

Box Controllers and Legality within Super Smash Bros. Competitions

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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Introduction

Video games have grown into a 217.06 billion dollar industry with an average expected annual growth of 13.4% from 2023 to 2030 (“Video Game Market,” n.d.). A growing subcategory to video games are Esports which focus on competition. Throughout the late 2010s and especially over the COVID pandemic, Esports has seen a massive surge in popularity and market value (Block, 2021). Super Smash Bros. (SSB), a fighting game series by Nintendo, has had substantial Esports popularity dating back to the release of Super Smash Bros. Melee (SSBM) for the Nintendo GameCube in 2001. The current landscape of competitive SSB consists of the latest release of Super Smash Bros. Ultimate (SSBU) for the Nintendo Switch and SSBM. SSBM has remained a mainstay in Esports for over two decades due to the nature of its high octane gameplay. The average professional player makes around 5-8 actions per second (APS), each with thought and reasoning behind it (Chung, 2020). In conjunction with the speed of the game, competitors need to be precise with every input or risk accidentally losing the game to a misinput.

Due to the high APS of SSBM, many players have developed arthritis or other ailments in their hands stemming from the strain of using the GameCube controller. The GameCube controller is a stereotypical video game controller with an analog stick on the left side to control movement. This movement is the primary cause for injury and has resulted in members of the community working to create solutions to prevent injury in the future. The main emerging technology to solve this is called a box controller, pioneered by the Smash Box. The main difference is that instead of using an analog stick, the player controls the movement using buttons mapped to up, down, left, and right. There are then modifiers that can change the angle inputted. This is very similar to WASD controls for computer games.

In this paper, I consider the benefits and detriments of box controllers compared to the standard GameCube controller to determine if or how box controllers should be legalized and regulated in competition. This determination is important to maintain competitive integrity and has recently been called into question by the 47th best SSBM player in the world (Scoles, 2025). The box controller will be viewed using Star's framework of infrastructure, which analyzes the social impact of technology by treating it as infrastructure for a larger system and analyzing the values and effects of it.

Background

An understanding of both the physical mechanics of each controller and the current state of controllers in competitive play is necessary to make informed decisions. The GameCube controller (Fig. 1) has been around since the release of SSBM in 2001 ("Super Smash Bros.," n.d.). The controller consists of a grey joystick (analogue stick), yellow joystick (C-stick), a directional pad, the face buttons (A, B, X, and Y), two bumpers (L and R), and a button mounted on the top right of the controller (Z). For over a decade, there was no alternative to using it. This established and embedded the controller in the culture of the SSB Esports scene. Even in SSBU, which has many different controllers available to use, a large majority of competitors choose the GameCube controller.



Figure 1. Image of GameCube Controller ("Super Smash Bros.," n.d.).

However, even with how iconic the controller has become within the scene, there are some known issues with it. The quality control of GameCube controllers creates a high amount of inconsistencies between factory new controllers. This problem is exacerbated by the fact that controllers only last about a year for a top-level competitor. The main way the controller wears down is through the analog stick. When the joystick is moved, the voltage for the X and Y axes measured changes, allowing the controller to detect where the current joystick position is at any position within the analog stick's range. When the joystick is released, compressed springs snap the joystick back to the neutral position. Wear occurs when the electrical components wear down or when the springs get weaker due to high use. Another known issue occurs when the joystick snaps back to the neutral position. Even though it is barely noticeable by the human eye, the joystick snaps past the neutral position first before returning to the center. This can register in game as an input in the opposite direction, creating inputs that the player did not want or input. Another issue that competitors have run into is overuse injury in their hands due to the grip on

the GameCube controller. This can be mitigated via hand stretches and taking breaks, however, it is a point of contention with the controller. Due to hand injuries or motor disabilities, some competitors are not able to use the GameCube controller to begin with.

One of the more recent developments is a completely open source GameCube controller that uses different components and allows users to load firmware onto it. This allows better quality control and the ability to add additional signal processing to properly process inputs. This gets rid of a lot of the typical wear and tear and the issue with the stick snapping back to neutral. These controllers are deemed legal in the current competitive landscape with few objections as they function very similarly to the original GameCube controller. What is explicitly forbidden is a button that executes a series of button presses which is called a macro (which are explicitly banned). Another common controller modification comes from modifying the game itself to have better signal processing, taking it off the controller and making every controller that's plugged in work more similarly (Salvato, n.d.). This software patch is called Universal Controller Fix (UCF) and is used sometimes. There is more controversy as it inherently changes the code of the game, leading many national tournaments to not adopt it.

Box controllers, which are the main focus for this paper, are fundamentally different from GameCube controllers. Many variations of this type of controller exist, but it was pioneered by the Smash Box (Fig. 2). The fundamental difference between the GameCube controller and box controllers is how each is laid out. The GameCube controller is meant to be held in your hands at all times while box controllers are meant to rest on your legs as you play with both hands laid flat out on it. The main difference this creates is with the analog stick input. While the GameCube controller has a joystick to control movement, box controllers map up, down, left, and right to individual buttons. Players can input diagonal directions by holding multiple buttons

down with extra modifier buttons that change the angle and position slightly. This allows the controller to input multiple discrete positions; however, this controller can never reach the full breadth of positions that a traditional analog stick can reach.

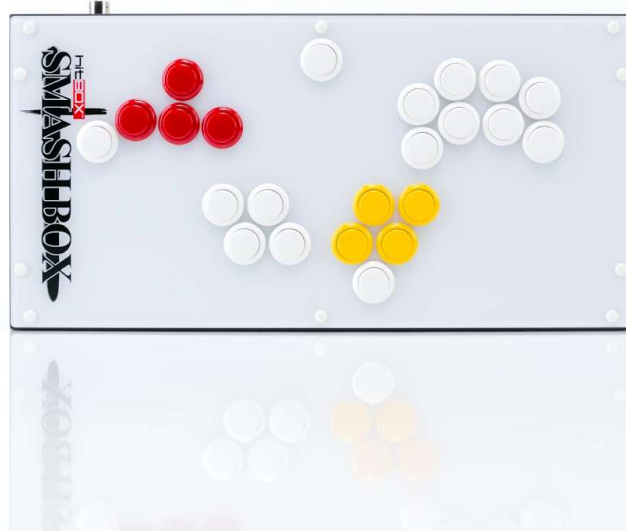


Figure 2. Image of Smash Box by HitBox ("Smash Box," n.d.).

Discrete values for movement fundamentally changes what is possible within the game. Opposite directions can now be inputted near instantaneously compared to an analog stick where there is travel time. Because there's no voltage being measured as well, this means the discrete values are set and will be near infinitely precise compared to the GameCube controller's slight variations. This combination of precision and speed of the inputs is not replicable on a GameCube controller. Dissidents of box controllers have pointed out that this could create an unfair advantage for players who use the box controllers, suggesting either an outright ban or regulation to slow input speed down to match GameCube controller travel time.

Literature Review

Due to the recent emergence of Esports and the even newer phenomenon of box controllers, there are not extensive academic sources available discussing SSBM and box controllers specifically. However, there is primarily one academic paper that directly mentions SSBM and other papers about Esports in general.

In a 2020 article titled “How User Modified Controllers Overcome Design Limitations to Create Competitive Advantage in Super Smash Bros. Melee”, David Cumming observes and characterizes the advantages that competitors seek through modification or alternate control types (Cumming, 2020). In this source, a fairly complete list of common controller modifications is assembled. Most of these are built upon the existing GameCube controller, such as adding components to help process the signal, making physical notches in the plastic around the analog stick for specific angles, and changing the feel of how some of the buttons feel. This article also notes that ergonomics of the controller are something that has caused players to develop injuries, leading to players attempting to reduce the strain they face. The overall takeaway from this source is that players have been modifying their native GameCube controllers from generic controllers to specialized pieces of equipment to compete with and calls into question whether these modifications should be legal.

Another emerging area of research is the ergonomics and discomfort in Esports or general gaming. In “eSports: Opportunities for Future Ergonomic Studies,” Viktoriya Lipovaya et al. stated that Esports has the opportunity for further ergonomic study, laying out information to show the prevalence and necessity that it gets studied in the near future (Lipovaya, 2019). Another paper titled “Leveling Up: An Overview of Common Esports Injuries,” by Kathryn Bartolo aims to lay out the common types of injuries within Esports (Bartolo, 2024). Most

related to the controllers is the prevalence of injuries in the hand, wrist, and shoulder. These are mostly attributed to repetitive strain and overuse and lead to, but are not limited to, the following injuries: carpal tunnel syndrome, different kinds of tendinopathy in the wrist or hand, and different kinds of neuropathy in the wrist of hand. Notably, the source also notes the lack of a large dataset. This paper is also focusing on Esports that use a computer and does not directly mention controllers.

Though not an academic source, the SSBM community has collected substantial data regarding controller inputs. A recent tweet from Andrew Nestico helps visualize different controller inputs and gives scatterplots of different types of controllers (Nestico, 2025b; Isan, 2025). Notably, the former best SSBM player in the world, Juan Debiedma, also had their inputs visualized, showing how he had used almost every angle in the game (Fig. 3; Nestico, 2025a). Using the 2023 rankings as a base, a member of the community started to compile a list of what controller each top 100 player uses (V0ltTackle, 2024). They were not able to gather data on every competitor, but 5 of the 62 surveyed competitors used box controllers. Notably, box controllers started to release around the 2017 timeframe.

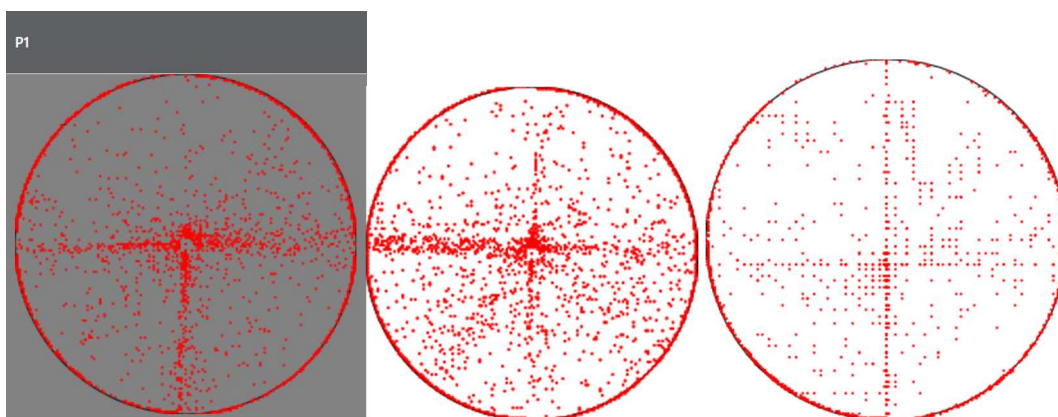


Figure 3. Controller Visualization for a GameCube Controller (Left), Top Player (Center), and Box Controller (Right).

STS Framework

Susan Leigh Star's framework of infrastructure will be used to analyze box controllers in their entirety (Star, 1999). Star defines infrastructure as something that is always relational such as doors being a part of a building. Star then claims that infrastructure is built and holds inherent social value, noting that, "For the person in a wheelchair, the stairs and door jamb in front of a building are not seamless subtenders of use, but barriers" (Star, 1999, p. 380). Star then defines characteristics of infrastructure as: embeddedness, transparency, scope, learned as part of membership, links with conventions of practice, embodiment of standards, built on installed bases, visible upon breakdown, and fixed in modular increments (Star, 1999).

The following aspects of infrastructure will be used to analyze box controllers: links with conventions of practice, built on installed bases, visible upon breakdown, and fixed in modular increments (Star, 1999). "Links with convention of practice" relates the adoption of new infrastructure to previously established norms, the example given being the QWERTY keyboard. "Built on an installed base" is defined as infrastructure does not change independently of its previous creation, it inherits and wrestles with the previous installed base. "Visible upon breakdown" refers to how most infrastructure is taken for granted until something goes wrong. The simplest example of this in our current lives is our reliance on electricity where we take it for granted. However, whenever there is a power outage, the status quo of the typical day is disrupted, showing how electricity as infrastructure becomes visible upon breakdown. "Fixed in modular increments" means that infrastructure does not change in one fell swoop, it changes in small increments over time.

Analysis

As outlined in the literature review, there is sparse but compelling data for both GameCube and box controllers. GameCube controllers have served as the established infrastructure within the competitive SSBM community since the establishment of the game. This controller, through its legacy and iconography, has become part of what competitive SSBM entails. However, the development of modifications to the GameCube controller and box controllers as a whole are because of the GameCube controller's flaws becoming "visible upon breakdown". As the game progressed and the players strived for perfection, the GameCube controller as infrastructure started to crack.

Imad Khan's 2017 article, "Control Freak: How an injured esports athlete got back into the game," follows the case study of the professional SSBM player Aziz Al-Yami (Khan, 2017). Al-Yami is known for playing an extremely technical character in SSBM and spent many hours a day practicing to compete at the national level, ranking 6th in the world in 2013. However, this all came to a screeching halt in 2014 when he was diagnosed with many types of arthritis in his left hand, tendon damage, and his cartilage pad damaged. With all of these complications, even after surgery, there would be no guarantee that the issues would flare back up. To continue his career as a professional, Al-Yami eventually found a doctor able to perform a surgery to remove the entire damaged tendon, losing a whole degree of movement in his hand. This prevented him from ever using a GameCube controller again, however, he was determined to keep playing the game he loved. Working with a company called HitBox, he worked with them to create the first box controller for SSBM. This controller was much more ergonomic and allowed Al-Yami to keep playing the game even with the severed tendon.

However, even though he started his journey with HitBox, eventually Al-Yami branched off and made a box controller in his own vision with all the features he believed would be the best for competitors. Fully realized, Al-Yami was able to return to competition after a large adjustment period. One of the most important pieces of information to note in this article is that the precision of box controllers was considered in the manufacturing of it. The makers realized that it allowed for increased precision and were pressured to add handicaps, limiting the precision or speed at which the controller can function.

The story of Al-Yami shows that the GameCube controller as part of the infrastructure to compete had the potential to harm competitors long term. With the rise in injuries, this plays into the infrastructure characteristic of “visible upon breakdown.” When the infrastructure, in this case the GameCube controller, is working properly, it seamlessly falls into the background and taken for granted. However, once injuries started to arise due to the GameCube controller, the infrastructure to play the game becomes visible. The lack of proper ergonomics of the GameCube controller led to the original box controller’s creation.

Another angle that is important to highlight is the improved accessibility that the box controller provides. This controller is more ergonomic than the GameCube controller, allowing users to play the game with a resting hand position. Al-Yami is a case study for this and also shows how box controllers allow those with hand disabilities to play the game. From a utilitarian standpoint, prioritizing the health of competitors and maximizing the amount of players that can play your game will result in the most growth for the Esport, since more players will be able to play over the long term. More competitors results in more interest in the Esport and this interest snowballs over time.

The box controllers were “built on the installed base” that was GameCube controllers. The inputs needed to directly map to GameCube controller inputs, but even the handicaps built into box controllers are done with the intent to build off of the GameCube controller. However, one could argue that box controllers break the “link to conventions of practice” that GameCube controllers have because it does not hold the same iconic status as the standard controller. This also does break the way players played the game before, allowing precision and speed of inputs that was not possible before. This precision is seen in the visualized inputs in the literature review, showing that box inputs on the right are much more precise than the standard GameCube controller.

The current best player in the world, Zain Naghmi, made a twitter post describing his thoughts on current controller discourse (Naghmi, 2024). In this post, he acknowledges that he and allegedly many other top players believe the box controller is game breaking but only three of the top fifty players use it. He believes that because of the stigma surrounding the controller, many players have not switched to use it. Naghmi predicts that if someone won a major tournament with a box controller, public sentiment would switch and push for a ban on box controllers. However, Naghmi then outlines how primarily two GameCube controller modifications, extra notches for the analog stick and Z-jump (which is mapping the Z button to jump using hardware), are much more prevalent in the current meta. Notably, notches do not have an ergonomic benefit but Z-jump arguably does. He believes that these should be banned but are allowed to be legal because of the current ruling on box controllers. This allows the GameCube controller to achieve better performance than the original and function closer to a box controller.

As described in Naghmi's discussion on controller legality, players started to build off of the GameCube controller as an "installed base" to match the precision of the box. This change was adopted instead of banning the box controller due to the lack of results the box controller has had, and is likely influenced by players wanting to have the best controllers possible. If they can make their inputs more precise or fundamentally better, this would foster a higher level of competition which has been a tenant of the SSBM community. This discussion has showed how box controllers had cemented themselves within the infrastructure of SSBM already and that the current modifications to GameCube controllers are being "built upon an installed base."

If the evolution and development of controllers overtime is considered, it is observed that nothing happened without a pre-existing reason. This helps to characterize controllers as infrastructure by identifying the trait of "fixed in modular increments." Controllers were not revolutionized over time; everything developed over time to address specific problems. The development of box controllers to improve accessibility and prevent injury was in response to the GameCube controller's lack of ergonomics. Then, with even more time, modifications to the GameCube controller to balance the playing field between box and GameCube controllers developed. This slow process shows how the infrastructure of controllers in SSBM has changed slowly overtime to fix specific problems in modular increments.

The SSBM community values the precision and high octane nature of their game, and due to the box controller allowing a higher level of precision, the community has been in an arms race to improve their current GameCube controllers to match the strength of box controllers. However, even if there are dissidents on what should be legal, both modifications to GameCube controllers and box controllers as a whole have transitioned to be part of the infrastructure of SSBM itself. Competitions have continued through these developments with players using and

modifying each controller to work for them the most. Infrastructure is not something that can be changed easily, and now that it is established, it will be hard to override muscle memory and change how competitors play the game.

Conclusion

Box controllers have permeated the infrastructure of competitive SSBM, forcing innovation for the GameCube controller and cementing itself within the community. While there has been backlash due to contesting the importance of GameCube controllers within the SSBM scene from a cultural perspective, box controllers have allowed many competitors to compete and have been a driving force in shaping the current landscape of competitive SSBM. With the ergonomics of the box controller and the current state of SSBM already having adapted, box controllers should be legal to use in SSBM competitions going forward.

Word Count: 3423

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