

Co-creating a Wii-game for the blind and sighted

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ABSTRACT

In the GAMES for the Blind And Sighted project (GAMBAS) the Wii-game *"The Explorer and the Mystery of the Diamond Scarab"* was developed. Apart from the fun of playing with other children, the blind children benefit from playing the game because it helps them to improve their balance and locomotion skills. This Wii-game can be played both by blind and sighted children on an equal basis in the age between 6 and 12 years. In this paper we describe the development of this Wii-game by applying the co-creation methodology.

Categories and Subject Descriptors

D.2.2 Design Tools and Techniques: Evolutionary Prototyping

General Terms

Design, Human Factors, Gaming

Keywords

Co-creation, Blind children, Wii, Locomotion, Serious Gaming

1. INTRODUCTION

Locomotive development of children with visual impairment often stays behind [1]. This forms a significant barrier to participate in physical activity and therefore these children are at greater risk for developing health problems.

The initial goal of the project was to develop a (serious) game with which the locomotive development could be improved. Of course, the game should be fun to play and can be played at school as well as at home. During focus group sessions, aimed towards the creation of game concepts, blind children indicated a need for games designed in a way that they can compete with sighted children on an equal basis.

Existing computer games, designed especially for blind children are based on audio feedback and provide no, or less, images on a screen. We observed that these games are very difficult for sighted children to learn and not as much fun as the games they are used to play with. Also, when blind children play audio games, they are quite isolated from other children. Their sighted siblings and friends are not able to see what happens during the game and can therefore not give support or laugh at the achievements of the blind child. Playing together and compete on

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an equal basis is very difficult.

There are examples of computer games designed to be accessible for both visually impaired and mainstream gamers. MIT developed AudiOdyssey for the Nintendo Wii [2]. Another example is a "Battleship" game that can be played using separate interfaces for sighted people and blind people [3].

Blind people do sometimes manage to play some of the regular computer games or even Wii games [4]. Recently ViBowling [5] and ViTennis [6] were developed to enable playing Wii games and be physically active, by children with visual impairments.

2. GOAL

The goal of GAMBAS is to design a game which can be played both by blind and sighted children, using the same interface, on an equal basis. The game should be played using a regular commercially available device. The Wii was selected because playing games with the Balance Board requires players to move their body. This type of kinaesthetic play is beneficiary for the balance and locomotive development of blind children. In parallel we created a method to evaluate the improvement of the locomotive skills and transfer to everyday life.

3. APPROACH

The game was designed in a collaborative setting between blind children, sighted children (siblings of the blind children), multimedia game developers (MAD Multimedia) and experts on the development of blind children (Royal Visio). The co-creation process was designed and facilitated by TNO, an independent Dutch research organization. Principal Blue coordinated the project as a whole.

We believe a co-creation approach to be very suitable for designing for people with disabilities, because it helps developers and designers to envision how blind children experience their world and interact with games. By making the children part of the development team, they can be involved in different stages of design and implementation. They can steer the design decisions and evaluate intermediate results.

We needed to improvise and adapt the usual co-creation methods to the capabilities of blind children and to make it fun for them to participate. Blind children cannot be asked to draw images. Nor is it easy for them to oversee and make selections from a large list of items. It is also more difficult to make them experience and evaluate intermediate results on paper.

3.1 Selection of co-creation participants

Four families with blind and sighted children in the ages between 6 and 12 were selected (9 children participated in total). We selected siblings of the blind children to give the sighted

perspective. They are equally motivated as the blind children to participate in the time consuming co-creation process.

3.2 Creating a shared understanding

3.2.1 Creating awareness

During co-creation end users are involved as experts of their experiences [7] not as game designers. We wanted the children to become aware of their fun/interesting gaming experiences and preferences. To stimulate their awareness, the children were asked to fill a mindmap at home during the holidays with the games they liked to play (not only computer games) and why they liked to play these particular games. A mindmap is a tool used to stimulate creative diverging thinking – we offered the blind children a Braille version. The games mentioned on the mindmaps were clustered based on the elements that characterized the game and made it fun to play. (e.g. “I need to be clever” or “I can laugh”).

3.2.2 Defining a shared goal

To design a game, based on the same game elements, the children had to decide on the game characteristics that were most important to all of them. Because it is difficult and boring for blind children to listen to long lists of items we designed a card trading game. Each card had one item on it in Braille code. They traded cards until they found the 4 preferred game characteristics:

1. Experiencing adventures and finding out how to continue;
2. Being smart;
3. Discovering and learning new things;
4. It makes you laugh.

3.3 Creation of a game concept

3.3.1 Experience with the new technology

To be able to design a game for the Wii, the children first needed to experience playing with the Wii at home. Especially the blind children had no or little Wii-experience. They played several games and were asked to keep a journal stating what they liked, what they disliked and to come up with ideas to make the Wii more suitable for them. This information was very important for the game developers during the design process.

3.3.2 Creating individual concepts

The creative process was carried out together with the game developers and the children. First the children were asked to discuss and act out what type of adventure they would like to experience. In a second phase each blind child and sighted sibling was coupled to a moderator (two of them were game developers). The children were asked to create and act out the adventure using LEGO bricks and toy animals (Figure 1).



Figure 1: Creating a game using LEGO bricks to visualize the adventure scenes.

The intermediate results were shared with the whole group so that ideas from others could be adopted. In the second phase the interaction with the Wii was “played” by standing on the Wii Balance Board and talking through the different events of the adventure.

3.3.3 Evaluating and combining ideas

At the end of the design session the groups presented the ideas to each other, they were rated and feedback was given. We analyzed and combined the elements of the game designs. This input was used by the game developers to create the functional design and the requirements of the game. In a next session these requirements were presented to the group in a first evaluation session. All the children could “experience” the basic elements of the game concept in a physical environment we simulated in a gym (Figure 2).



Figure 2: Simulation of the game in a physical environment using audio feedback to indicate barriers.

The sighted children had limited vision glasses, imitating the dark surrounding within the game. Audio feedback was given using musical instruments or voice feedback. Difficult navigation situations were “solved” in situ in a dialogue between the children and the game developers.

3.4 Prototype evaluation

3.4.1 Navigation and orientation

Already in early stages of the game development we wanted to ensure that the navigation, orientation, audio, feedback in the game would offer an equal challenge for the blind and sighted children. During the design phase several ‘play testing’ sessions were conducted. Play testing method means participants play with a prototype version of the GAMBAS Wii game by using a previously established research protocol. Consecutive versions of the working prototype on the Wii were tested and evaluated by all the children individually. These children already had participated in the first co-creation stages of this project. Based on the results of the evaluations the navigation and orientation elements were evolved to make it easier to manoeuvre and create more sense of direction and distance for the blind and visually impaired players.

Main lessons learned about navigation and orientation:

- All children prefer navigation where it is possible to rotate the viewing perspective in the direction of the movement. However in this solution blind children tend to lose their orientation. By rotating the viewing perspective it is also less necessary to lean left or right, thus diminishing the possibilities to train the children’s balance.

- Because we selected a navigation method where the viewing direction is fixed in a forward direction, the children are required to walk backwards (by leaning). Because this is very difficult for blind and visually impaired players, the speed for walking backwards had to be faster.
- Not only feedback is needed about obstacles and the location of the treasure, but also about your location in the level and the direction of your own movements.
- Maintain good balance and diversity in audio feedback: too much feedback clutters the total experience.
- Create a tutorial in which all sounds are clearly explained and how the controls work

3.4.2 Game play

Once the tests showed that we could achieve equal navigation results for both the blind and the sighted children we then focused on designing and evaluating the game fun experience and the game play. To enrich the game experience and provide specific locomotion exercises extra mini-challenges were built in the game. With a version of the game, with all the audio and tactile elements implemented and some basic mini-challenges, the game was evaluated by the involved children and also with a new, unbiased group of children. The results from all these tests supported our design ideas and implementation of them in the game. The results showed that children were enthusiastic about the game and that they felt engaged in the game - even the blind children who are not playing, but listening to the others play. In some case these non-playing blind children told the playing children how to play and corrected their errors. This is a unique experience for blind children.

Main lessons learned towards game play:

- Provide additional game mechanisms to make the game more challenging to play and to entice children to repeat playing the game in the future. For this purpose we introduced a system of rewards and penalties during the mini challenges and an overall performance score at the end of a level.
- To stimulate the need for competition, the children asked for a high score listing. Due to technical limitations of the Wii platform we used this is not possible in this version.
- To make the game more adventurous it is necessary to vary the type of mini-challenges and to make it less predictable which challenge appears where.

4. RESULTS AND FUTURE WORK

4.1 Game description

The game is set in an old Egyptian underground, mazelike, dungeon from which the game character (named Ben) escapes after solving several levels. The goal of the game is to collect treasures which are hidden under the tiles of the dungeon.

To create an equally challenging navigation for the blind and sighted children the lights in the dungeon are darkened and the range of Ben's flashlight is very limited, so the sighted players only see a small portion of their direct surroundings. An Egyptian princess helps Ben in the game with instructions (Figure 3).



Figure 3: (Screenshot) Characters Ben and Tiri.

The player navigates through the dungeon by leaning forward, sideways or backward on the Wii Balance Board (Figure 4) Each direction of movement (right, left, forwards and backwards) triggers a different audio feedback sample, to support the player to determine in which way the character in the game is walking.

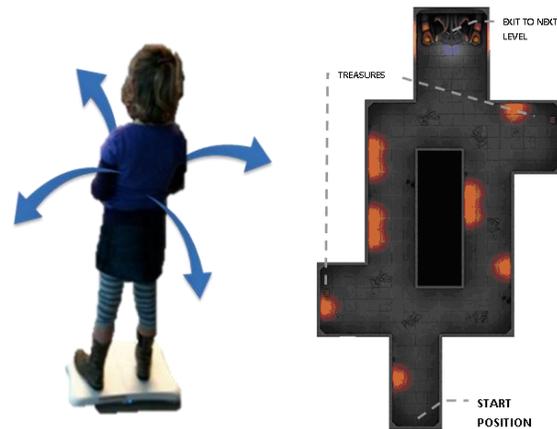


Figure 4: Navigation through the environment.

The treasures are hidden under tiles, so they are also not visible for the sighted children. Using a special sonar-like sound both the sighted and the blind children can find the location of the treasures. The closer the character is located near a treasure the higher the frequency of the sonar-beeps.

To support the orientation in the game, audio feedback is given when the character is in close distance of a wall (sound of falling rubble) or when a side corridor is present (sound of wind). Tactile feedback is given through the Wii-mote if the character hits a wall. After finding the treasure music is played and the content of the treasure is explained (see Figure 5). When all the treasures are found, the child can move to the next level.



Figure 5: (Screenshot) Ben finds a treasure.

Mini-challenges can appear at random places in the dungeon. Their purpose is to enrich the game experience and to provide specific locomotion exercises (see Figure 6). In these exercises children need to change their balance to avoid snakes, arrows and mummies. They were designed in collaboration with movement scientists and physical therapists. To make the game even more challenging the difficulty of each level as well as the mini-challenges increases in every level. The higher the level, the higher the challenge!



Figure 6: (Screenshot) Mini-challenge: change balance to avoid the mummy.

4.2 Conclusions towards co-creation

We found that co-creation is a very valuable methodology to develop applications for children with visual impairment. The fact that they can contribute to the creative process during design and implementation offers the developers many valuable insights and experiences. A lot of solutions implemented in the game were created by the children during the co-creation sessions.

Our experience is that existing co-creation methods can be adapted very well for special target groups to create participation and involvement.

4.3 Next steps

One of the main purposes of the game is to improve the locomotion skills of visually impaired children. To evaluate the effectiveness of the game to reach improvement of locomotive skills this game will be used in the physiotherapy sessions at the primary schools of Dutch Royal Visio. A standardized measure and evaluation method was also developed during this project. The method consists of a pre-test to assess the current level of locomotive skills and balance of the child and longitudinal measurements to establish any improvements over time. In this test the static balance skills of the children will be measured using the Wii Balance board [8] and the motion skills will be determined using a TGMD-2 (Test of Gross Motor Development – Second Edition, [9]). Only after having played the Wii-game with the same children for a certain period of time during lessons and at home, we will be able to assess the value of the game for training purposes.

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