SwivelPad: An Active Body Game Controller

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Abstract—**While motion control for gaming has grown in popularity, enjoyment of physical interaction continues to be a mainstay in digital games. Combining the benefits of several popular game interfaces, the researchers outline the design of an alternate game control interface called Swivel Pad. The Swivel Pad is a unique, stand-on interface for game playing. The game controller is designed to offer light exercise activity for young children and adults requiring rehabilitative practice in balance, cognition, and muscle memory**

Keywords- Alternative game interfaces, exergaming, game controllers, physical gaming

I. INTRODUCTION

Computer entertainment is increasingly extending beyond buttons and joysticks. Games in particular have moved toward gesture based systems like the Nintendo WII [1] and the Playstation Move [2]. Such systems use portable interface elements to provide user agency in games world and deliver user feedback. Adoption of computer vision based play like the Microsoft Kinect [3] have removed the physical objects of interaction entirely.

In the relatively brief history of these interaction systems, they have been touted as the future of physical activity and computer entertainment. These types of games, typically identified as exergames, are expected to help address the growing health and obesity issues plaguing the developed world. Such games are actually part of a much longer history extending as far back as Nintendo's Power Pad in 1987 [4]. It is followed by the oft cited Dance Dance Revolution [5] and similar clones.

While all of these aforementioned games do offer opportunities to sweat while they play, many of them are also subject to player shortcuts which negate their benefits. The accelerometers in the Nintendo WII, for example, allow players to merely waive their wrist to play. Players of Nintendo's Power Pad often chose to play by tapping their hands on the power mat instead of using it as intended.

Beyond the player's ability to reduce the amount of physical workout produced by the game, the design of many of these motion controlled games is a potentially limiting factor. The games produced for these interaction systems is surprising limited. Motion games sales amounted to only 14.5% of the games sold [6] in 2011, which is twice as much as the previous year. This lack of variety is a likely detrimental to their proliferation. If, for example, players are not interested in dancing, the Dance Dance Revolution mat is not particularly useful for other types of games. Anonymous

Likewise, players have been enveloped in a series of games with very specific game toys. The most notable of these are the Rock Band [7] and Guitar Hero [8]. While these games are not exergames, the novelty of their experience is largely derived from the novelty of their interface. Players are encouraged to feel like they are playing instruments, as the custom game controllers are button-based simulations of musical instruments. In these types of games, the physicality of the controller is its appeal.

It is the gap between physical exertion and the physicality of play that this basic research initiates its addresses. It is understood that play is enjoyable as a physical interaction. The environments and objects of play offer a kind of satisfaction created through the physical interaction of real objects. There are playgrounds and there are virtual playgrounds. Each offers its advantage, and disadvantage.

Dance Dance Revolution, Rock Band, Guitar Hero and similar games are largely versions of the common Simon Says play model practiced by children. The game software produces a pattern the game player must match the pattern through the game interface. Such games offer a unique cognitive opportunity. They require players to practice pattern matching.

This research seeks to embrace the benefits of physical play and cognitive training through the development of an exergame controller. The controller is called the swivel pad. This custom game controller prototype is designed around the simple pleasure of pressing buttons and practicing pattern matching. The game controller is a floor mounted, durable game interface. It is a USB enabled hardware solution, affording it the ability to control a wide variety of games

II. THE CONTROLLER

The Swivel Pad is designed around five primary buttons as shown in figure 1. It contains a central platform, and four orbiting command buttons. Players stand on the central platform at all times. The main platform is a button on which players rotate to each of the 4 command buttons, called floor keys. Rotating between each of the floor keys is designed to help practice balance skills.

Each of the floor keys are color coded. They serve as the primary control buttons. The keys are red, blue, green or yellow. The keys are connected via a ring of lights.
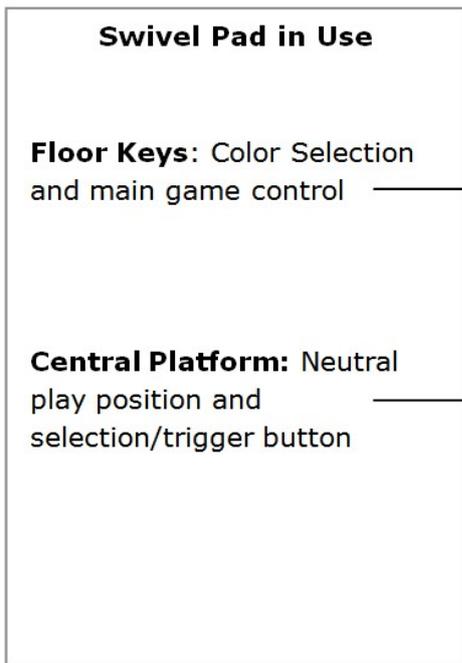
Figure 1. Swivel Pad in use

The complete controller has a 40 inch diameter. Under each of the command buttons is a durable, binary sensor. The command buttons simply detect an on or off state for player input. The 1 inch housing for the complete controller serves as a channel for the wiring to support the sensors and the LED lights ring between command buttons. The device is powered by a set of two USB connectors. The USB connections are also communicate input to a processing computer.

III. THE GAMES

The game controller is connected to a standard Windows or Mac OS computer. As part of the prototype, the researchers developed a set of simple pattern matching games. The games demonstrate how the controller works and allow new players to

Score: 30

Figure 2. Swivel Pad game screen

understand the mechanics of the experience. Each of the games displays an animated image of the game controller to help orient players. The basic display screen for each of the games is demonstrated in figure 2.

The first game is a simple pattern matching game. The player is presented with a sequence of colors on screen. The player must repeat the pattern through the controller. Players need only match color sequence, not timing. Each color has a distinct tone which is played when a pattern is presented and when the player steps on the appropriate color. The player is given one point for each correctly matched color. Score is displayed on the right hand-side of the screen.

The second game adds timing and agility to the first. Players must match a pattern through timing and color. The patterns make song. As the player completes the 1-minute songs they matriculate through levels. In each level the song's tempo increases, requiring the player to be more agile.

The third is a simple toy. The player can activate specific 2D animation sequences by pressing any one of the floor keys. This play modes is specifically designed for demonstration on non-competitive practice.

The game requires players to time their floor key press appropriately. Any floor key must be pressed immediately after each animated sequence. If the player presses the floor key too soon or two late, the animated sequence starts again. The goal is to play the entire animated sequence. The game is designed to help players practice the specific actions while being entertained. This is the least demanding of the games and is
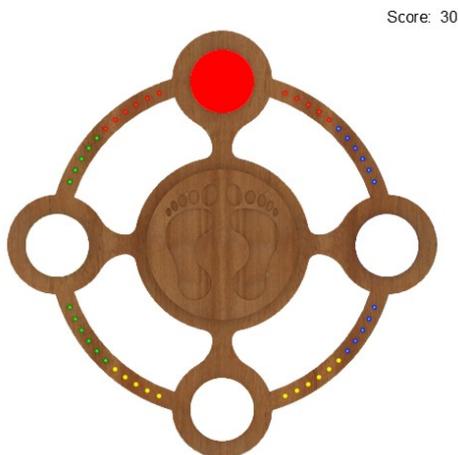
best suited for very new players or players with balance or cognitive load impairments.

Since the game controller connects through USB it can be used with a variety of traditional computer games. The Swivel Pad can be used to play popular arcade games like Pac Man [9] and Space Invaders [10]. The floor keys can be mapped to left, right, up and down, while central platform maps to a trigger button.

IV. APPLICATION

This project is designed to be useful to a wide variety of players. It is expected that players between the ages of 4 and 7 years will find the novelty of the game play experience attractive. It's simple, 4 color buttons should be viewed as identifiable and attractive.

The project is also envisioned as offering potential for patients working through rehabilitative exercises. Patience recovering from hip surgery, for example, are often asked to work through a series of leg adductions. These exercises are similar to the repeated motions required to use the controller. Other patients working through balance and memory exercises are expected to find benefit in playing with the controller.

V. CONCULSION

This research demonstrates a small addition to the wide environment of play technologies. The researchers offer the experience to demonstrate the potential in such solutions. Future work will involve controlled study in its efficacy. In particular, the researchers seek to understand its benefits in rehabilitation through cognitive and physical play.

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