Video Analysis for Includification Requirements

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ABSTRACT

In extensive trials we asked participants with disabilities to play a set of computer games, demanding a variety of cognitive and physical skills. In particular we presented a Tetris variant we developed ourselves, which follows various includification guidelines. Participants were recorded on video in order to identify strengths and weaknesses in coping with the presented game challenges. In the videos we recorded the game screen, a frontal video of the participants showing emotional responses, and eye gaze. Post processing tasks are used to analyze and retrieve data from the videos. This helps to build up a video database for later analysis and answer questions raised after the recordings were taken.

Categories and Subject Descriptors

K.4.2 [**Computers and Society**]: Social Issues - Assisitive technologies for persons with disabilities; K.5.2 [**Information Interfaces and Presentation**]: User Interfaces - User-centered Design; K.8.0 [**Personal Computing**]: General - Games

General Terms

Computer Games, Includification, Accessibility, Video Analysis

1. INTRODUCTION

People with disabilities are usually not the target group for companies developing computer games, although according to [3] 23% of all gamers live with disabilities. Hence disabled gamers face various problems while playing computer games, problems that might easily be avoided if already taken into account during game development.

The project GETIN (Game and Entertainment Technology for Includification [1]) focuses on the research of new technologies [2] to not only make computer games accessible, but primarily develop strategies to actively help developers to enrich computer games with includification features. This might even go as far as adding software components using artificial intelligence to actively help gamers with disabilities to become competitive and thus improve their subjectively experienced self-efficacy.

This short paper describes requirements and methods to improve includification. In [4] Barlet & Spohn mention the need of new technology to make it possible that all gamers play the same games despite their disabilities. This is the purpose of GETIN.

2. PLAYING WITH DISABILITIES

To investigate the requirements for gamers with disabilities, our research group established a cooperation with a local caregiver, taking care of 29 clients with physical and intellectual disabilities. They receive special treatment by offering e.g. physical exercises. 18 of them agreed to participate in our investigations and this research project. Two students of our research group where responsible to set up a game computer to record trials for playing computer games on video, give instructions and supervise the trial.

2.1 Experimental Setup

Figure 1 shows a screenshot taken from a recording, showing participant Franz playing our own plain and detraction-preventive version of Tetris. On the left side the important part of the game scene is recorded, while on the right side at the bottom, the user is recorded showing emotions while playing. Above the keys on the keyboard used for steering the game are visible, a pressed key is rendered in light grey. The white circle in the game scene shows the current eye focus of the player, recorded with the Tobii EyeX [7] controller.

2.2 Recorded Parameters

To retrieve a broad range of biometric data of the game we first thought about using biometric sensors. However, the pure usage of such sensors might already introduce a measurement bias, e.g. with sensitive of phobic players. First, attaching the sensors might cause a major distraction, preventing players from focusing on the game. Another example is given by pulse meters, the basic hypothesis here being that the measured pulse frequency is a measure for general arousal or excitement. However, the act of attaching a pulse meter to a test participant alone is enough to raise the pulse frequency to an abnormally high level. Another problem is the need to synchronize biometric data to the recorded

ASSETS '15, October 26-28, 2015, Lisbon, Portugal.
ACM 978-1-4503-3400-6/15/10.
http://dx.doi.org/10.1145/2700648.2811398

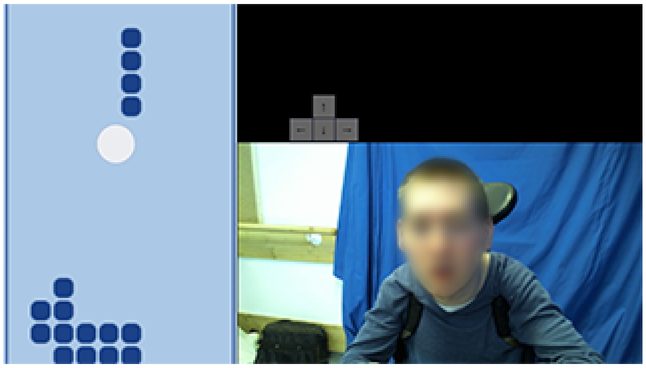

Figure 1: Franz, playing our first plain Tetris game

videos. Biometric data thus must be annotated with appropriate timing data, but the same is true for recorded videos. We therefore decided to refrain from using biometric sensors, but instead use the recorded videos as sole sources for subsequent data analysis. The results thusly computable include reaction time being the time difference between the occurrence of two subsequent events (e.g. block spawn and first key pressed), pulse frequency [5], emotional expressions or an eye focus heatmap.

2.3 Video Recording

We made several recordings of the participants playing the described games. Screen recordings as shown in Figure 1 plus an additional camera from right or left behind the test person, showing the screen and the gamer, as shown in **??**. We at first explained the game rules, then let them freely play for a while.

All the recordings are currently disclosed and off-limits to general public. Although all participants, involved care givers and parents agreed in an informed consent and also signed a media usage contract. Nevertheless we handle the recordings and images with respect and care, so decided to close them for academic evaluation and usage only.

2.3.1 Main Findings

The results of the evaluation of Tetris was quite astonishing. First it turned out that the Tetris rules are not self evident for players with intellectual disabilities. The gameplay is actually very difficult to understand, rotating the bricks is something the gamer has to figure out during the play, the speedup function (key down) was not mentioned to the participants at all. In the first trial the participants where often distracted by the various colors of the bricks. Therefore we developed another uni-colored Tetris version (just in blue) with Unity 3D and carried out more trials. Some participants had even more fun with building towers than sorting them in rows. Others had troubles with visuo-motor coordination, according to [6] being "a basic skill required for everyday activities involving movement, such as writing, dressing, walking, driving or playing sports. Playing video games also requires visuo-motoric coordination". Players often had to shift their eye gaze away from the screen down to the computer keyboard to be able to change keys from left/right and up for rotation. As a consequence they often subsequently missed the chance to react to game events in time. Essentially, for many of them, the game was simply too fast.

Furthermore, uncoordinated and superfluous key strokes often made it virtually impossible to rotate and position the blocks in a proper way. Sometimes, even if the bricks were positioned well at one time point, gamers accidentally hit a key and prevented the bricks from being positioned correctly when they finally arrived at the floor.

At other times, when a brick was already at the wall, some gamers continued hitting an arrow key again and again, although the brick could not change its position any further. Finally, some players wanted to move the blocks even after they had arrived at their final position on the floor, and did not understand why this was no more possible.

3. CONCLUSIONS

Within this paper we described a way to record trials in a way to build up a video repository for later analysis. Furthermore we describe practical trials carried out with several disabled participants at a Viennese care giver. Participants played several different computer games, include the well known Tetris game. By analyzing the game play using our video recordings, we found several ways of improving the includification factor of some games, most importantly of our own Tetris version.

4. ACKNOWLEDGMENTS

We appreciate all contributions by our students and especially the clients of our project partner who patiently played our Tetris prototype.

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