Playing with sound and gesture in digital audio games. From prototype design to evaluation.

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ABSTRACT

This article introduces the genre of a digital audio game and discusses selected play interaction solutions implemented in the *Audio Game Hub*, a prototype designed and evaluated in the years 2014 and 2015 at the Gamification Lab at Leuphana University Lüneburg.[1] The *Audio Game Hub* constitutes a set of familiar playful activities (aiming at a target, reflex-based reacting to sound signals, labyrinth exploration) and casual games (e.g. *Tetris*, *Memory*) adapted to the digital medium and converted into the audio sphere, where the player is guided predominantly or solely by sound. The authors will discuss the design questions raised at early stages of the project, and confront them with the results of testing performed on two groups of sighted casual gamers and one group of visually impaired players.

Key words: digital audio games, sound interaction, gesture based audio interface, accessible computing

INTRODUCING DIGITAL AUDIO GAMES

Have you been mesmerised in your childhood by playing the "blind man's buff"? Or maybe you always wondered why the fables read out by your parents were far more magical than their counterparts watched on the TV screen? After all, sounds have limitless potential to create beautifully immersive sceneries without the help of a single paintbrush or animated pixel. For centuries human beings have wilfully got lost in the imaginary worlds of sound, from oral stories told by the fire, through music to more recent inventions, such as radio drama and audio books. With the introduction of the first computers and the ever-growing popularity of electronic entertainment, it was only a matter of time before the "blind man's buff" would be adapted to the digital medium.

[1] The following team members of the Gamification Lab participated in the project: Jarosław Beksa (lead concept design, sound design, production), Sonia Fizek (concept design support, in-game scripts), Enrique Perez (production support), Laleh Torabi (graphic design), Julie Woletz (testing and evaluation), Silke Laub (testing support), Sophie Jent (programming), David Scheele (programming), Marvin Töllner (programming support).

When the sound gets entangled in a cybernetic interactive loop and the darkness coats the screen, digital audio games come to light. Contrary to popular video games, they exist primarily or solely in the world of sounds and "[…] do not rely on visuals. They generally can be played without graphics by the visually impaired" (Collins 2013, 24). It is the sonic layer that becomes the basis for gameplay mechanics and interface design.

The first attempts to build electronic audio games may be tracked to late 1970's, when Atari designed *Touch Me*, a rhythm game on a handheld device, which became an inspiration for the popular *Simon* (1978). Although sounds played a crucial role, it was not possible to play the game and operate the device with no visuals. The player had to memorize and reproduce the sequence of four buttons lighting up with particular sounds attached to them. In 1996 another sound-based handheld playful device appeared on the market – *Bop It*. This time the interaction pattern was designed solely with audio in mind. The device featured a button, a lever, and a handle. The player's task was to listen to the commands (Bop it, Twist it, or Pull it) and interact with respective parts of the electronic console. Interestingly, point values were also represented by various tones. The latter example, although not designed with visually impaired players in mind, could have been easily operated by them due to its intuitive design that did not require the engagement of vision.

The potential of solely sound-based mechanics was also explored in story-driven audio games, such as *Real Sound – Kaze No Regret* (1999) created for Sega Dreamcast and Sega Saturn consoles. In 2001 *Shades of Doom*, the first Windows-based adventure title fully accessible to the visually impaired, was introduced by the GMA Games.[2] Inspired by the graphical game *Doom* (1993), it adapted the first-person shooter (FPS) genre to the world of sounds. The players oriented themselves in the soundscape by the echo of footsteps, the wind howling through the passages, and the subtle sounds of nearby props.

In the recent years, digital audio games have been gradually gaining popularity, also amongst visual players. Several games based on moving through space have been created, predominantly for tablets and smartphones: *Papa Sangre* (2010), *Sound Swallower* (2011), *Audio Defence: Zombie Arena* (2014), and *Blindside* (2012) for PC, amongst others. An experimental playful audio experience was developed by a Copenhagen Game Collective, using the existing commercial game controllers. In *Dark Room Sex Game* (2008) two players bring their invisible avatars to orgasm by shaking the Nintendo Wii motion controls (Oldenburg 2013).

With the popularization of touchscreen portable devices (smartphones and tablets), the ubiquity of mobile game platforms (e.g. App Store, Google Play, Windows Store), and the proliferation of independent game scene ("indie"), audio games seem to be entering a yet to be explored territory. More importantly, they gain a wider recognition and, as we will demonstrate, have the capacity to attract not only visually impaired but also visual players.

THE AUDIO GAME HUB PROTOTYPE

Have you ever imagined playing *Tetris* with the eyes shut? Now you can. In the *Audio Game Hub* (2014) multiple casual games and cross-culturally familiar playful experiences have been transferred into the audio sphere. The players may draw their audio bows in *Archery* and *Hunting*, improve their memory in *Animal Farm,* test reflexes in the multiplayer *Samurai*, or find the way out of the fearsome audio *Labyrinth,* amongst others.

The *Audio Game Hub* is a practice-led research project and a work-in-progress. A collection of eight various mini-games constitutes a perfect playground sample, as it allows for the evaluation of

[2] The titles designed by the GMA Games in the past decade are exclusively tailored to the visually impaired community and known only in relatively small circles.

various interface solutions in a homogeneous interactive environment. Each of the games requires a different type of interaction pattern and audio gameplay mechanics. Another crucial aspect of the audio gameplay experience is the platform. The game has been developed for mobile touchscreen devices (iOS operating system), with an interface combining gesture-recognition with auditory instructions.

The *Audio Game Hub* interface uses a set of gestures and corner buttons, which allows the player to navigate through the available options and menu elements. A minimalistic graphical interface was implemented to reduce the entry barrier for sighted players. It can be disabled and enabled at any time. This feature has been used during user tests with sighted players – one group started the game with visual aids off, and another with visual aids on.

The main focus has been laid on the audio interface. Each user action is represented by an interactive sound. Each game starts with an audio tutorial explaining the rules and game mechanics. An array of background, ambient sounds and various in-game character voices have been implemented to represent each of the game worlds and enhance the immersion of the player. Selected interactive sounds used in the game's menu and in individual games have been assigned to the same actions and events. This points to another crucial aspect of interactive sounds - their repeatability, which "… establishes an expectation that we will hear the same sound as a reaction to the same action" (Collins 2013, 33).

Main Menu Interface

The interface solutions have been implemented on the level of the main menu interface, and in-game interfaces. The *Audio Game Hub* interface constitutes the main menu of the application, which allows the player to navigate through the available options and menu (fig. 1). The options are assigned to four functional corner buttons as follows:

- The upper left corner: **Return** (to previous menu)
- The upper right corner: **Information** (additional cues corresponding to the selected menu squares or in-game content)
- The bottom left corner: **Blind mode** (visual aids on and off; for visual players)

The bottom right corner: **Settings** (voice, sound effects, ambience, and music volumes)

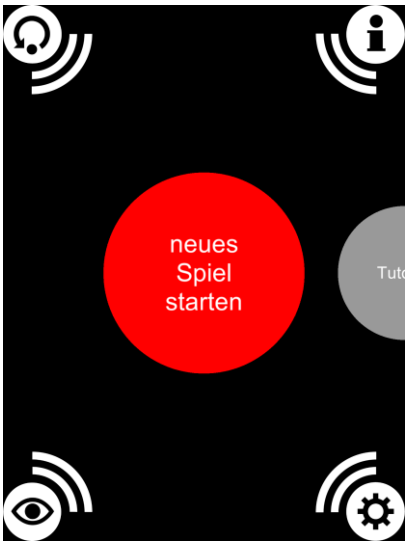

Fig. 1. *Audio Game Hub* main menu interface with supporting visuals

The menu elements and corner buttons are activated by the double tap gesture. The UI elements are scalable to any screen size. When the player double taps any of the buttons, the audio

description is activated. Such a feedback loop provides auditory cues, which further guide the player's actions. Each corner is also assigned a unique descriptive audio icon, which adds another level of a sonic signifier to a given option.

The gesture-based audio menu interface has been designed specifically with visually impaired in mind. Image-based cues are provided for the visual players, but they may be turned off by double tapping the Visual mode button. The menu elements may be browsed by swiping left or right. The sounds of the audio descriptions of the consecutive menu elements are placed in stereo panorama corresponding to their position in the menu. In all the games subtle whispered audio cues are available, informing about reaching a corner button or the edge of the screen. The sounds of the menu interface corner buttons have been recorded in the binaural 3D technique, which provides spatial audio representation corresponding to their physical location on the screen. "When such stimuli are presented over headphones, there is a realistic perception of auditory space …" (Wenzel et al. 1993, 111).

In-game Interfaces

The in-game audio interfaces are discussed here with reference to two exemplary mini-games - *Animal Farm* and *Labyrinth.* The first example is a digital audio adaptation of *Memory*, an analogue card party game, also known as *Match Match* or *Pairs,* amongst others. The player's task is to find matching pairs of farm animals stored in boxes. To locate the box, the player moves their finger on the screen (looking for a wooden box sound). The box is opened by a double tap gesture, which triggers the sound of a selected animal.

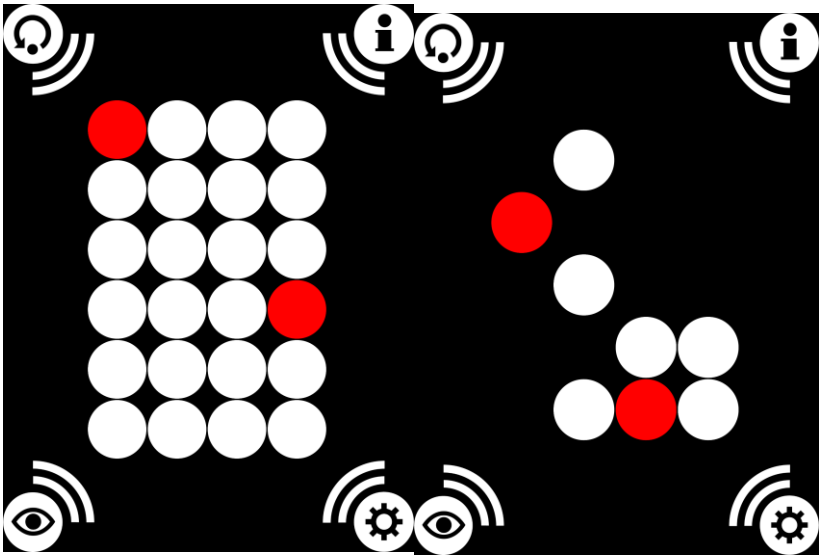

Fig. 2. *Animal Farm* in-game interface

Labyrinth is a classic arcade maze. The player's goal is to find the exit by following the "guiding" sound. When getting closer to the exit, the guiding sound becomes louder. The game consists of randomly generated rooms, whose borders are drawn by sounds signifying the player stepping against a wall.

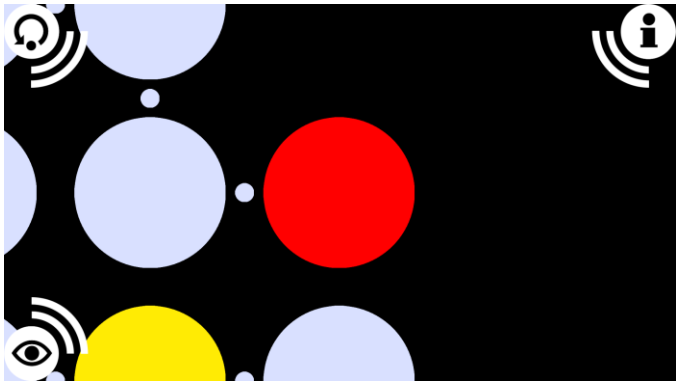

Fig. 3. *Labyrinth* in-game interface

TESTING AND EVALUATION

During the development process (using Agile method) each of the mini-games and the main user interface were preliminarily tested with sighted as well as visually impaired players. Gathered feedback allowed the team to improve user interface and game mechanics. At a later design stage the *Audio Game Hub* was introduced to and tested on two groups of sighted casual gamers (12 in each group) and one group of 4 visually impaired players:

- Group one: playing games with visual aids on, then again with visuals off
- Group two: playing games with visual aids off, then again with visuals on
- Group three: playing games without being able to see the screen at all

CONCLUSIONS

We need to realize that the potential of audio games is not a stable indicator and depends on various factors, surpassing the gameplay design itself. The interactive digital entertainment has matured over the past few decades. An independent scene focused on the development of experimental projects is also contributing to the growing popularity of audio games. Contemporary players are more likely to turn to games initially reserved for the visually impaired community.

The potential of audio gaming is also increasing due to the constant improvements in technology. Since sound-based games do not need to rely on visual elements, mobile devices seem to be perfect solutions. The invention of a smartphone in the late 2000's opened new possibilities in front of audio game designers. The ease of access to mobile digital content platforms, such as App Store, Google Play, and Windows Store should also be acknowledged. On the other hand, visually impaired players, thanks to more ubiquitous and intuitive digital technologies and devices, seem to be entering a lower usability barrier than ever before.

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