

Hitbox vs Arcade stick

A study on the advantages and disadvantages they provide

ABSTRACT

Controller legality and benefits have been a long running discussion within the fighting game community. Two of the most common controllers used in today's fighting games are the arcade stick and the hitbox. This paper studies the advantages and disadvantages that these provide a player. This is done by several interviews followed by a thematic analysis method to find patterns.

The results show that both controllers have advantages and disadvantages depending on the usage. However, the hitbox is shown to have a slight technical advantage over the arcade stick when it comes to input speed and other factors.

CCS CONCEPTS

- **Human-centered Computing -> Interaction Design -> Interaction Devices**

1 INTRODUCTION

A long running discussion within the fighting game community, the FGC for short, has been the legality of using certain controllers, their benefits, disadvantages and other factors they provide. While this topic has been discussed countless times on different forums and other sites there aren't a lot of articles or papers written about it. This paper will specifically look into the advantages and disadvantages of two of the most common controllers, the historical arcade stick and the newer hitbox.

The following two research questions were created to reach the goal of the paper:

- What advantages and disadvantages does an arcade stick provide a player in fighting games?

- What advantages and disadvantages does a hitbox controller provide a player in fighting games?

2 BACKGROUND

2.1 The controllers

While you can nearly play any game with any type of controller, fighting games usually have a wider variety of viable controllers compared to other popular game genres. For example Multiplayer Online Battle Arena (MOBA) games on the computer are nearly always played with the use of a mouse and keyboard and First Person Shooter (FPS) games are usually played with either gamepad or mouse and keyboard. Out of all the controllers available used in conjunction with fighting games the hitbox and the arcade stick are two of the most common ones in professional play [3], most notoriously in the Street Fighter and Tekken professional scenes.

The arcade stick dates back to the 1970s when arcade games became popular. In 1987 the NES Advantage controller was manufactured by the company Asciiware and released by Nintendo for the Nintendo Entertainment System [5]. This was one of the first arcade stick controllers sold for home use. After this they became increasingly more popular to use while playing fighting games outside of the arcade. The arcade stick controller consists of a lever, which is used for directional inputs, such as up, down, left and right, and several buttons laid flat on the surface used for other actions (see Figure 1).



Figure 1: The Hori RAP4 Kai arcade stick.

On the other hand the hitbox controller (see Figure 2), or controllers with similar button layout is a lot newer. This controller usually consists of four buttons that are used for the up, down, left and right directions and usually at least six other buttons. While most newer games provide an option to rebind buttons, the larger red button at the bottom is by default used for the up direction. To make a diagonal input the user has to combine the two corresponding buttons. For example, to input the up and right diagonal, both the up and right buttons have to be pressed down simultaneously.



Figure 2: The official Hitbox controller.

2.2 Technical terms

To fully understand the results and the discussion several technical terms have to be introduced and explained.

Dash

A quick movement left or right, usually executed by double tapping the left or right button.

Korean Backdash

A faster type of dash backwards that is more complex to execute than the normal dash.

Simultaneous Opposing Cardinal Directions Resolution (SOCD Resolution)

SOCD can be described as: “It is the physical actuation of cardinal directions that are separate and oppose each other - ie, pressing Left and Right at the same time” [1].

To remove the possibility to press opposing directions simultaneously, different types of

SOCD resolutions have been implemented. A common version is the one called SOCD neutral. If a game or controller has this type of resolution and two opposing directions are pressed at the same time, the input is read as neutral which means no direction is output [1]. Another one is called SOCD Last Input which leads to the last direction pressed being the final direction [1].

SOCD Shortcuts

These are shortcuts that the SOCD Resolution provides a player.

Frame

A frame is the time it takes for a picture to be rendered and presented on the screen. Fighting games usually render at a fixed rate of 60 frames per second [4].

3 METHOD

To answer this paper's research questions, data had to be gathered. This study used interviews to accomplish this.

3.1 Interviewing

A post was created on several subreddits and Discord servers. It briefly described the study's purpose and asked to interview people who had experience with either controller. This led to 17 interviewees, where 13 of them were interviewed using voice communication in Discord. The other four interviewees were interviewed via text chat. Every interviewee had at least 3 months of experience with either controller in either Street Fighter, Tekken or Guilty Gear.

All of the interviews using voice chat, except one, were recorded with permission from the interviewees and later transcribed. The interviews were between 20 and 50 minutes, with 25 minutes being the average length. The interviews using text chat were accomplished by writing all the questions and then letting the interviewee answer them in order (see Appendix 1).

Lastly, it's important to note that most of the responses are subjective. This means that some of the advantages and disadvantages found in this paper might not be accurate for every player. Especially not when the sample size isn't very large and is randomly selected. However, since they all have mentioned similar topics it may indicate that the results can be generalized.

3.2 Analyzing the data

After transcribing the interviews, the data had to be analyzed. This was done using a thematic text analysis method [2]. It was executed by reading through the transcriptions, looking for themes and sorting statements into the themes. To easily handle and group the statements into the different themes, a Google Excel document was used (for an example see Appendix 2).

4 RESULTS

After analyzing the data six themes could be found.

4.1 Intuition

Firstly, 6 out of the 17 participants thought the arcade sticks were intuitive to use for movement of the character. Only one interviewee mentioned this for the hitbox. However, seven interviewees said that the hitbox was less intuitive than the arcade stick, with one of the reasons being that the thumb is used for jumping.

4.2 Difficulty

Another theme that could be seen was the difficulty level of the controllers.

The data showed that different actions were easier to execute on different controllers. At least seven interviewees mentioned that motion inputs were easier using an arcade stick than using a hitbox. Especially when it came to 180, 360, 720 or even 1080-motions. Meanwhile only three interviewees thought the same about the hitbox. However, when it came to doing charge moves or double taps, for example executing a dash, at least five

interviewees thought the hitbox excelled over the arcade stick. The main reason for this being the difference in travel time between the two controllers.

Two interviewees also mentioned that they think hitbox is easier to learn if the user is used to controlling a character using a keyboard. This is because the layout of the left, right, up and down-directions are very similar. As Interviewee 8 said:

"You don't have to own a hitbox to play a hitbox."

Another two interviewees also mentioned that doing inputs that required the use of the ring and middle finger were more difficult due to them moving less independently.

4.3 Consistency & Accuracy

The data showed that 15 interviewees thought the hitbox excelled in consistency and accuracy, while only 2 people thought the same about the arcade stick. When Interviewee 2 were asked he said:

"I think the arcade stick is a bit more inconsistent as compared to the hitbox because it's very easy to accidentally input down + forward instead of just forward."

However when asked if this matters, there was less of a consensus. Some interviewees thought it might impact, but differently depending on what level of play. Other interviewees thought it wouldn't matter at all and that game theory is more important.

4.4 Input Speed

When asked about the controller's input speed, the majority answered that the hitbox was faster. One of the interviewees explained it as followed:

"It's instantaneous. There's no buffer period, there's no movement, you just go straight to

the other button, all three fingers are already ready.” - Interviewee 7

4.5 SOCD Impact

Many interviewees, when asked about the advantages the hitbox provides, mentioned SOCD shortcuts. Interviewee 10, when talking about the benefits the SOCD Last Input resolution gives, said:

“Normal hitbox SOCD resolution also has similar shortcuts. Where it's basically taking advantage of how the software is reading your inputs.”

Interviewee 7 also mentions that Korean backdashes are easier executed using a hitbox, specifically because of the SOCD shortcuts.

4.6 Ergonomics

The data also showed that there were advantages and disadvantages between the two controllers when it comes to ergonomics. 6 out of the 17 interviewees said that the hitbox is less taxing on the user's wrist, due to less movement. Interviewee 6 said:

"It's very good on your wrist. As opposed to arcade sticks where you're moving the stick, with a hitbox you're basically just typing.”

4.7 Other

Two of the participants also said that, being able to use both thumbs to jump, is an advantage that the hitbox provides a player.

5 DISCUSSION

The data provided from the interviews helped to answer the advantages and disadvantages that the arcade stick and hitbox gives a player.

5.1 Advantages & Disadvantages with the arcade stick

By analyzing the results several advantages could be found with the arcade stick. One of

the major advantages seemed to be that motion inputs, especially 180 degree or higher, were easier when compared to executing them on the hitbox. Another advantage was that the arcade stick was more intuitive to use.

The data also showed a lot of disadvantages with the arcade stick compared to the hitbox. Firstly, the arcade stick was less consistent and accurate than the hitbox. While the participants didn't share the same opinion about if it mattered or not, this still points at something. Another significant disadvantage the arcade stick had, compared to the hitbox, was its slower input speed. Lastly, another disadvantage was how it's more taxing on the user's wrist and hand.

5.2 Advantages & Disadvantages with the hitbox

The hitbox showed to have a lot of advantages over the arcade stick. Some of the advantages were being more consistent, having better accuracy, being less taxing on the wrist and having faster input speed. However, the primary advantage lies in the SOCD shortcuts. The shortcuts, depending on the game, will provide the player with easier executions, one of the examples being execution of the Korean Backdash in Tekken. Another advantage shown were how charge moves were easier executed on a hitbox.

The hitbox only seemed to have two disadvantages compared to the arcade stick. First and foremost the motion inputs were more difficult to execute. Secondly the hitbox was seen to be less intuitive.

6 CONCLUSION

So which controller is the “best”? In the end, no controller will automatically make a player better. This is shown throughout the professional fighting game history, where both controllers are used by the top players. However, the results of this study, points to the hitbox having a slight, at least technical, advantage over the arcade stick. The primary

reason for this being the SOCD shortcuts and the faster input speed. But in the end, game theory, physical reactions and other factors will determine the final outcome of a match.

7 FUTURE WORK

Many of the themes that arose in this study would be interesting and beneficial to explore further. Researching how input speed and accuracy could be improved for the arcade stick would be useful when designing new arcade sticks. Another subject that would be useful to develop further is the ergonomics of the arcade stick. This would help find solutions to decrease wrist and hand issues from extensive or poor use. Lastly, looking into SOCD shortcuts and how to prevent them would decrease the technical inequality between the arcade stick and the hitbox.

8 REFERENCES

- [1] Hitbox (n.d). Introduction to SOCD and Resolutions.
<https://www.hitboxarcade.com/blogs/support/what-is-socd> [2022-03-11]
- [2] Caulfield, J (2019). How to Do Thematic Analysis.
<https://www.scribbr.com/methodology/thematic-analysis> [2022-03-15]
- [3] Hamilton, A (2019). What controllers do Street Fighter pros love to use on the Capcom Pro Tour?
<https://www.redbull.com/gb-en/street-fighter-v-controllers> [2022-03-16]
- [4] Silman, J (2021). Fighting Games Explained: What is Frame Data and How to Use it to Your Advantage?
<https://compete.playstation.com/en-se/article/fighting-games-explained-what-is-frame-data-and-how-to-use-it-to-your-advantage> [2022-03-16]
- [5] Oxford, D (2018). A Closer Look at Nintendo's Official NES Peripherals: NES

Advantage.

<https://www.oldschoolgamer magazine.com/a-closer-look-at-nintendos-official-nes-peripherals-nes-advantage> [2022-03-16]

9 FIGURES

Figur 1. ProFightStick (2019). Hori Real Arcade Pro 4 Kai Review.

<https://www.profightstick.com/hori-real-arcade-pro-4-kai-review> [2022-03-16]

Figur 2. Hit Box (n.d).


<https://www.hitboxarcade.com/products/ps4-ps-c-hit-box> [2022-03-16]


10 APPENDIX

[1] Questions asked via text

So I think, since we're using chat, this is the best option: First I write the questions, then you answer them by using the discord reply mechanic and lastly I ask eventual follow up questions. So here are the questions:

1. For how long have you played fighting games?
2. What games are you playing / have played using arcade stick?
3. What advantages and disadvantages do you think a hitbox or keyboard gives a player? Are those from first hand experience or not?
4. What advantages and disadvantages do you think an arcade stick gives a player? Are those from first hand experience or not?
5. Do you think one controller having higher input speed impacts the gameplay? In what ways? Do you think it matters?
6. Do you think one controller gives a player an advantage in input precision? Do you think it matters? In what ways?

 Gusto 1. For how long have you played fighting games?

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on and off since 2015, but i didn't start playing them on stick until the latter half of 2017.

[2] Example of the Google Excel document

M	N	P
Themes		Themes
Intuition		Consistency & Accuracy
STICK		STICK
examples here		examples here
HITBOX		HITBOX
examples here		examples here
Difficulty		Consistency & Accuracy
BOTH		examples here
examples here		
STICK		
examples here		