

Effects of User input types in gaming.

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ABSTRACT

There are many different input types in today's modern world of gaming. This research paper takes a deeper look into how different input types effect user experience and interactions when gaming. It begins by conducting a study on users performing a simple obstacle course with varying input types. The data is then collected on how this affected each user and is then used to infer a result for each input type. This paper finally examines related works to see how these results compared to others.

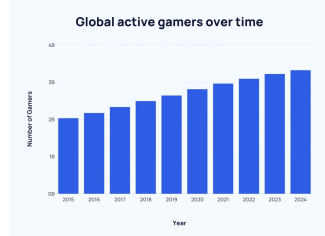
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1 INTRODUCTION

Video games have really began to be a huge hit in the 21st century. "According to the latest data, there are approximately **3.32 billion** active video gamers worldwide" as of January, 2024 (shown below).

[11] This is where much of the motivation of this study comes from I myself consider myself an avid gamer, but one of the biggest questions that has began to arise is which is better for the user, the basic controller or a keyboard and mouse. I know many other users have their own personal preferences which we will take into account. But what will the data show and how will this compare to the many other studies that have been conducted.



Study showing how video game players has increased each year

2 METHODOLOGY

To conduct this experiment I gathered twenty participants and had them each sign consent forms. Of the twenty ten used a keyboard with mouse and ten used a controller. For keyboard and mouse the

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usual W,A,S,D for movement with space bar for jump and mouse to look. For controller users I used a PlayStation 4 controller with the same basic controllers (shown below).



The analog sticks for move and look around and the x button to jump. All of the users varied at random with their experience playing video games. My hypothesis is that the keyboard and mouse users will be faster as there is more variability with their movements. The constant variables between each of these studies was the obstacle course and the point of view camera being first person. It remained the exact same for each user regardless of the users input device. While the independent variable was the input device depending on the group and the dependent variable the times to complete the course. The reason I decided the between subject study would be preferred compared to a within subject was to keep users from memorizing the obstacle course. Which would skew the data depending on what device the user began with. We also allowed each user 2 minutes to familiarize themselves with the controls prior to the experiment beginning. This is to keep a high internal validity or high accuracy of our data because we will be examining the times over ten attempts for each user. In this study, we focused on the data to examine human performance between the devices, calculating an average for each user as well as for each device. I also looked how each user performed over each attempt to see if they improved, to look at the ease of learning each device. This experiment was conducted using Unreal Engine in first person camera. This was used as many games are now using first person point of view as the main point of view.

3 EXPERIMENT

The way I ran each experiment was by creating a obstacle course using Unreal Engine to run the game. Each user had the same point of view and obstacle course. I then created an executable file to run on my personal computer and have each user conduct the experiment. The users would go 10 times and each time of completion would be recorded. After, I averaged everyone's times across their attempts as well as the total average for each device to

compare the results. This allows for an easy way to see how everyone performed based on the device as well as over time as the attempts increased.

4 RESULTS

After months of working around contestant's scheduling and setting up the experiment, the results will shock many people. Let us begin by examining the keyboard and mouse group. The data is shown below

Keyboard User's

User #	Attem pt 1	Attem pt 2	Attem pt 3	Attem pt 4	Attem pt 5	Attem pt 6	Attem pt 7	Attem pt 8	Attem pt 9	Attem pt 10	Average
1	75s	80s	77s	76s	73s	77s	75s	71s	78s	74s	76s
2	43s	45s	42s	41s	45s	44s	40s	47s	46s	40s	43s
3	60s	61s	59s	60s	57s	70s	69s	58s	58s	64s	62s
4	93s	91s	96s	90s	93s	94s	92s	91s	90s	95s	93s
5	58s	56s	52s	59s	60s	54s	52s	51s	57s	53s	55s
6	48s	52s	44s	50s	49s	48s	51s	47s	46s	50s	49s
7	65s	64s	63s	66s	68s	62s	67s	64s	65s	61s	65s
8	54s	58s	52s	54s	55s	51s	57s	50s	56s	53s	54s
9	88s	86s	87s	90s	92s	89s	86s	88s	91s	84s	88s
10	104s	102s	100s	99s	101s	105s	103s	98s	97s	100s	101s

Total Average: 68.6s

Standard Deviation: 19.018506776296

We can see that the average was relatively low at just over one minute. The most surprising thing to me however was the average improvement between attempt 1 and attempt 10 was only minus

2.43 seconds which was remarkably low. Especially when comparing to other studies conducted. This leads me to believe that the keyboard and mouse was harder for some users to learn and become comfortable with over the attempts. We can also see that some users really just did not understand how to use a keyboard and mouse very well which was to be expected. Also make a note of the standard deviation. Now pay attention the the average time when compared to the controller data below.

Controller User's

User #	Attem pt 1	Attem pt 2	Attem pt 3	Attem pt 4	Attem pt 5	Attem pt 6	Attem pt 7	Attem pt 8	Attem pt 9	Attem pt 10	Average
11	85s	84s	83s	86s	89s	90s	84s	82s	80s	78s	84s
12	106s	106s	104s	102s	100s	101s	98s	90s	88s	90s	99s
13	70s	71s	69s	66s	64s	70s	72s	68s	67s	63s	68s
14	68s	66s	69s	72s	70s	67s	66s	65s	59s	58s	66s
15	88s	89s	87s	85s	86s	85s	83s	83s	80s	81s	85s
16	50s	53s	51s	49s	50s	48s	47s	46s	41s	45s	48s
17	63s	63s	60s	61s	59s	57s	58s	60s	56s	54s	59s
18	45s	40s	41s	44s	43s	39s	40s	37s	36s	37s	40s
19	48s	49s	47s	47s	44s	50s	43s	44s	42s	40s	45s
20	54s	52s	50s	51s	48s	50s	53s	49s	46s	47s	50s

Total Average: 64.4s

Standard Deviation: 18.867962264113

Now that is a improvement of 4.2 seconds across users for the controller input. And if it were not for a few outliers, this could have been even more. While observing the study, I noticed that users seemed to have an easier time with the controller. However, the standard deviation among both sides of the study is remarkably close with about only one tenth of a difference between them. This goes to show the varying experience of users

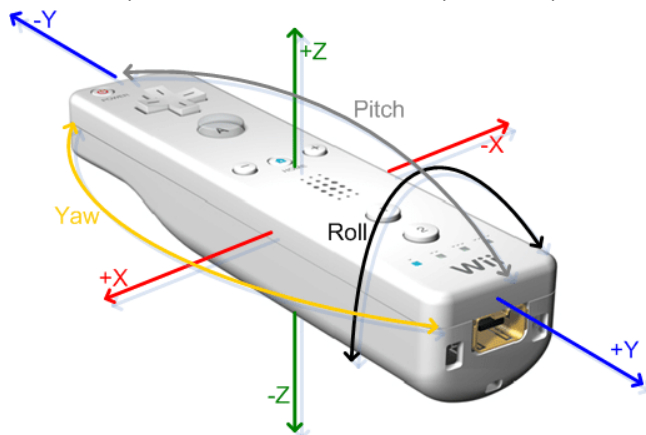
between groups. However, the biggest discovery of this study is the improvement between the users. Look at the attempts for the controller users from attempt one to attempt 10 compared to the keyboard users. We can see that almost every user is improving over time, with around an 8-second improvement from attempt one to attempt 10 across all users. This is extremely showing for how much quicker users were able to learn the controls. Not only were users faster, but they also improved much quicker than their keyboard counterparts. Not only were the controllers superior for human performance but also for faster learning. My initial hypothesis was indeed wrong as the controller users were quicker in nearly every aspect. Perhaps there could have been error in my keyboard and mouse programming, however I find this very unlikely as I did extraneous testing both myself and others.

5 RELATED WORKS

Over the years, there have been many studies conducted following the different user inputs in gaming. Not all have had the same conclusion as the study I conducted, however they should be examined to see how our data compares. One study that I would like to highlight is that of "A Usability Study of Input Devices on Measuring User Performance in Computer Games" conducted at Charles Sturt University. In their study they went a bit more in depth than I did. They "conducted a series of experiments to test a number of input devices from human-computer interaction point of view. We chose three input devices: keyboard, joystick and mouse, as well as two different types of driving games." [1].

Whereas my study focused primarily on first person games and had a limited number of input devices. However, their results were very similar to mine in that users performed better with their desired. They took user responses to study the users experience as well as what input device they preferred. They stated " Our research results suggest that choosing a dedicated input device for a specific game is necessary to improve players' performance and satisfaction in playing computer games. This may be a keyboard or a joystick depending on the nature and the style of the game. [1]. I believe that if I conducted a study much like theirs I would have found similar results. Another major study that was extremely similar to the one I conducted is that of "The Effect of Authentic Input Devices on Computer Game Immersion"[4]. This study as the title suggest focused more on the immersion aspect which with more time I would of loved to of dove into. This study in particular used wii controllers to conduct there study and how the increase in freedom of input increased the immersion of users within a game. They found "The results of the study show, in accordance with our assumptions, that a more authentic input device results in a higher degree of immersion and entertainment value. " [4]. This is something that could be in affect with the controller. Maybe the users felt more immersed in there game with the controller in our study. Certainly something to research more in the future. The most similar work to mine is a study known as "The golden (hands) rule: Exploring user experiences with gamepad and natural-user interfaces in popular video games " [2]. "This research report sought to understand how gamers experienced recent gaming sessions using traditional game controllers (gamepads) or natural user interfaces (NUIs, such as the Nintendo Wiimote)." [2].

Similar to the previous study they specifically looked at the wii remote (shown below) as well as a typical controller such as the PlayStation 4 controller I used in my own study.



In there study they used a 1:1 interview study where they asked participants on there opinions on each of the controller types. The results showed that a resounding number of individuals said the gamepad controller was more precise and accurate. This is also supported in my results as the gamepad users performed better. Finally I want to highlight a study that contradicts my own. The studies name is "A comparative study of four input devices for desktop virtual walkthroughs." [10]. In this study they compared 4 devices keyboard, a mouse, a joystick and a gamepad. However in their results they found that the users completed the tasks in less time with the mouse. They stated "The use of the mouse also significantly reduced the number of collisions, while the use of the gamepad resulted in significantly more collisions." [10] This could be a large part due to the experience of users as well as the study was conducted in 2011. Controllers and games have grown more popular in the 13 years since but it is still something to consider

6 IMPROVEMENTS

There were many flaws in my study that I conducted and ways to improve upon it. One is I could have conducted a longer term study to see if the mouse and keyboard users improved over time. I also wish I added an elicitaion aspect of having 1:1 interviews with the participants to see how they felt using the device. Were the comfortable, did it become easier over time etc... With more time and preparation, I would have been able to complete this. The other thing I should have included in the study was the error rate for each attempt but I did not know how to define what is an error and what is not in terms of completing an obstacle course.

Although the biggest improvement would have been including more input devices as the other studies above did.

7 CONCLUSION

Throughout this whole experiment we examined how user's interacted within video games and how the input device altered that. We focused entirely on the human performance based on which input device was used. In my initial hypothesis I believed that the mouse and keyboard would be superior however I could not be more wrong based on the results. Based on our findings the

controller outperformed the keyboard in mouse in two very large aspects. One being of course the better over all average time by over 4 seconds. The second being the quickness of learning the controls and applying that to the game to acquire better performance. The majority of similar works I have found supported these, however as with most things there are other studies that refute this. For the future I will continue to research more as well as apply more input devices and other forms of study. Specifically, identifying more of the user experience as well as extending the study further over time.

8 PEER REVIEWED ARTICLES

The Links to the peer reviewed articles are shown below:

- 1 M. Kavakli and J. Thorne, "A usability study of input devices on measuring user performance in Computer Games," Charles Sturt University Research Output, <https://researchoutput.csu.edu.au/en/publications/a-usability-study-of-input-devices-on-measuring-user-performance-> (accessed February 10, 2024).
- 2 N. D. Bowman, D. Pietschmann, and B. Liebold, "The golden (hands) rule: Exploring user experiences with gamepad and natural-user interfaces in popular video games," *Journal of Gaming & Virtual Worlds*, <https://intellectdiscover.> (accessed February 26, 2024).
- 3 A review of Affective User-centered design for video games | IEEE conference publication | IEEE xplore, <https://ieeexplore.ieee.org/abstract/document/7002681/> (accessed March 5, 2024).
- 4 D. Pietschmann, G. Valtin, and P. Ohler, "The effect of authentic input devices on computer game immersion," *SpringerLink*, https://link.springer.com/chapter/10.1007/978-94-007-2777-9_18 (accessed March 6, 2024).
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- 10 Author links open overlay panelJ.-F. Lapointe et al., “A comparative study of four input devices for desktop virtual walkthroughs,” *Computers in Human Behavior*, <https://www.sciencedirect.com/science/article/abs/pii/S0747563211001208> (accessed May 7, 2024).

9 SOURCES

[11]J. Howarth, “How Many Gamers Are There?” *Exploding Topics*, Jan. 29, 2024. <https://explodingtopics.com/blog/number-of-gamers>

- (1) Fig 1 - [11]J. Howarth, “How Many Gamers Are There?” *Exploding Topics*, Jan. 29, 2024. <https://explodingtopics.com/blog/number-of-gamers>
- (2) Fig 2 - Created from my study
- (3) Fig 3 - Created from my study
- (4) Fig 4 - <https://www.amazon.com/DualShock-Wireless-Controller-PlayStation-Black-4/dp/B01LWVX2RG>
- (5) Fig 5 : <https://www.researchgate.net/figure/The-Wii-Remote-as-three-dimensional-input-device-and-the-6-degree-of-freedom-realized-byfig5221096206>