T. Gaudy, S. Natkin, C. Leprado, T. Dilger and D. Archambault. Tampokme : A Multi-Users Audio Game Accessible To Visually And Motor Impaired People. In proceedings of CGAMES 2007. La Rochelle. 21st-23rd November 2007

TAMPOKME : A MULTI-USERS AUDIO GAME ACCESSIBLE TO VISUALLY AND MOTOR IMPAIRED PEOPLE

Thomas Gaudy(1) Stéphane Natkin(1&2) Cécile Le Prado(1&2) Thierry Dilger(2) Dominique Archambault(3)

(1) Centre De Recherche en Informatique du CNAM
292, rue St Martin,
75003, Paris, France
tomgody@yahoo.fr
natkin@cnam.fr
cecile.leprado@free.fr

(2) ENJMIN/CNAM
121 rue de Bordeaux, Angoulême, France
dilger@studiowan.com

(3)Université Pierre et Marie Curie,
Inserm 483/Inova
9 quai Saint Bernard,
75 252 Paris cedex 5, France
00 331 44 27 26 10
dominique.archambault@upmc.fr

KEYWORDS

Game Design, Accessibility, Audio game, Visual impairment, Mobility disability.

ABSTRACT

We present in this paper a quick overview of the games accessible to the people who are visually impaired. First, these audio games require often a too great number of commands: for this reason, they are hard to learn and many people do not enjoy playing them. Second, the users want more audio games with multiplayer feature. This paper presents the audio game TAMPOKME, which is accessible to people who are visually and motor impaired. It can be played from one to four players and combines principles of competition and cooperation. We describe in this paper the methodology that enables us to produce such a game. After presenting the aims of TAMPOKME, we detail its interface and gameplay. We then present how this audio game has been improved, in a sound design perspective, by the students of the Graduate School of Games and Interactive Medias, France, and the interface qualities that have resulted from it. It is possible to make an audio game with very simple control. In that way, such a game can be easier to learn and it can be enjoyed by another community than the visually impaired one.

STATE OF THE ART

Research carried out on video audio games, accessible to people who are visually impaired, focuses both on the accessibility of the man/machine interfaces and the question of an adapted gameplay. In this paper, when we mention video games, we refer to « classical » commercial games and with the expression audio games, we refer to video games specifically designed for people who are blind. This paper results from a state of the art concerning this type of media (Gaudy et al.2006a), the main results of which are the following:

There are over 400 video audio games accessible to blind people and there are more and more developments. These games follow the principles of « classical » video games, but with a limited cost, and, as a result, a limited content and complexity. However, the sensations given by these games are quite different from those given by video games. They are, at first, quite disconcerting for sighted players because of the absence of a visual interface and of an unusual appeal to hearing. The aims of these games often seem confusing to them, and the interaction, awkward.

We consider that this difficulty to enjoy audio games is related to the excessively great number of commands the players have to use. A great number of audio games requires more than ten keys on the keyboard. In consequence, the player has to pass through a learning process, first by reading the leaflet and then by playing the game. Most of the time, players have to read the leaflet again and try the game many times before they can begin to enjoy it. Another consequence of this long and unavoidable learning phase is that people who can discover other interactive games in a more easy way will not try these audio games. We think that it is for this reason that sighted players do not want to play audio games.

We experienced several ways of improving them, while developing a maze audio game. In particular, the learning of the perceptive interface has to be progressive with a very pleasant and easy starting situation. In that way, people can play our audio game without having to read the leaflet. We think that this approach can be implemented in a more efficient way: as videogamers, audio gamers should play simple games without the help of any kind of verbal instruction. We have obtained some encouraging result on that purpose (Gaudy et al.2006b).

USER'S NEEDS

In parallel to the state of the art, we inquired on the needs of young visually impaired people concerning digital leisure thanks to a questionnaire and interviews. The main results of this survey seem to show that the games that have been specifically designed for them are not necessarily their favourite ones. The complexity of the instructions given in a foreign language constitutes a significant factor of rejection. As most of the audio games are in English, they are little played by non English-speaking visually impaired people. Furthermore, numerous video games, supposedly inaccessible to disabled people, are, in fact, much enjoyed by many players who are visually impaired or partially sighted. According to another survey carried out in 2007, 64% of the

interviewed visually impaired people said that they liked playing « ordinary » video games (France 2007). Fighting games are much enjoyed, as well as some race games. We met visually impaired players who finished very complex video games such as « Zelda, a Link to the past » or « Donkey Kong Country ». The strategies used to play these games are amazing and require ingenuity, perseverance, and a good ability to memorise. It seems that the pleasure they have to play these video games is not the unique motivation of the people who are visually impaired. The fact that they practice a leisure activity intended for the general public also plays a significant role. As a matter of fact, these games can be considered as vectors of communication between sighted and visually impaired or partially sighted people. They therefore have a deep social importance. This social feature has been noticed as being particularly important for multiplayer video games (Manninen, 2003)

This particular feature is particularly required by the editor of "Audyssey", a specialised magazine about audio gaming, who has followed the evolution of audio games since ten years (Feir, 2006). The future audio games will need to include more social features or multiplayer modes. At this point, we wanted to work on this original contribution: a multiplayer feature on a new original audio game. We work on this aspect of audio games by considering also the problems linked to controls that are too complex.

QUICK OVERVIEW OF OUR GAMES

In the continuation of those observations, we developed three audio games. The first one is a musical maze game and the second one is an exploration audio game which requires the mouse to provide different feelings to visually impaired players. In audio games, the mouse can no longer be considered as an inaccessible device for visually impaired people (Bors, 2007). In those two games, we want to limit the number of required keys. In that way, we hope they are easier to handle. We had the opportunity to test them on a man with mobility disability at an exhibition. The maze game in particular was much enjoyed. The other one is not accessible to motor impaired people due to the mouse. The maze game only requires the four arrow keys. If one more key was required, this game could not be accessible to that player. Since then, we have considered the possibility to make audio games which can be played by people with motor impairment.

Other studies on audio games pay attention to multi handicap problems and there are games that can be played by visually impaired people or by motor impaired people. Those produced by UA-Games of the ICS HCI Lab are impressive and give encouraging examples of strong accessibility applied to action or puzzle games (Grammenos et al. 2005 ; Grammenos et al. 2006 ; Grammenos et al. 2007).

Our third game, which this paper deals with, is called. TAMPOKME : « The Audio Multi Players One Key Mosquito Eater ». TAMPOKME was developed for a competition called « DonationCoder Game Accessibility Contest 2006 » organized by DonationCoder and by the International Game Developer Association (IGDA). This competition offered to develop a game in one of the two following categories: either an audio game accessible to visually impaired people, or a game with a single switch accessible to people with motor disability. TAMPOKME tries to meet the two constraints. It is a game that can be played by one to four players and that combines principles of competition and cooperation. It is the first game to combine accessibility for visually impaired people and physically impaired people and with a multiplayer mode which allows up to four players to play together at the same time.

In the following paragraphs, we detail the aim of this study, the methodology and the evolution of TAMPOKME. This game was then improved by students of the Graduate School of Games and Interactive Medias, Angoulême, France (ENJMIN). At last, we will describe the remaining problems of the game.

AIMS OF THE STUDY

The development of the game TAMPOKME is part of a research on the understanding and the development of the interaction principles specific to visually impaired people but also, with this game, to people with mobility disability. This development is part of a current of research carried out by « Game Accessibility Special Interest Group » of IGDA (IGDA 2004), the Game Accessibility Project, the Audio games.net community and the French project TIM (Archambault 2004).

TAMPOKME is an experiment on several aspects of the conception of an interface and a gameplay based on sounds, usable with a single switch, and intended for users with different modalities of perception: the game must be playable for visually impaired players, physically impaired people and people without these kinds of disabilities.

The aims of the study are simple. First, we want to develop such a game. Second, we want players to find this kind of game enjoyable. We will explain in this study that the first goal was very simple to reach, but the second one was much harder. Many tests with blind and sighted players show a lot of problems. The experiment carried out with the students of ENJMIN enabled us to note that it was possible to improve the fun mechanisms of the interaction with the improvement of the sound design. This paper will describe the development process and in particular the significant help provided by the ENJMIN which has allowed us to bring a new and original pleasant free audio game.

METHODOLOGY

We wanted to develop a very simple game. TAMPOKME is a reflex game. The players have to identify a sound signal and properly react by pressing a key the appropriate number of times.

From this point of view, the rules are not complex at all. We wanted to make a simple game because we wanted to have the maximum time for the consultation and evaluation process by the target user group. This particular aspect of development takes more than three months with more than twenty sighted players and more than ten visually impaired players. We have no performed test with motor impaired people and we assume that this was a mistake.

The development method of this game is quite classical: we have followed a spiral cycle through successive prototyping, having the functionalities evaluated (Natkin 2006).
Each test requires only one new tester, and eventually other players which are already familiarised with the game, on a new version of the game. We consider each time the whole behaviour of the tester. With this approach, we could not focus on specific results as the time or the progression in the game. We wanted to identify when the tester feels difficulties, what was the nature of these difficulties and what in the game makes them occur. In that way, each test reveals a lot of problems and was followed by improvement developments.
This kind of development process presents a great advantage: one tester is sufficient to give many hints on the needs for improvement. But it presents also a great disadvantage: the results are just hints, based on the interpretation of the tester's behaviour. It is not a statistical and objective type of result. In consequence, at this point of the development, we can't prove the validity of the game. We assume this is a major weak point of this study but we will not only describe the qualities of TAMPOKME. We will also insist on the negative aspects. In that way, we hope this paper will contribute in an easier process to future works and research in these fields of studies.

EVOLUTION OF TAMPOKME BEFORE THE ENJMIN'S HELP

The first test of the first prototype revealed that sighted people did not understand the rules of the game because they are not familiarised with games without screen. The solution for this problem was to implement a « scenario ». The « scenario » of the game is based on a story of a carnivorous plant, controlled by the player, and different kinds of mosquitoes which come in turn to attack the plant. "Regular mosquitoes" require the key to be pressed once whereas "super mosquitoes" require the key to be pressed twice and "toxic mosquitoes" require no pressing of the key.

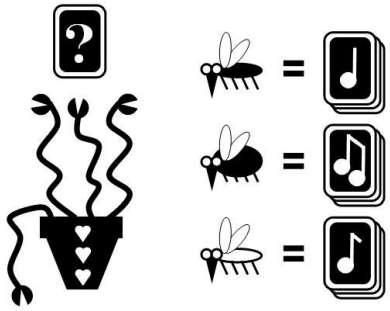

Figure 1. Representation of the principle of the game following the analogy with the game card. Each player controls a stem. Each kind of mosquito, "normal", "super", "toxic", has its own type of sound, produced in various versions.

Each kind of mosquito is associated to a type of sound signal and each sound signal can be produced in a variety of forms, in order to give the game variety and also more difficulties, as the number of sounds to identify increases. In fact, to make an analogy with a card game, it is as if a card was picked up at random and that the players had to determine what kind of card it is as quick as possible (see Figure 1).
We had to work on the difficulty of the game. The testers familiarised with other audio games found this one too easy. We realised that the different sound signals have to sound quite alike. The process of recognition is willingly made ambiguous and difficult.
As the game requires only one key, it was possible to include a multiplayer dimension more easily. Each player uses his/her own key on the same keypad. The sound signal calls for all the players to react together. Then, we had to improve this multi-player dimension. The test reveals that the social aspect of the game is more pleasant if the multiplayer mode is both cooperative, as the game is over only when all the players lose, and competitive, as the players can compare their performances through their score. These competitive and cooperative dimensions are also found through specific "life point" systems, a principle which is found in most video games. We make a distinction between individual life points, for the competitive dimension, and community life points, for the cooperative dimension. Concerning the competitive life point system, each player has a life point that he/she loses if he/she makes a mistake, and is thus temporarily withdrawn from the game. If all the players lose their life point, it is a community life point that is lost and all the players take back their individual life point. If all the community life points are lost, the game is over. The cooperative dimension is the most important one as the best player does not play against the worst one, who, thus, can play longer.
In that way, the game had a better social feature, but the rules of the game became more complex, and we had to improve again the scenario. As the information of the game is only based on sound, we had to manage it temporally and not spatially, as it is the case with « classical » video games. All the information cannot be given simultaneously. We made a scheme of the different steps that the game presents in turn and that a beginning user has to go through to know how to master the game (see Figure 2). All these steps are explained to the players with recorded verbal instructions included in the game. The time needed to explain the rules through the scenario became longer and we had to adjust again the difficulty. We decided also to implement a shortcut in the game for players who are familiarised with TAMPOKME. At the end of the game, a last manipulation is explained, which has to be done at the beginning of the next game: in that way, the player can go to the last step directly without going through the intermediary steps.

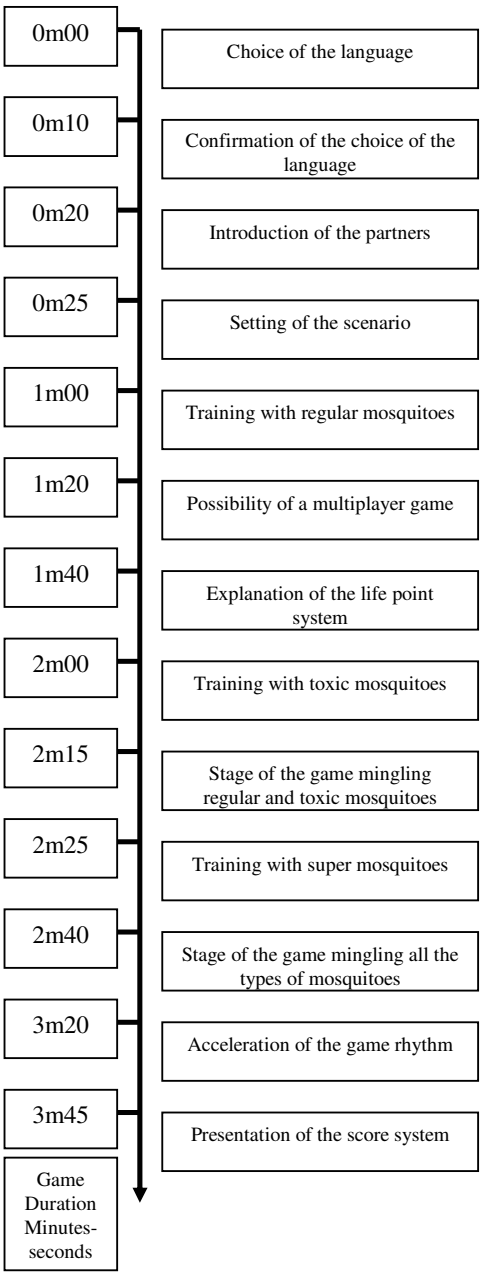

Figure 2. Order of presentation of information.

Then we had to consider two possible kinds of final users: the French speakers and the English speakers. We developed a one-key audio system permitting to have a choice between two languages: English and French. The game alternatively offers to play with either French or English instructions. The player has to press the key at the right time to choose the language. The game then asks the player, in the corresponding language, to press the key three times to confirm his/her choice and to continue the game. In an incomprehensible language, the player would have little chance to do the right number of interactions, and wrong manipulations are punished with a new change of language. Specific sounds punctuate the number of interactions: neutral sounds when the number is not sufficient, a more melodic sound when the required number is reached and a more aggressive sound when the number of interactions is too high. This type of sound system reinforces the comprehension of the interactivity of this audio menu.

At this point of development, the game still had some perceptive defects and defects of interface. Three categories of sounds can be essentially distinguished: the sounds emitted by the plant - swallowing, digestion noises, super swallowing, produced by a double press, the sounds of mosquitoes and the verbal instructions. Each category had specific problems in that version. The verbal instructions that were meant to give a context to the action were too long. The flow of instructions was slightly accelerated so that the beginning of the game is not too long, even though the instructions are consequently less intelligible. If the tests that were done with visually impaired people did not reveal any problems, on the other hand, the comprehension of the game instructions was often confusing for most of the sighted players. The problem of the comprehension of included in-game verbal instructions by the sighted people seems to be recurrent with most of audio games. Finally, the verbal instructions were given by three characters: a mad scientist, the carnivorous plant and a voice off. The quality of the voices made it difficult to distinguish the different characters. As for the sound of the mosquitoes, they were too aggressive. We used a synthesiser of which the sounds were a little too stressing to make the game pleasant. At last, the noises of the plant were totally abstract and did not help the player to have an idea of the situation of the game. Generally speaking, the game triggered a great hearing tiredness. The students of the ENJMIN, whose major is sound conception, helped to improve the sound design.

SECOND EVOLUTION PRODUCED WITH THE STUDENTS OF ENJMIN

In the ENJIM school, six majors are offered to the students: game design, sound conception, image conception, project management and ergonomics. The four first year students, whose major is sound conception and who studied either music or sound engineering for their graduation, have, as a practical exercise for the sound design course, to improve the game TAMPOKME. They were helped by two students whose major is Game Design.

This period of development combined two phases. In the first one, the students, working in pairs, suggested three very different versions of TAMPOKME.

The specified aim was clearly to solve the identified problems:

a) The sounds of mosquitoes that created an atmosphere too irritating to be pleasant

b) The sounds of the different players which had so different characteristics that it was difficult to picture that they all referred to the same musical entity.

c) The verbal instructions are quite rough and probably lack a musical design.

The overall aim was to create a coherent, pleasant and efficient world through the sound design.

The students started by testing the game, analysing it and suggesting, from what has been noted above, what could be improved from the player's viewpoint. They then thought about the possible transformations of the sounds of the plant and the mosquitoes and proposed what they wanted to do with the sounds before incorporating them into the games.
Then, in a second phase, we consider the works of the students in a new iterative process with new testers. The kept modifications exclusively concern the change of the sounds, of the atmospheres and the music, as well as the substitution of some locutions with evocative sounds. They then suggested some ideas to improve the interface and the gameplay: the use of sound spatialisation (Gonot et al.2006), a multiplayer mode on several machines, a system of gradual difficulty by changing the sound aesthetics of the game for each level.
All the suggestions were very interesting, but all of them could not be materially applied. We focused on the three sound versions. The game, as it was designed, could not include all the sounds: the limit was three kinds of mosquito sounds, which remained unchanged from one game turn to the other. After some thinking, it appeared that the life duration of the game could be expanded if the game randomly chose three categories of mosquito sounds from a wider range of mosquito sounds for each new game turn. In that way, we could better use all the students' works and from one game turn to the other, the sounds changed, which means that the challenge is renewed every time. Unlike the first version, the players can no longer rely on their learning and recognition of the sounds of the previous game turn (see Figure 3). The game becomes more difficult, which is not bad, given that, after a few game turns, visually impaired players could very quickly manage not to make any error in the first version.

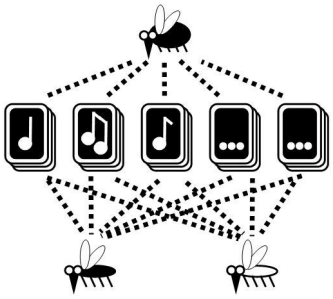

Figure 3. Visual representation of the choice at random of the categories of sounds attributed to the different kinds of mosquitoes at the beginning of the game, inspired by the works of the students of ENJMIN.

GOOD AND BAD ASPECTS OF TAMPOKME

Since the distribution of the game TAMPOKME, we have been receiving numerous comments. They are generally very favourable. Sighted people, visually impaired people and physically impaired people managed to play together on the same game and a lot of them enjoy it. Comments about the game can be found on the Internet.
We will now consider three actual limitations of the game.
First, the difficulty of the game is still not good enough. From a subjective point of view, the difficulty of the game is not the same for the different populations of gamers. Sighted players find Tampokme quite hard to master and to understand whereas visually impaired players find it too easy at the beginning. For motor impaired players, the difficulty has to be adjustable because some people have a very huge handicap and it is harder for them to react within the good timing.
Second, the multiplayer mode and the solo mode both have to be improved. The game is pleasant when it is played by two or three players, but it presents less interest when only one player tries it. At last, when the game is played by four players at the same time, the situation can be confused and sometimes, players did not manage to recognize the sounds produced by their own interaction.
Third, the accessibility of the game for the multiplayer mode presents a problem for the motor impaired people. The keyboard can hardly be used by four people with this type of handicap. The mouse should be used. If physically impaired players had been included in the development process, this problem would not occur in the final version.

CONCLUSION

Many projects start with complex features on the paper and the iterative process which requires to simplify them. We have presented the development of an audio game, which was very simple at the beginning. This point allowed us to modify the game in a more complex way in order to take into consideration the needs of the testers. Finally, we succeeded in developing a new audio game which provides a strong social feature by gathering people with varying disabilities in the same game environment. The controls required by the game are simple and the players do not have to read the leaflet, in spite of a relative complexity of the actual rules. The experience of students in a video game school was particularly useful to obtain a more pleasant game. However, the game is not perfect. Our next aim is to solve the three main actual problems.

ACKNOWLEDGMENTS

We thank Nicole Chun Lu, Fabien Deleurme, Samuel Lachaud, Jean Leman, Xavier Montels and Bertrand Poulain, students of the 2006-2007 promotion of ENJMIN for their help.
Thanks to all the testers and the players.
This work has partially been realised with the support of CECIAA, in the framework of a CIFRE contract.

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BIOGRAPHY

Thomas Gaudy studied at the National School of Video Game and Interactive Media (ENJMIN – France) and is now preparing a PhD entitled “Video Games for visually impaired people”. He has been developing four audio games which he is testing with users: two musical maze games, another one which is playable with a mouse, while the fourth one combines accessibility for visually impaired people and for people with motor impairment.