



A Design of Multifunctional Interfaces to Control Game Screens

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Abstract. Due to the great potential that technological games have regarding interactivity, motor and cognitive development, as well as the notable advances of the technological society, traditional games have been replaced. It was analyzed how object design can connect with new areas like multimedia to create a higher level of interactivity in the games through tangible interfaces to support learning processes based on sensory development. For this study, the researcher has developed games based on multimedia for an audience from six to nine years of age. The games seek to teach the concept of competitiveness.

Keywords: Interactivity · Multimedia · Playability · Children · Interfaces

1 Introduction

According to Paredes (2003), playing games is considered to be a very important activity in the development of human beings in all stages of their lives. It is also considered to be an activity connected with entertainment that uses intelligence while skills are being developed. For this reason, it has become a means of socialization, expression, communication, and development.

On the other hand, Bravo (2005) affirms that multimedia, from a didactic viewpoint, is a surprisingly potential resource, considering it allows interaction with all the currently existing communication systems. For this reason, it contributes to the learning process and knowledge construction. Similarly, Morón and Aguilar, in their Multimedia in Education article (1994) argue that multimedia elements facilitate and strengthen the dissemination of information through the high level of interaction with users they generate.

This research presents the process of designing multimedia toys, so as to improve the level of interaction with users by incorporating multimedia elements through tangible interfaces which may support a kind of learning based on sensorial activities, besides looking for teaching users the concept of competitiveness. By using a micro-controller board called Makey Makey, which simulates direction and selection commands that allow you to take these commands to a screen it is connected to, tangible interfaces can be generated. The use of these open interfaces allows users to both increase their motivation for learning in a more active environment and improve their interaction with toys.

2 Concept

Considering we belong to a technological society which keeps moving forward, being able to introduce new ways of interaction with objects has become indispensable in the field of toy design. For this reason, the incorporation of multimedia in toy design is an alternative to increase interaction with users.

This project's aim focuses on designing toys using multimedia as a support element for children's learning and development by working on their senses and letting them experience new ways to play. This work proposes a type of control which may both adapt itself to different kinds of games and let users change the level of complexity depending on how the remote control is used.

To exemplify this, two proposals of toys which strengthen children's physical and cognitive skills have been developed. In the first case, the idea is to provide users with more command options so that the game activity be more interactive and may adapt itself to as many games using basic commands as possible and, at the same time, may vary and project new game ideas. In the second case, the command options are limited to two buttons which users can control with swinging movements as required by the game on screen.

3 Development

3.1 User

In order to develop these toys, it was necessary to determine the age of the user for whom the products were intended, this being the reason that a field study was carried out and an analysis of both how the game activity occurs in the different stages of human beings' lives and which its main characteristics are was made. It was then determined that an estimated age range of children who would use these proposed products was 6 to 9, considering the fact that at this age users meet certain characteristics that may be strengthened by using the products that have been proposed. Besides, they are in a stage of their lives in which they have to develop their empathy with other children of their age, this being the reason that it is important they learn the meaning of winning and losing through competition games.

3.2 Multimedia Learning

Bedolla's writings about Human Senses and Product highlight the importance of senses in learning. She states that senses are the basis of all knowledge. She also affirms that all information is firstly perceived by the senses and then it is changed into the paths of access to the understanding of the surrounding environment. On the other hand, multimedia is one of the most interactive means by which users may experience the integration of all forms of expression in a coordinated and dynamic way. After analyzing all these concepts, it was decided that it is convenient to take advantage of these characteristics of multimedia and make them work together with the users' senses, so as to generate their learning and development.

4 Materials

4.1 Makey Makey

This is a microcontroller board which functions as an electric closed circuit. It allows, through electrical contacts, to control selection and direction commands in a computer this is connected to. With the purpose of improving interactivity, it was decided to vary the ways of playing with toys by developing two command options which may adapt themselves to different games that are available to the user's imagination.

4.2 Buttons

The material used to build this toy's structure was wood with a 4 mm layer of MDF. The buttons were made of two 10-mm wide Eva rubber plates separated by an acrylic plate. The necessary wiring was installed in the interior of the toy in a way that it allows the receiver to operate. Led lights were placed on each corner of the buttons. These lights turn on when in contact with the Eva rubber plates. In the interior of the toy we find a signal transmitter connected to the led lights, the button, and a copper antenna located to the sides of each button (Fig. 1).

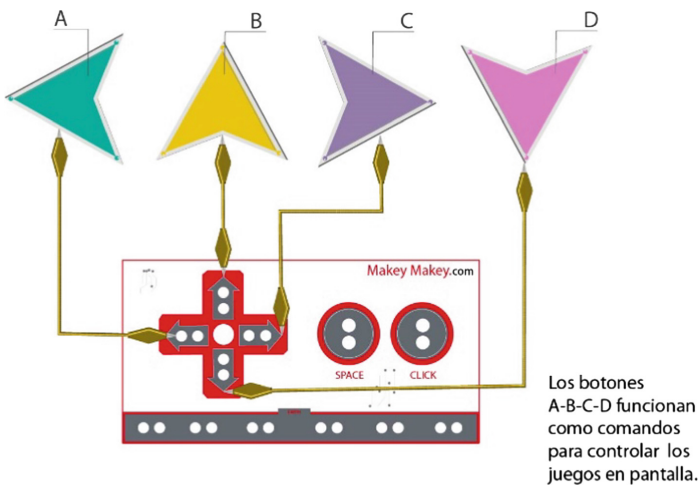


Fig. 1. Conexión de los botones al Makey Makey

4.3 Rocker Arm

The materials used to construct this toy were a 12-millimeter acrylic plate for the rocker arm; the base was a 9-millimeter MDF board covered with Eva rubber to protect the wires which are directly connected to a computer and the Makey-Makey (Figs. 2 and 3).

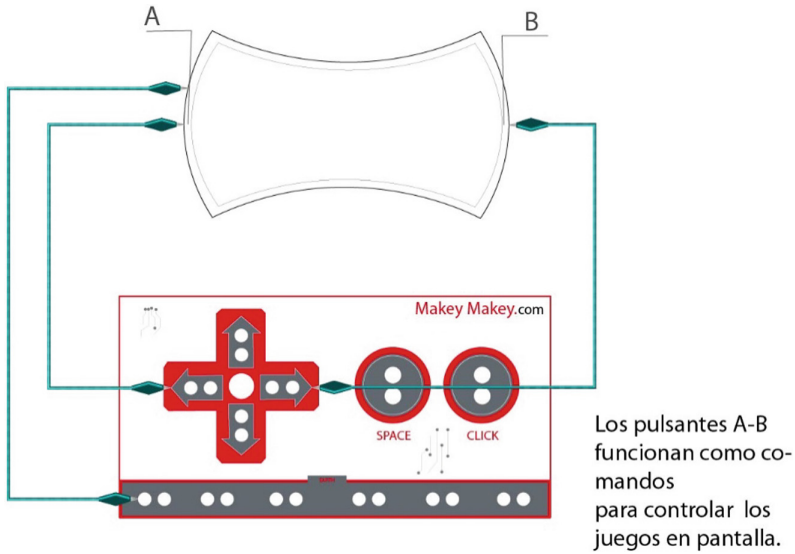


Fig. 2. Conexión del Balancín al Makey Makey



Fig. 3. Interacción Usuario Objeto

5 Aplicaciones

The applications of each control have been designed by considering the users' characteristics and skills and taking into account their physical abilities at school age. Each toy may be connected to an Android mobile device through a USB OTG adapter, which provides more versatility of use and more game options. To exemplify each toy's applications, a Friv Games platform has been used. This offers more than 250

online games which use basic and simple commands for their actions. Besides, users can decide which controls to use, as well as the arrangement and complexity of the game (Fig. 4).



Fig. 4. Online Friv games

5.1 Application 1 - Buttons

The buttons developed are based on 4 buttons that may control any game that uses direction, selection, and, among other options, keyboard commands. In order to improve this interaction, a wireless-button option was proposed. A transmitter which, when pressed, sends a signal to both the receiver connected to the Make Makey plate and the computer was placed in each button (Fig. 5).



Fig. 5. Arrangement of buttons

Each button has an antenna that amplifies signals and allows a range of distance from the receiver of up to 5 m. For this reason, users may play in different ways, change the arrangement of the pieces and, in turn, change the level of complexity of the game. All this has been developed by taking into account the users' skills and favoring the children's cognitive and physical development (Fig. 6).

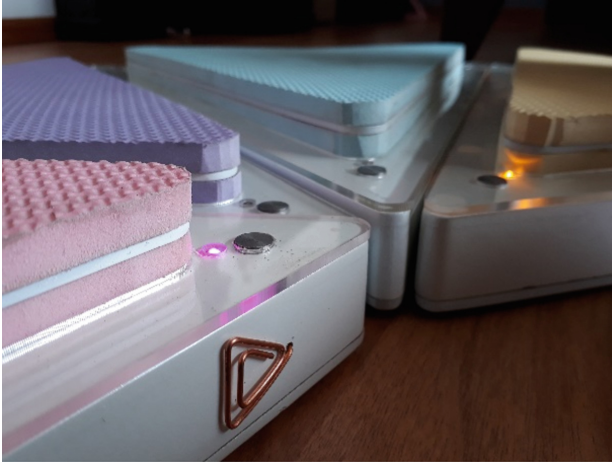


Fig. 6. Signal amplifier antenna

5.2 Application 2 - Rocker Arm

For the development of this toy, a similar concept was applied; that is, the users' skills were considered, as well as the idea that the toy can be used to help children improve their coordination, concentration, and attention. In this case, the command options are limited to two buttons which are directly connected to the computer and the Makey Makey. This toy allows children to activate buttons and control the screen game with body movements.



Fig. 7. User-object interaction



Fig. 8. Rocker arm

6 Results

The results of this research have shown that the proposed multimedia toys increased the users' interactivity. Besides, it was confirmed that the incorporation of these multimedia elements into conventional toys may be beneficial for children's development and learning.

The incorporation of open interfaces has allowed us to realize that the creation of a game platform for the use of these products is not necessary, but rather has shown us that these products may adapt themselves to different types of existing games and to users' characteristics and skills, leaving the use and distribution of toys and the complexity of interaction that users may be able to get at their convenience (Figs. 7 and 8).

7 Conclusion

Playing games is extremely important in all stages of a human being's life. It implies having not only physical activity but also mental activity. Consequently, it is an excellent means for people's physical and cognitive development. On the other hand, taking advantage of the great potential multimedia has to offer as a didactic tool, it may be linked to a type of game activity that can lead to the development of much more active toys.

This research project has allowed us to develop multimedia toys which may offer a much more dynamic and interactive experience through the multiplicity of toys that are available to users. These kinds of toys offer many other benefits, like for example the development of skills, creativity, imagination, and learning through the senses, among others.

The design of these two products is centered on the user-toy interaction design, not on the design of game platforms. But it is important to state that this interaction may be applied to other different fields of education, like for example medicine, therapy, among others.

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