Chapter 26
Game-Based Learning with the Leap Motion Controller

Martin Ebner
Graz University of Technology, Austria

Norbert Spot
Graz University of Technology, Austria

ABSTRACT

Learning through games is a promising field for the future of education. In this research study the authors describe the development process of an educational application, a game targeting P-12 students. This application is meant to be used with the Leap Motion Controller, a small 3D infrared camera, which while in use, tracks the user's hands and finger movements in the 3D space. The chapter describes the application itself and presents the outcomes of a field study, which was carried out with a small group of students at an elementary school. It can be pointed out that there is a huge potential of using innovative input devices in school education.

INTRODUCTION

Computers have evolved rapidly and become part of people's everyday life. They spread into every field of industry and entertainment. People use computers almost everywhere, at work, at home, at schools and universities. Nowadays at least in middle Europe more than 90% of our youth (age 12-18) own a smartphone with mobile Internet access (Ebner et al, 2013). This affects of course also the field of education and therefore Prensky (2011) provokes by asking, whether today's students are the people our educational system was designed to teach or not? Since then several studies/publications has been carried out addressing a new generation of learners called digital natives (Prensky, 2011), netgeneration (Oblinger & Oblinger, 2005) or generation@ (Opaschowski, 1999). More a less all studies concluded that there is a change concerning the ownership of digital devices and also an increase of the digital literacy, but this did not affect the general learning behavior. (Conole et al, 2006) (Bullen et al, 2008) (Margaryan et al, 2011) (Nagler & Ebner, 2009). With other words students are equipped very well and can use all these devices professionally, but only rare for learning purposes.

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Usually if people talk about using a computer, we imagine someone sitting at a table, typing on a keyboard, moving around with the mouse or tapping the touchpad and staring at the computer's screen. The way we interact with computers has not changed significantly since the 1960's when these peripherals were invented (Altman, 2013). This is slowly changing, though. Today, there are more and more innovative (input) devices on the market. On the one hand they differ from traditional ones and on the other hand they aim to change the way we interact with different kinds of computers. These peripheries however, do not intend to replace the traditional keyboard-mouse setup. They act as an addition, useful for diverse applications. Some of them represent also a more natural way of human-computer interaction. The computer can with the help of such peripheries sense motion in front of the screen or touch instead of getting input from the user by a keyboard and mouse. This more natural way of human-computer interaction enables a so-called Natural User Interface (Altman, 2013).

Prior to the works on this study, a literature study has been carried out about currently available innovative input devices aiming to find different ways for educational games. One of those found is the *MaKey MaKey*[1] seen on Figure 1. The device's name is a word play from the words "make" and "key". Essentially it is a printed circuit board with a micro controller running Arduino Leonardo firmware. It uses the Human Interface Device (HID) protocol to communicate with the computer, and it can send key presses, mouse clicks, and mouse movements. For sensing closed switches on the digital input pins, its engineers use high resistance switching to make it so that we can close a electric circuit even through materials like the human skin, leaves, and play-putty. That means we can create buttons from play-putty or just even draw a joystick with a pencil on a paper and use our "do it yourself" controllers to play a game. Or we can load up a piano software and instead of keyboard keys hook up the MaKey MaKey to bananas so that they become the piano keys. On the board itself there are six inputs on the front as shown in Figure 1, which can be attached to via alligator clips, soldering to the pads, or any other method. There are another 12 inputs on the back, 6 for keyboard keys, and 6 for mouse motion, which are accessible with jumpers via the female headers, paper clips, or by alligator clips

Figure 1. Makey Makey