BEOWULF: A GAME EXPERIENCE BUILT ON SOUND EFFECTS

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ABSTRACT

A computer game with most of the traditional graphics removed and replaced with a detailed and realistic soundscape, can give immersive gaming experiences. By reducing the graphical, explicit output of information from the game, the player becomes free to concentrate on interpreting the implicit information from a rich soundscape. This process of interpretation seems to have the power to invoke clear inner, mental images in the player, which in turn gives strong and immersive experiences. This paper describes a project that explores some of these mechanisms and points out some new potential directions for computer games and game play design.

[Keywords: Computer game, sound effects, sound design, audio, immersion, gameplay, navigation]

1. INTRODUCTION

What processes are at work when users create personal game experiences from the audio/visual/interactive information provided by a game application? How will the gaming experience be affected if almost all information the player gets as to the type of environment they are supposed to be in, comes through sound effects rather than graphics? Will a shift from graphics to sound to drive game play create a greater space for the player to develop her own mental pictures of the game world? Will this greater space give a richer, more intense and immersive gaming experience?

These are some of the questions that led to the decision to start the project described in this paper. In this project, a traditional adventure computer game is used as basis, but with its focus shifted from the traditional 3-D graphics to a rich 3-D soundscape. The idea is to use this game as a research tool that can help answering some of the questions formulated in the beginning of this introduction.

2. CREATING ROOM FOR IMAGINATION

The first half of the movie "Jaws" could not be filmed as intended, because the extremely expensive mechanical shark simply refused to work. Stephen Spielberg had originally designed the opening sequence to show the shark attacking the girl swimmer. Forced to rethink outside the script, he filmed only the girl's reaction to the shark hit. He has since admitted that this version was far more powerful than if he had shown the attacker. The audiences were forced to imagine what lay below the surface of the water, and our personal imagination is far more dynamic and compelling than anything that a filmmaker can create. In fact the film benefited enormously from the inability to show the shark until half way through; by that time the audience had invested heavily with their own imagination in the concept of the giant shark, so that when it finally appeared, they were able to ignore the fact that it is, in fact, not at all convincing. This can be tested by seeing a sequence of the shark out of context (it is clearly a clumsy mechanical model) and then comparing the same sequence when the whole film is seen from the beginning.

Our brains want to have fun, they want challenges. It is often said that reading books is rewarding since you have to supply the images, sounds, smells and other sensations yourself from the basic information the characters on the paper supplies. Imagination, interpretation, the creation of mental, inner images seem to be something we like to do or even do automatically, in order to bring meaning to the world we inhabit.

Boehner et al. [1] makes a distinction between two models of emotion, the informational and the interactional model. In the informational model, emotion is a representational state to be transferred from one place to another via a transmission link. It is an internally whole and intact entity that can be expressed and communicated through a process of encoding, transmission and decoding. This process can be described in very much the same terms as any technical transmission such as radio, TV och binary data. In the interactional model on the other hand, emotion is an aspect of collectively enacted social settings, it is complex, ambiguous, malleable and non-formalizable. Communicating emotions in the interactional model is more than transmission; it is an active process of interpretation.

The entertainment industry is putting in huge resources to give us more and more overwhelming visual effects in movies and computer games. But listening to Steven Spielberg's anecdotal evidence and the research by Boehner et al, this might be counter productive. These works tell us that "less is more", that removing information from for example a game application can create room for interpretation and imagination and through this might give a richer and more immersive gaming experience. We use two concepts to describe this: 'User investment' and 'Scary Shadow Syndrome'.

'User investment' refers to the process where by the creators of the entertainment content and the viewer/gamer enter into a mutual contract. This contract shares the responsibility for the 'Suspension of Disbelief' [2] between the two parties. By getting the users to invest both time and imagination in the game experience, we give them space and opportunity to share in the creative process. This in turn creates a far more compelling game experience for the player.

This leads us to the concept of the 'Scary Shadow Syndrome'. This name came from the observation that horror films were far more effective and scary before the advent of large budgets and overwhelming visual effects. A suspicious shadow on a wall was enough to trigger a strong emotional response in an audience. So, if the conclusion drawn from this is that 'less might be more', a set of new questions arises: How do these processes of user-visualization work? What, if any, are the limits, on content and presentation technique, on what experiences can be triggered?

We decided to take a conventional type of computer game and see if removing components and aspects from it could help answering the questions above. Can the removal in fact add value to the game and potentially also reveal new and untested types of game play? The Beowulf game described below is an attempt to create an interactive game built on the same mechanisms as Steven Spielberg's missing shark and the interactional model of emotion and affect described by Boehner et al. The absence of almost all game graphics potentially makes the game scenario ambiguous enough to demand an active interpretation from the player. Having to disambiguate the system and thus make an emotional and cognitive investment in the game, might give a richer gaming experience.

3. GAME APPLICATION FOR TEST

Beowulf is a heroic epic poem probably written sometime between 700 and 1000 A.D. and is sometimes referred to as England's national epic [3]. In the game used for the test described here, one small episode of the poem is lifted out and translated into a gameplay scenario. The episode in the poem narrates how the Scandinavian hero Beowulf defeats the monster Grendel in its lair.

In the game, Grendel lurks in a dark system of caves and tunnels inhabited not only by the monster itself but also by wolverines, snakes, bats and a host of potential dangers. As our hero enters the first cave, a gust of wind blows out his torch and darkness descends. The player, as Beowulf, must now trust almost completely to her hearing to navigate, with only the minimal help from a simple revealing map, a route to the monster.

The player's task is to successfully navigate all the hazards lying between the start and the monster. She interprets the myriad sounds that fill the environment both for navigation and for confrontational combat situations. Finally the monster must be located and dispatched with a well timed swing of Beowulf's sword.

The scientific aim of the Beowulf project is two-fold. The first goal is to investigate what happens, in a broad sense, to a gaming experience when playing a game driven mostly by audio and less with visuals - we call this an "Audio-Mostly Game". Beowulf is an Audio-Mostly Game for sighted persons having various reasons for requesting the shift from eye to ear.

The second goal is to start investigating the phenomenon described above as the "Scary Shadows Syndrome". Our hypothesis is that the player will have a richer and more immersive game experience if she is invited to emotionally invest in the experience. One way to open up for such an investment is to create the opportunity for the player to interpret and disambiguate the game scenario. In the Beowulf project we do this simply by not showing the game world and its inhabitants visually, but instead use a rich and varied soundscape to communicate the properties of the game world.

3.1. User interface

The game world is graphically represented by a non-detailed map that shows only the parts of the cave system the player have visited so far. In this way the map slowly reveals as you progress through and explore the game world. Figure 1 shows one example of what this revealing map can look like after a couple of minutes play.

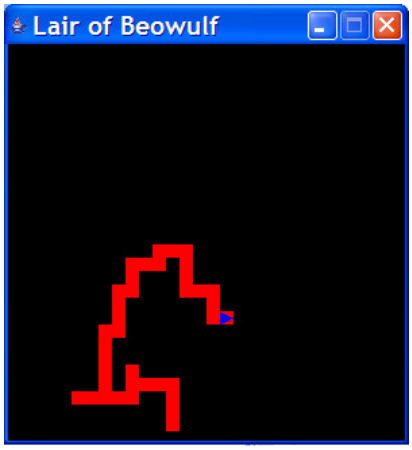

Figure 1. *The revealing map*

Navigation and movement is controlled through the arrow keys on the computer keyboard in the same way as in the Sleuth game [4]. The blue triangular arrow on the revealing map (Figure 1) shows both the players current position on the map and the current direction: north, south, east or west. The Right arrow key turns the current direction 90 degrees clockwise and the Left arrow key turns the current direction 90 degrees anti-clockwise. This means that if the current direction is "east", as in Figure 1, pressing the Right arrow key will alter the current direction to "south" whereas pressing the Left arrow key will alter the current direction from "east" to "north". The Up arrow key moves the current position one step in the current direction. In Figure 1 pressing the Up arrow key will move the player one step to the right (east). The condition for a move is that there is a map point to go to. If the player tries to move to a map point that does not exist, the blue arrow is not advanced and a "bump" sound is played, telling you that you stepped into a wall.

Compared to the sparse graphics, the auditory output from the game is very rich. The 3-D soundscape is designed to replace the traditional 3-D graphics of conventional adventure games. We hear through Beowulf's ears, a first person perspective, and we localize items and find directions in the three dimensions of the game world by listening, turning and moving, using the same stereophonic principles as in real life. Headphones give the best stereo experience and are recommended.

The soundscape behaves differently depending on if you (Beowulf) are currently in a tunnel or in a cave. If you are in a cave, you do only hear the sounds emanating from that same cave, i.e. sounds do not "leak" in from the tunnels ending in the

cave and thus not from the caves in the opposite end of those tunnels. A cave is like a large hall and sounds may come from any direction and position within that hall. The tunnels on the other hand do not contain any sound sources other than the ambient wind. The sounds you hear in a tunnel instead emanate from the caves that the tunnel ends in. Since the tunnel is a pipe, the sounds you hear are virtually moved to a position corresponding to a point in the same direction as the tunnel has at the point you are currently standing on, extended to a length corresponding to the total length of the tunnel.

4. SOUND DESIGN

Three dimensional sonic landscapes can be as immersive as their graphical counterparts, communicating not only environmental cues but also very specific moods and events. The computer game industry has started to realize this and is paying more and more attention to the values that good and careful sound design adds to today's top selling games. The industry is still young but certain ways to work and roles of play are already established. Graphics are, for example, always placed as number one when it comes to driving and realizing the game play. Other ways to handle the game design process could be to start with the soundscape and then add just as much graphics as needed, or to develop both the graphic and sounding aspects in parallel. This could potentially lead to all new types of games.

General design principles and methodologies are still very much to be developed in the field of sound design. Therefore, when designing soundscapes, the designer still has to trust her aural sensitivity and intuition, her general knowledge, experience and common sense about how people generally experience and associate to sounds [5]. In Beowulf, the soundscape is the expressive, three dimensional narrative medium of the game. Having reduced the visual support to merely the simple revealing map, it was decided to use neither music nor dialogue in the game. There was also to be no supportive text in the test version. This was a deliberate move to create as pure a soundscape as possible, so that any response from the player was based only on the sound environment, and not on any interpretation of contextual content. The individual sounds that build the total Beowulf soundscape where chosen from their imagistic value, the potential to trigger associations in the imagination of the player.

The resulting sound effects (SFX) library used to create the Beowulf soundscape can be divided into five simple groups:

Footsteps; the sound from each footstep Beowulf takes reveals two aspects of the location he currently is in: the nature of the surface he is walking on, i.e. rock, gravel, twigs etc. and the size of the room; a cave has a long reverb and a tunnel has a small reverb.

Environmental sounds; if you are in a tunnel you will hear a wind; a cave has a unique ambient sound that can be used to memorize the various locations and the way through the underground maze of the game world.

Dynamic landscape elements such as waterfalls, dripping, falling rocks, bubbling lava etc.

Living elements such as bats, wolverines, snakes etc.

Combat SFX; this comprises of sword swishes, misses, hits and the resultant reaction sound from the target object.

The Beowulf sounds can also be divided into positioned and non-positioned sounds. Positioned sounds have a specific location that can be determined in the 3D-space. The dynamic landscape elements and the living elements are all positioned and are used to navigate the way in the cave. Non-positioned sounds are sounds whose locations are not possible or necessary to locate in the 3D-pace. The footsteps, the environmental and the combat sounds are all non-location based.

Yet another way to categorize the sounds of the Beowulf soundscape is to use the terminology developed by acoustic researcher Murray Schafer:

Keynotes are the ambient, background sounds that is present large portions of time. In Beowulf this is the "room tone", a diffuse ambient sound that adds mood to the scene.

Sound signals are foreground sounds revealing information about the environment. In Beowulf the footsteps are used as sound signals and tell about what materials Beowulf is walking on and if he is in a cave with long reverberation time or a narrow tunnel with short reverberation time.

Soundmarks are typical or unique sounds that define a scene. Soundmarks in Beowulf are for example the sounds of falling water, bubbling lava or a howling wind.

The sounds of animals can serve as both sound signals and soundmarks depending on the context.

The ambient sounds or keynotes are composed from several sources, recordings from natural environments combined with sounds from software synthesizers (FM7 and Absynth from Native Instruments). The goal was to create sounds that in very sublime ways add mood and feeling to a specific location. To this base was added the dynamic landscape elements of which some are played randomly, such as falling rocks, and others are played in loop, such as waterfalls. The material for the footsteps where taken from sound effects archives combined with custom recordings of stepping on, cracking and dropping different materials like egg shells, spaghetti and crackers. Often several sounds mixed together gave the best impression of walking on bones, gravel, twigs or mud. The sounds of the living elements category where compiled from different sources and sound effects archives.

The Beowulf game has only very few visual cues to guide the perception and instead sounds have taken the role graphics usually play in computer games. In order for this to work, the sounds used must be of high quality and give a realistic, detailed and accurate description of the game world. On the other hand, hearing can be very subjective and sounds can be perceived to have volumes totally different from the volume measured by objective means. The sound designer has to take this into account when balancing the individual sounds that make up the soundscape. The footsteps are one example of this. They are the main navigation sounds and act as sonic radars, revealing the material on the ground Beowulf is stepping on and the size of the room he is in. The footstep sounds are in a situation like this perceived to be very important (your virtual life may depend on it). In the game this is sonified by playing the footstep sounds with a higher volume relative to the rest of the soundscape than they would have had in real life. The sounds of living elements are, when they occur, intended as surprise sounds played on a background of relative silence. In real life situations, these sounds are perceived as important and are in the game therefore played louder than the physical size of the creature motivates. In the game design, care is taken to account for this shifting focus of attention and to reflect how the listener perceives the difference in the various groups of sound FX's.

5. TECHNICAL IMPLEMENTATION

The intention of the project has been to develop an Audio-Mostly Game that can run on mobile phones. But in order to be able to test some of the game design aspects early on, it was decided that a first version should be developed to run on a traditional PC-platform. Having the mobile platform in mind, portability therefore became an important issue early on and Java was chosen as the software platform. For 3D sound positioning, OpenAL was chosen through the Lightweight Java Game Library (LWJGL).

Today's mobile phones have impressing calculating power and give developers great possibilities to create applications that utilize techniques such as 3D graphics and image recognition. Sadly enough, the sound capabilities are in most cases much less developed. The Beowulf game needs to stream several sounds simultaneously from a memory medium, for example a Flash memory card or a hard drive. The game also need to position sounds in a 3D space. On PC-platforms, such technologies are since long standard. When the media technologies now are being brought to the new, mobile platforms, the graphical technologies are given higher priority than their audio counterparts. The result is that currently (January 2007) there is no mobile phone supporting the technologies needed to take Beowulf to a mobile phone platform.

One example of this is JSR-234, which is a multimedia supplement to the Java standard proposed and developed by Nokia. Reading the specs of the supplement it is clear that a device implementing the functionality described will be a perfect target platform for our Audio-Mostly Game ideas. Sadly enough, none of the functionality described is in fact implemented, even on Nokia's own mobile phones. If you are developing games based on the phone's built in camera on the other hand, you will be well served with built in functionality. This is only yet another proof of the necessity to increase the awareness about audio and its potential in everyday life.

6. THE TEST

When designing the test, two hypotheses were formulated to guide the development: 1) It is possible for sighted users to navigate to a set of predefined positions in the Beowulf game world within reasonable time, using hearing as the prime sense and with the support of the visual overview the revealing map gives. 2) The soundscape of the game will give adequate information for the subjects to form an inner (mental) picture of the game world, a picture rich enough to generate an emotional response in the subjects.

Seven map points for the subjects to find and describe were chosen. The map points were evenly distributed over the map and each map point was located in a cave (as opposed to in a tunnel) with distinct ambient sound and unique positioned sounds. The subjects' task was to find the seven map points and describe two aspects of each point: the physical properties of the environment and the content and characteristics of the environment. The subjects were instructed to give an as objective description as possible of the first aspect, the physical properties of the environment and a subjective description of the second aspect, the content and characteristics of the environment.

A questionnaire with two major parts was developed. In the first part, the subjects described the two aspects of each of the seven map points. The second part of the questionnaire contained general, overall questions on the experience of navigating the Beowulf world, for example: grade how easy it was to navigate the environment from 1 (easy) to 10 (difficult); grade how fun it was from 1 (boring) to 10 (fun); where or in what situations could you imagine playing an audio-mostly game like this (mark one of): in the car, in the TV couch, on the bus, while walking.

The test was taken by eleven subjects, seven male and four female, age 13 to 45 years. The test began with a short presentation of the project, then the game prototype was launched and the subject started the first part of the test form. The average time for the user to navigate to and describe the seven map points was 30 minutes. The tests were conducted on computers running both Windows XP and MacOS X.

6.1. Results

The results from this first test clearly show that our two hypotheses were correct. The reduction of game information to mostly audio did not present any problem to any of the subjects and all of them managed to navigate to all the seven target map points without problems. The soundscape also seems to have been rich and detailed enough to stimulate imagination and inner visualization in the subjects of such qualities that they could give vivid descriptions of the map points in the questionnaire. Following are some examples of phrases used by the test group to describe the game environment, based solely on the impressions from the soundscape: *'Unpleasant big place with humid stones and moss'*, *'Forest, crunching twigs, really big cavity in the rock, above is a small hole that lets daylight in.'*, *'A dark feeling appears.'*, *'(Poo) with flies, flying around, it stinks!'*, *'The muffled noise does hurt my stomach, it smells musty, old filthy'*, *'My feet's get stuck in the ground, it bubbles, it is some dark slush'*, *'Sweet and playful dog, but a little bit angry, I hope that it gnaws on a bone, but not mine.'*, *'Cruel, big monster with reptile eyes, teeth. Creepy.'*
The descriptions also show that navigating the game world induced emotional responses in the subjects.

However, the descriptions show that some of the subjects sometimes interpreted the soundscape differently than intended by the designers. At some map points, some of the subjects described other types of environments, such as forests or swamps instead of the underground cave system. This does not seem to have diminished the experience, since the subjects who had "miss-interpreted" the soundscape rated the game as more entertaining than the average.

7. CONCLUSION AND FUTURE WORK

The game prototype used was limited in the sense that it had no game play implemented. The test was also designed to "just" give an indication if there is any substance in our two hypotheses, that it is possible to navigate the environment and that focusing the output from the game to a soundscape will leave space for the users to form rich inner pictures of the game world. In spite of the limitations in game play, the results and the responses from the subjects clearly show that our ideas are well worth continued research.

A soundscape can be designed and used to open up for interpretations and associations. This characteristic, used with care and insight, can be turned into a powerful feature. Ambiguity potentially demands of the user to disambiguate and interpret the soundscape, thus making the user invest cognitively and emotionally in the experience. This in turn potentially gives the game a richer and more profound value for the player.

From the very start of the project, the aim has been to develop a mobile version of the Beowulf game. Due to technical limitations and difficulties on the currently available mobile platforms, the prototype ran on standard PC's. The next step will be to develop a version that can run on Sun's JavaME emulator as a step towards a truly mobile phone platform. When this version is at hand, a test will be carried out on the full concept, including an implementation of the game play. The Interactive Institute Sonic studio has in previous project used non-verbal methods to gather data about subjects' experiences. The aim is to continue this work and develop non-verbal methods suitable for the Beowulf game and similar interactive applications [6, 7].

A modified version of the Beowulf prototype will be used to test how sound quality inflicts on the experience, the ability to navigate the environment and the emotional responses it gives.

8. ACKNOWLEDGEMENTS

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