

A Comparison of Mouse/Keyboard and Gamepad on First Person Shooter Games

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ABSTRACT

Many video game inputs have been developed to enhance the gaming experience of the player. Two of the gaming controller which are the mouse/keyboard and the gamepad are often source of debate in the gaming community, especially in the community of First Person Shooter player. In this study we scientifically analyze the performances of these two input methods, using the Wilcoxon signed rank test [1]. We noticed that there is a clear difference in using one or other in playing FPS games.

INTRODUCTION

As the video game industry is becoming economically more important [2], video game players are also getting more recognition and [3]. It is then important for video game players to have the necessary mean to win a game while playing, especially in an online game session or a tournament, where they can earn money or reputation. The most important way a video game player can interact with the game is by using a game controller. A game controller is a device used with games or entertainment systems to provide input to a video game, typically to control an object or character in the game. Input devices that have been classified as game controllers include keyboards, mice, gamepads, joysticks, etc. [4]. On the other hand, one of the most popular gaming genre in the Professional gaming world is called First Person Shooter (FPS). First-person shooter (FPS) is a video game genre centered on gun and projectile weapon-based combat through a first-person perspective; that is, the player experiences the action through the eyes of the protagonist [5].

A frequent argument among the player community is whether one of two most frequent input methods for

FPS gaming, which are the combination of Mouse and Keyboard and the Gamepad, is more effective than the other [6] [7] [8]. Still it is difficult to find scientific paper on the topic.

The previous paragraph motivated this study where we will compare the two major video game input, previously cited. We will also compare these inputs methods in a FPS game. We will first describe the methodology used to conduct the study, then we will present the results of our experiment before giving an interpretation, and finally discuss the result and give hints for future work.

METHOD

12 participants have been recruited for this study (10 males, 2 females). They were all students, in the 25-30 age range. 3 of them had no experience in playing FPS games. 7 of them were familiar with using the mouse/keyboard for playing FPS games while 5 others were not. 8 were familiar with using a Gamepad to play FPS games while the 4 others were not. They all have previous generic gaming experience with the mouse and keyboard, but only 1 participant had no prior experience in using a gamepad. The form used to collect these information can be found in the appendix.

Environment

For the experiment we choose the widely used 'QWERTY' layout keyboard and a general purpose mouse for the mouse/keyboard combination input. We used an Xbox360 controller which is a generic purpose gamepad used for console gaming as well as PC gaming and supported by most published PC game as a de-facto controller.

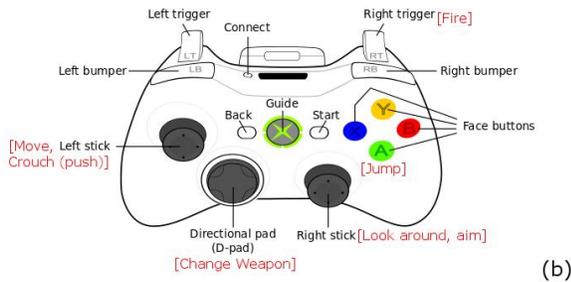
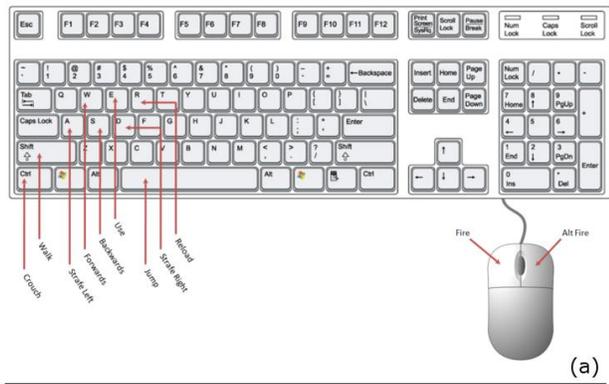


Figure 1 Schema of Keyboard/Mouse (a) and Xbox 360 Gamepad controller (b) layouts with related triggered action in the game.

The First Person Shooter game used is Team Fortress 2. It is a popular online FPS game produced by Valve Corporation, and based on the Source Game Engine that power many other famous game of the company including Half Life and Counter Strike [9]. It is a Free-to-Play game but one can purchase special items within the game. Thus Team Fortress 2 (TF2) has a trading economy worth \$50million [10], which support the fact that it is a very popular FPS game. TF2 is freely available to download and play via the Steam application store [11].

Experiment

Each participant was asked to play the training session of the Soldier character type of the game, for 2 gaming sessions. The first using the mouse/keyboard combination and the second using the Xbox 360 gamepad. All participants played using the same laptop sufficiently powerful to run the game.

The training session can be divided in 3 phases. The first consisting in familiarizing the player to perform various actions with the gaming character using the

game input, the second consisting in shooting at static targets using different weapons and the third consisting in shooting at mobile targets.



Figure 2 Team Fortress 2 Gameplay and Soldier character training phases

The recorded data are the time spend by the player in each gaming session; and the shooting accuracy of the player number of shot hit and miss, for both gaming sessions.

Thus for this experiment, the Independent variables are the Gaming input method (gamepad or mouse/keyboard), and the dependent variables are the player performances (playing time and the shooting accuracy). We will conduct the study by comparing the

speed of execution, measured with the time spent in the training session and also comparing the shooting accuracy of the player.

RESULTS

For each player, we recorded the time spend in each of the 3 training phases, and the number of shoots hit on target as well as the missed one for the 2 shooting phases (static targets and mobile targets). This for both gaming session involving the different input type. Table 1 and 2 show the collected data for one participant (P12).

	Keyboard	Controllor
Move around	75	109
Static targets	138	159
Mobile targets	72	100

Table 1 Time spend (in seconds) in each training phases by participant P12

		Keyboard	Gamepad
Static targets	Hit	18	19
	Miss	5	3
Mobile targets	Hit	15	18
	Miss	10	6

Table 2 Number of hit and missed shots on different targets type for participant P12

We will compare the collected data using the Wilcoxon signed-rank test [1]. First we will compare the pairs of total time spent by the participants playing with the mouse/keyboard and playing with the gamepad (cf. Figure 3), and then the pairs of the accuracy percentage (percentage of the total hit shots among the total shots fired) (cf. Figure 4).

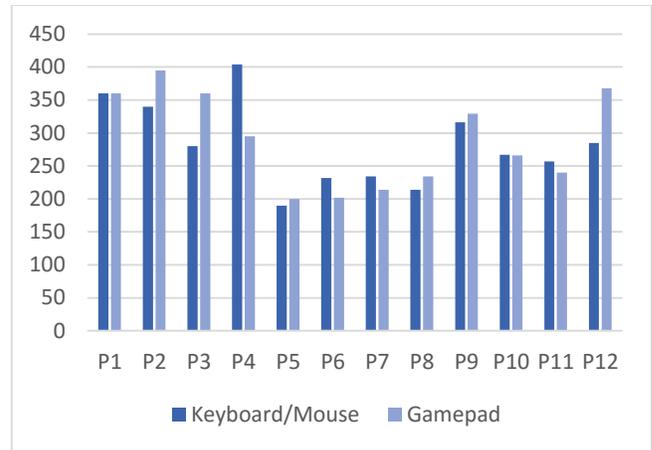


Figure 3 Pairs of total time spend (seconds) in each gaming session using different input method

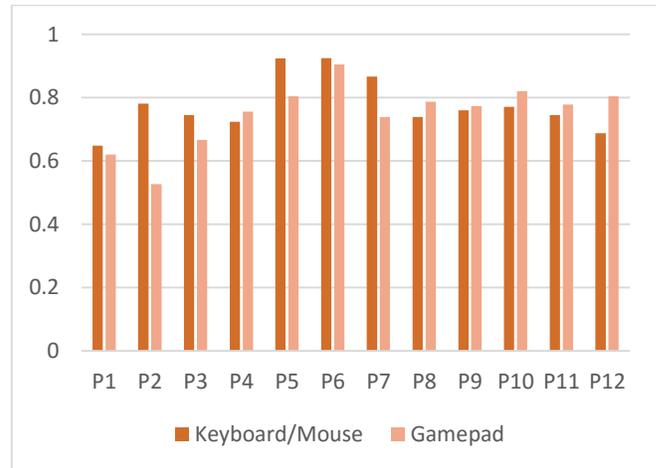


Figure 4 Pairs of shooting accuracy percentage for each participants using different input method

Comparing the speed of execution

To compare the playing time (speed of execution) we will use the total time spent playing and emit the following hypothesizes:

H_0 : *There are no performance differences in term of speed of execution, in playing a First Person Shooter game with a mouse/keyboard combination and playing with a gamepad.*

H_1 : *There is a performance difference in term of speed of execution, in playing a First Person Shooter game with a mouse/keyboard combination and playing with a gamepad.*

Let N be the sample size N=12. For $i=1 \dots N$, let $x_{1,i}$ the playing time with keyboard/mouse and $x_{2,i}$ the playing time with gamepad, by the i^{th} participant (P_i).

We have the following table

i	Keyboard	Gamepad	$x_{1,i}-x_{2,i}$	
			sgn	abs
1	360	360	0	0
2	340	395	-1	55
3	280	360	-1	80
4	404	295	1	109
5	190	200	-1	10
6	232	202	1	30
7	234	214	1	20
8	214	234	-1	20
9	316	329	-1	13
10	267	266	1	1
11	257	240	1	17
12	285	368	-1	83

Table 3 comparing the speed of execution (step A)

Where **sgn** is the sign function **abs** is the absolute value, and R_i is the rank.

After ordering by absolute difference we have

i	Keyboard	Gamepad	$x_{1,i}-x_{2,i}$		
			sgn	abs	sgn.Ri
1	360	360	0	0	0
10	267	266	1	1	1
5	190	200	-1	10	-10
9	316	329	-1	13	-13
11	257	240	1	17	17
7	234	214	1	20	20
8	214	234	-1	20	-20
6	232	202	1	30	30
2	340	395	-1	55	-55
3	280	360	-1	80	-80
12	285	368	-1	83	-83
4	404	295	1	109	109

Table 4 comparing the speed of execution (step B)

Where **sgn** is the sign function **abs** is the absolute value, and R_i is the rank.

We from here we ignore the entries where $x_{1,i}-x_{2,i}=0$. The size sample change to $N_r=11$.

We can calculate the test statistic

$$W = \sum_{i=1}^{N_r} [sgn(x_{1,i} - x_{2,i}) \cdot R_i]$$

We obtained $W=-84$.

Using a table of critical values of the Wilcoxon signed ranks test [12] we obtain the critical W.

$W_{\text{critical}} = 10$ For a two-tailed test with $\alpha = 0.05$ and $N_r=11$. Thus, we have: $|W| > W_{\text{critical}}$. Then we can reject H_0 , which mean there is a significant performance differences in term of speed of execution, in playing a First Person Shooter game with a mouse/keyboard combination and playing with a gamepad.

Comparing the shooting accuracy

We will still use a notation similar to the previous one, with N be the sample size N=12. For $i=1 \dots N$, let $y_{1,i}$ be the accuracy percentage with keyboard/mouse and $y_{2,i}$ the accuracy percentage with gamepad, by the i^{th} participant (P_i). We then emit the following Hypothesis:

H_0 : There are no performance differences in term of shooting accuracy, in playing a First Person Shooter game with a mouse/keyboard combination and playing with a gamepad.

H_1 : There is a performance difference in term of shooting accuracy, in playing a First Person Shooter game with a mouse/keyboard combination and playing with a gamepad.

We have the following table representing the accuracy percentage of each participant with the different input devices:

i	Keyboard	Gamepad	$y_{1,i}-y_{2,i}$	
			sgn	abs
9	76	77	-1	1
6	93	90	1	2
1	65	62	1	3
4	72	76	-1	3
11	74	78	-1	3
8	74	79	-1	5

10	77	82	-1	5
3	74	67	1	8
12	69	80	-1	12
5	92	80	1	12
7	87	74	1	13
2	78	53	1	25

Table 5 comparing the shooting accuracy (step A)

After ordering by absolute difference we have

i	Keyboard	Gamepad	$Y_{1,i}-Y_{2,i}$			
			sgn	abs	R_i	$sgn.R_i$
9	76	77	-1	1	1	-1
6	93	90	1	2	2	2
1	65	62	1	3	4	4
4	72	76	-1	3	4	-4
11	74	78	-1	3	4	-4
8	74	79	-1	5	6.5	-6.5
10	77	82	-1	5	6.5	-6.5
3	74	67	1	8	8	8
12	69	80	-1	12	9.5	-9.5
5	92	80	1	12	9.5	9.5
7	87	74	1	13	11	11
2	78	53	1	25	12	12

Table 6 comparing the shooting accuracy (step B)

We can calculate the test statistic $W=15$.

Using a table of critical values of the Wilcoxon signed ranks test [12] we obtain the critical W .

$W_{critical} = 13$ For a two-tailed test with $\alpha = 0.05$ and $N=12$. Thus, $|W| > W_{critical}$. Then we can reject H_0 , which mean there is a significant performance differences in term of shooting accuracy, in playing a First Person Shooter game with a mouse/keyboard combination and playing with a gamepad.

CONCLUSION

In this report we study whether or not in a First person Shooter Game, the player performance are impacted when he/she use different input devices which are for instance a combination of mouse/keyboard and a Gamepad. We compare two aspect of the performance: the speed of execution as well as the accuracy of the player. We did so using the Wilcoxon signed-rank test.

We observed that both performances are impacted by the input device. Looking at the data we are tempted to

say that playing an FPS game with a combination of Keyboard/Mouse can make the player faster in executing actions and improve his/her accuracy. This is probably because even though most candidates felt comfortable using the gamepad, it was difficult for them to aim at targets using the gamepad right stick than using the mouse. This may be due to the fact that most candidates are more familiar with the mouse because they use it in their daily life for other tasks in addition to playing games.

For future work we can try to have a more diversify population by including people who are either unfamiliar with video games or unfamiliar with both the keyboard and a gamepad. Since all our participant were already familiar with playing a video game and using a keyboard.

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APPENDIX

Participants Questionnaire

- How old are you?
- What is your Gender (Male/Female)?
- Have you ever used a keyboard?
- Have you ever played a video game?
- Are you familiar with First Person Shooter (FPS) Games?
- Have you already used the keyboard and mouse to play an FPS game?
- Are you familiar with Video Gamepad?
- Have you already used a video game controller to play a FPS game?