	1	
Spinal Cord Injury Complete	5.6%	8	Migraine	0.7%	1	
Brain Injury	4.9%	7	Musculoskeletal problems (bad hip)	0.7%	1	
Chronic Fatigue Syndrome	4.9%	7	Myasthenia Gravis	0.7%	1	
Memory Loss	4.9%	7	Myasthenia Gravis, Lupus, Peripheral Nerve Hyperexcitability	0.7%	1	
Acquired Brain Injury	4.2%	6	Nerve Damage	0.7%	1	
Dyslexia	3.5%	5	No ACL in knee	0.7%	1	
Hearing Loss	3.5%	5	Non verbal learning disability	0.7%	1	
Learning Disabilities	3.5%	5	OsteoArthritis, behavioral addiction	0.7%	1	
Myofascial Pain	3.5%	5	Osteogenesis Imperfecta (Brittle Bones)	0.7%	1	
Osteoarthritis	3.5%	5	Paraneoplastic disorder	0.7%	1	
Spinal Cord Injury (Lower Back L1-S5)	3.5%	5	Peripheral nerve hyperexcitability	0.7%	1	
Stroke	3.5%	5	PTSD	0.7%	1	
Amputation of the upper limbs	2.8%	4	Skin Rashes	0.7%	1	
Autism	2.8%	4	Spinal Muscular Atrophy (SMA)	0.7%	1	
Blindness	2.8%	4	Tendon issues / Hyperflexibility Syndrome	0.7%	1	
Color Blindness	2.8%	4	Acrophobia	0.7%	1	
Deafness	2.8%	4	Alcohol Addiction	0.7%	1	
Hearing Impairment	2.8%	4	Amputation of the lower limbs	0.7%	1	
Hypoglycemia	2.8%	4	Ankylosing Spondylitis	0.7%	1	
Tinnitus (Ringing In the Ears)	2.8%	4	Dermatopolymyocytis	0.7%	1	
Vertigo	2.8%	4	Diabetic Retinopathy	0.7%	1	
Cancer	2.1%	3	Drug Addiction	0.7%	1	
Dyscalculia	2.1%	3	Motor Neuron Disorder	0.7%	1	
Head Injury	2.1%	3	Spina Bifida	0.7%	1	
Parkinson's Disease	2.1%	3	Traumatic Brain Injury	0.7%	1	
Phobia	2.1%	3	I Don't Have a Disability	16.1%	23	
Sciatica	2.1%	3				

## 5. REFERENCES

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