Martial Arts Beat Boxing, Boxing Exercise Virtual Reality

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ABSTRACT

UPDATED—May 9, 2020. The goal of this study was to observe the effects of exercise utilizing Virtual Reality. We expect that exercise done through VR will have the same positive effects on the human mind and body as normal exercise. In order to do this we have designed a Virtual Reality boxing exercise game called MABBoxing (Martial Arts Beat Boxing). Our team built this game to conduct an experiment testing the effects exercise had on human mood and physical reaction, while in a VR environment. We used an Oculus Quest and a before/after questionnaire to conduct our experiment. Due to recent events, our experiment could only be tested by students with computers and Oculus systems, but we were still able to collect data from roommates at all three of our homes in order to come to a conclusion. We learned that participant's mood improved and they felt like they got the same if not a better workout at the end of trying MABBoxing than they would in real life.

Author Keywords

Virtual Reality; Boxing; Exercise; Mood

CCS Concepts

•**Human-centered computing** → **User studies; Virtual reality;**

INTRODUCTION

Boxing is a universal sport that is a healthy way to stay active. However, it can be a dangerous sport in regards to physical contact. We are designing a Virtual Reality boxing game that will test exercise, reactions, and mood. MABBoxing, Martial Arts Beat Boxing, is a boxing video game played on the Oculus Quest. It is a Virtual Reality boxing game that will have objects coming toward the user that he/she will have to either punch or dodge. This will introduce a unique layer of game play that will elevate the users experience.

Literature Reviews

One of the first studies using virtual reality for exercise occurred in 1999. Doctors Grealy, Johnson, and Rushton conducted a study about using virtual reality to improve cognitive functions after brain injury. 13 adults were assigned to the control group, regular cognitive exercises, and another 13 adults were assigned to the virtual exercise group. After 4 weeks, the Doctors found that the patients that did virtual exercises performed significantly better on digit symbol, verbal, and visual learning tasks. They also performed better in reaction times and movement times. [2] The positive feedback from this experiment allowed many others to occur in the past 20 years.

In 2002, Rachel Kiznoy, Noomi Katz, and Patrice Weiss, did an overview of the impacts of virtual reality for neurological rehabilitation. In the early stages of VR, it was most commonly used as a method of rehabilitation. It was specifically used to help those with traumatic brain injury and to train their balance. A repeated pattern between the results of numerous experiments was that virtual reality improved the participant's mood and motivation to train. In the long-run, it showed to be beneficial to their health and improve their physical activity, specifically balance. [3] Continued positive feedback from the users is what encouraged us to pursue MABBoxing as a method for exercise.

Two psychology teams from Santa Clara University and Stanford University did a study focused on the psychological benefits of Virtual Reality exercise. In early 2003, they conducted an experiment with 88 participants randomly assigned to do one of three tasks. They recorded the users' mood and compared the data amongst other tasks. [8] In our experiment we will also be measuring mood, however, we will also be measuring several other variables.

Later into 2003, staff from University of Ottawa and The Ottawa Hospital came together to study virtual reality versus conventional exercise programs for rehabilitation. Using information from two clinical trails underway, and several other preliminary reports on the topic, they sought to prove that virtual reality could be used for physical rehabilitation. Virtual reality should be brought into mainstream practice and the data proves that it is successful. [6] Data from our boxing experiment will also help to prove this even further.

In 2005, Iowa State University created a Virtual Reality boxing game called Cyclone Uppercut. This was designed as an immersive boxing experience. It takes place in a boxing arena and the player fights a boxing champion.The game was made to be only used in Iowa State University's fully immersive environment, C6. C6 is a "six sided CAVE-like projection system". [10] Our game, MABBoxing, is more available to the public and can be accessed on any Oculus system.

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CHI'20, April 25–30, 2020, Honolulu, HI, USA

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ISBN 978-1-4503-6708-0/20/04…$15.00

DOI: https://doi.org/10.1145/3313831.XXXXXXX

In 2005, numerous Phd researchers frrom University of Ottawa and Ontario conducted a study on the benefits of activity and virtual reality with balance exercises for adults with traumatic brain injury. They had 27 participants and were given 6 weeks of activity-based or a virtual reality balance exercise program. Results showed that the participants had significantly more enthusiasm and knowledge when using the VR system. Both programs offered benefits to improve balance, but the VR one had larger improvements on the user's experience. [5] This experiment is similar to ours as we will also be studying user experience to come to a conclusion.

In 2007, researchers from University of British Columbia and University of Victoria came together to study the health benefits of interactive video game exercise. They had 14 college males that were assigned randomly to a control or experimental group. There were several variables measured including health-related physical fitness and resting blood pressure before and after training. They conducted this study for three weeks. The researchers learned that aerobic power and vertical jump both were significantly greater and systolic blood pressure was significantly lower in the group that trained virtually. [1] While we will not be able to measure blood pressure and health benefits with our experiment, we still hope to be able to learn about the exercise that the user received.

In 2008, pyschology students from Stanford University and University of California at Berkely, studied how virtual reality could offer new ways of performing physical therapy and exercise. They specifically studied the physical behavior and the ability to review what has been done. Participants learned better and enjoyed being ablt to see what they did and what they need to fix. This experiment proved to be successful and that virtual reality could be used to record and review movements. [7]

In 2010, Dr. Gustavo Saposnik and his team from the Stroke Outcome Reasearch Canada, researched the effectiveness of using a Wii Gaming technology as rehabilitation for stroke patients. They had 110 participants, the average age was 61.3, and they were split into two groups. Over the course of two months the researchers tracked data and found out that the Wii Gaming system offers a safe and effect rehabilitation. [11] We are hoping that we can be as successful using an Oculus Quest system rather than Wii Gaming.

In 2012, students and faculty from the Institue of Psychology at University of Sao Paulo in Brazil set up a Nintento Wii Fit to train patients with Parkinson's disease and healthy elderly people. The goal was to evaluate motor learning, retention, and transfer of performance improvements. 16 participants had early-stage Parkinson's and 11 participants were healthy elderly people. The patients with Parkinson's showed no difference in learning or retention, and showed poorer performance. The Wii Fit did not prove to be an optimal method for training for these patients. [9] This was an experiment that did not turn out to be successful. We believe that is partially due to the Wii Fit system which is not the easiest to use and the most accurate. Our game, MABBoxing, will help to determine if games can help with exercise because the Oculus Quest is a well-built, easy to use system.

In 2015, a psychology team from the Republic of Korea did a study on the effect of Virtual Reality exercise on the balance and gait of stroke patients. 20 patients were divided in half, 10 would do a normal neuromuscular exercise (control group) and 10 would do the Virtual Reality exercise. The results showed that the Virtual Reality exercise had a positive effect on the stroke patients. [4] The positive results gave us optimism with our experiment. Although we will not have stroke patients as our primary users, we are still looking to test the effects of Virtual Reality exercise.

Recently, in 2019, Kardem Udas and Ilgi Semin from Izmir University of Economics did a study on the biological and motivational effects of using virtual reality for aerobic exercise. They used 20 patients as a control group and split up another group of 60 into two groups; traditional exercise and virtual reality exercise. They ran the tests for 8 weeks in order to collect enough data to come to a conclusion. They found out that virtual reality exercise increases motivation, however, traditional exercise increases physical strength. [12] Our Boxing game can be used to test motivation and would be interesting to do for a future experiment. Currently, we are focusing on mood and experience.

METHOD

We will be using an Oculus Quest for our hardware and Unity for our software to conduct our experiment. The game will have cube blocks coming at the player as well as obstacles for the player to dodge. The player will be required to do a number of movement combinations such as punches, squats, and physically moving their body. We have added music to make it a fun experience, but still get the exercise as the user would from boxing.

Our experiment will be within-subjects and utilize a questionnaire design. There will be three tasks: slow, medium, and fast cube speed. These will be our independent variables. We will use counterbalance and latin square for administering the tasks to participants. Prior to the experiment will record the user's age, prior experience with virtual reality, prior experience with boxing, number of times they workout per week, and questions about mood. During the experiment we will measure accuracy for hitting each block and number of blocks dodged. These will be two of our dependent variables. Our other dependent variables will come from our questionnaire we plan to give after the experiment is complete. We will ask about the user's mood, soreness, how sweaty they are, and if they feel like they got a good workout.

Update for COVID-19

We plan to continue with our experiment, however, we will be asking participants to have an Oculus Quest and to download our game to run it. Professor Ortega has mentioned that several students in the class have Oculus Quest systemes. We will ask them fill out a form before the experiment and then to record their screen when they play their game so that we can review it and take measurements. After the experiment, we will send them the questionnaire to fill out about mood, soreness, how sweaty they are, and if they feel like they got a good workout.

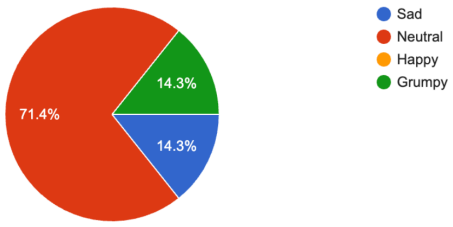

Figure 1. Graph of user's mood before the experiment.

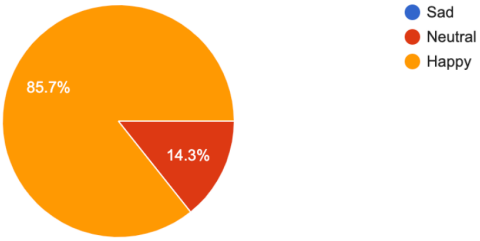

Figure 2. Graph of user's mood after the experiment.

RESULTS AND DISCUSSION

Due to COVID-19 we were not able to collect as much data as we would have preferred, but we were still able to collect enough to come to a conclusion. We had a total of 7 participants between the ages of 20 and 22. There were five males and two females. Most were at least average virtual reality users except for two inexperienced ones. We noticed that all males were average at boxing, while both females were inexperienced. However, this did not affect the data due to each person responding for their individual workout. All participants had an improvement in mood and felt like they got a good workout after playing MABBoxing.

The first questionnaire we conducted was before the participant played the MABBoxing VR game. Figure 1 above shows that most of the participants felt neutral before playing the game. This was expected as our participants were unsure of what they were doing. We were surprised to see that 4 out of the 7 participants do not work out at all. These same participants did not get as sore or sweaty as those that work out weekly.

Our second questionnaire Figure 2 above shows that after the game, most participants felt happy and that they got a good workout. Our game proved to be successful in improving the user's mood. This confirms our hypothesis and helps support why virtual reality should become more popular for exercise and training.

CONCLUSION

In spite of current events, we were able to complete our experiment and learn about the effects of using virtual reality for exercise. We saw improvements in user mood and workout, which helped confirm our hypothesis. In the future, virtual reality could be used for exercise and to train certain physical activities.

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