Don't lose control

Considering movement systems in direct relation to control schemes and player interactions

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ABSTRACT

One of the core elements in any game is how the player moves from point A to point B within game space. This paper will begin to unravel how the creation of a successful movement system can make or break the success of a new game. It will also highlight successful control layouts that synergise with the implemented movement to create a seamless experience that the player can become fully immersed in.

Keywords

Control, Intuitive, Immersion, Momentum, Contextual, Buttons, Movement, Learning curve, Mechanics, Interaction

1.   INTRODUCTION

This study will compare and contrast successful examples of movement and controls in games. This comparison of key players in the industry will allow new and existing developers to make the most of their game environment using character movement. This paper will use the default control mapping of these key players to identify trends and practices that were employed to improve player experience.

Movement and controls may not seem important at first to a new developer but this is one of the biggest hurdles that development of a new game faces. For certain companies movement is the most important thing to get perfect, and this shows most in Nintendo's Mario series which is world renowned for its stellar movement system ([4] Foster 2018). For the development of Mario 64 the team had Mario standing in a room with nothing but movement until they decided that the game was fun with no other interactions. In contrast, a bad movement system can kill the initial traction of a game. The creation of character movement requires finesse and a lot of iterations to get perfect. However, this paper will explore the common practices that create the foundation of a successful movement mechanic.

Another huge impact on player satisfaction whilst moving and interacting with a game is how the default controls are laid out. By looking at the trends in examples we can see the exact practices to avoid as well as the methods to employ when mapping your movement options to a controller. Where a control is mapped by default can completely change how people perceive the movement inside the game. One button out of place can cause an otherwise perfect system to feel clunky and unresponsive to the player.

2.   FIELD

This study will be exploring how games successfully create a complete movement system by analyzing both the controls and the actual mechanics inside the game.

2.1 Controls

This involves analysing how buttons are mapped to a specific controller to create the best user experience. Controls can also refer to how player motion affects the game. Different actions can be bound to the same button, when that button is pressed the system decides the output based on context (contextual buttons).

2.2 Movement

This relates to how the player walks, runs and jumps and how to create a fluid connection between player input and game response. The uses of physics also plays a large part in its movement system. Is momentum conserved? Does gravity affect the player? Is it based on real world interaction?

3.   KEYPLAYERS

The key players discussed in this paper cover a varied amount of control and movement systems. The key players show off movement and control systems developed for different play environments and show a wide range of options during play and how each is made fun.

3.1   Spider-Man (2018)

3.1.1 Controls

Spider-Man has controls for both on the ground fighting and web swinging. This means that it needs a control scheme that is compatible with both situations. It also means that to avoid breaking up the gameplay they use contextual controls in a lot of situations. An example of this is running and swinging being on the same button. By holding this button, all of the players movement is fluid, they player never have to change buttons when you hit the ground or a building in the middle of a swing. Another example of a contextual button in Spider-Man is with the jump and webzip button. This button is used as a jump when the player is standing on the ground but it performs different actions when the player is swinging around the city. When on a web the jump button instead flings the player off the web and if used correctly can boost the players momentum. If the player is in midair the jump button instead becomes a webzip action.
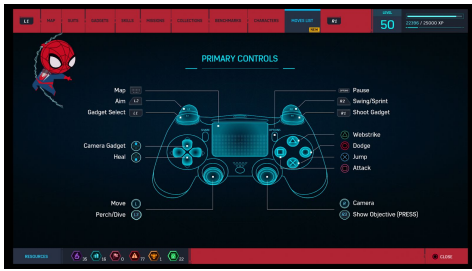
Figure 1: Spiderman control list ([7] Green 2019)

3.1.2 Movement

The main thing that makes the movement feel so satisfying in Spider-Man is its use of momentum.

"You really feel like Spider-Man is flying around as a weight at the end of a rope. And by chaining your swings correctly, you can build momentum and speed just like you'd expect in real life (if swinging around New York City were a possibility, that is)." ([6] Gartenberg 2018)

As Gartenberg states in this quote it feels realistic to build your momentum as you swing from building to building. This realism allows the player to more easily become immersed in play. The realism is also very important for the construction of a smooth learning curve for players, a realistic movement system allows players to apply their own experiences outside the game environment. In the context of Spider-Man an example may be swinging a pendulum and letting go at different points in its arc. The pendulum example applies to the movement in spider-man because it means that the player will instinctively know the optimal point at which to release Spider-Man from his swing for maximum increase in momentum.

Spider-Man also features a skill tree that expands on the already in depth mechanics.

Figure 2: Spider-Man skill tree ([1] Anon 2018)

The 'webslinger' skill tree in Spider-Man adds some really interesting options for the player during movement. The developers, Insomniac Games, managed to avoid the pitfall of

making the movement rely too heavily on the skills you can obtain. The skills in this tree allow for more fluid and interactive movement that just adds to the already fantastic system. These skills contain things like a super jump and second webzip. These extra movement options allow for more skillful players to perform extremely efficient maneuvers. Spider-Man really shows how a system that is easy to learn but hard to master coupled with intuitive controls and responses can make the player feel incredible when moving around as Spider-Man.

3.2 Sunset Overdrive

3.2.1 Controls

The two main mechanics of Sunset Overdrive are the shooting and the movement. Certain control placements show moves that should generally be used independently of each other, this is because average players like to hold a controller in a certain way as shown in [Figure 4]. In most circumstances, people like to use their index fingers to operate both the bumpers on the controller as well as the triggers as this is generally the players most dexterous fingers. This means players should not be required to press both the trigger and the bumper on one side at the same time as that would require them to use their middle finger for one of the actions.

"The middle finger is both less dexterous and also important for maintaining a firm grip (on a controller)" ([3] Croshaw 2019)

We can see this practice in the Sunset Overdrive controls [Figure 5] as when the player dashes it does not allow them to shoot at the same time. Another thing is that players will use their right thumb to operate the left analog stick as well as the face buttons. This means that tight and quick use of the right analog stick should not be required to perform the actions of the face buttons. This is why the shooting on the right trigger is independent of the aiming on the right analog stick. It is also why the actions on the face button do not require accurate camera placement. The only action that could require tight aiming and also a face button is the ability to melee. This is counteracted by giving the player a wide arcing attack as well as having it swing in the direction of the player model rather than the player camera (the left analog stick is used to aim rather than the right).

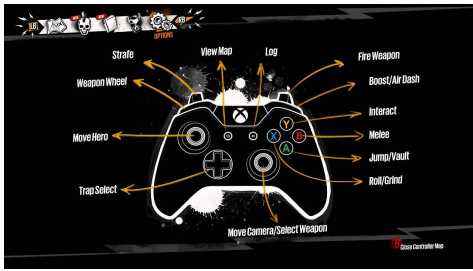**Figure 3: Holding a controller**([8] Porsche 2019)

Figure 4: Sunset Overdrive Controls([2] Anon 2014)

3.2.2 Movement

The various movement options that the player has to use allows them to never have to touch the ground. (A fun challenge that can added to the game if the player is so inclined). The huge amount of movement options and the smoothness that they mesh together makes the movement feel incredible. The player feels fully in control and it has various skill based options to increase your ability to move quickly.

Another part of the movement in Sunset Overdrive is that it needs to be balanced against the shooting aspect of the game. The way that the developer, Insomniac Games, handles this is by using an on rails type of system. When the player grinds on a rail or other grindable surface the movement is locked to the specific surface, meaning they can focus solely on the shooting as the movement is handled for them. The way that the player can move between rails and other grindable surfaces allows for the game to not feel lacking in movement options. If the player ever wants to move around to a better position the way they achieve this is by using the air dash, rails and other interactable sections of the terrain. This movement feels great due to the momentum you can gather as they move from the different environmental structures in tandem with the dash.
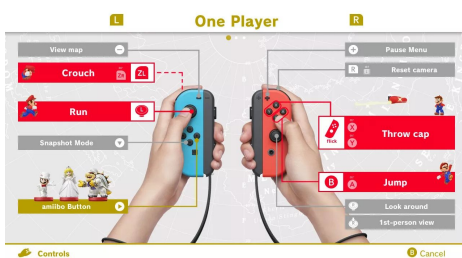
3.3   Super Mario Odyssey

3.3.1 Controls

Figure 5: Super Mario Odyssey control scheme(Frank 2017)

Super Mario Odyssey has a relatively simple control scheme, utilizing only four core buttons as well as the analog sticks. Mario also allows for players to use the built in motion controls to interact with Mario's hat, 'Cappy'. Whilst the amount of buttons that perform critical actions is low the amount of different things Mario can do in the game is large. The large list of moves that Mario can perform with so few buttons is due to the contextual controls as well as the interaction that Mario has with his hat Cappy. A few actions that the player can perform

aren't on specific button such as the dive action, which involves pushing up the left analog stick and pressing the jump button whilst Mario is in the air.

Figure 6: Mario doing a dive([9] Scullion 2017)

The amount a player can do with such a small list of controls using contextual moves and combinations allows for an incredibly smooth learning curve for new players.

"All of the best skills return from Super Mario 64 and the introduction of some brand new ones really rounds the whole moveset out." ([4] Foster 2018)

Super Mario Odyssey also plays on the fact that there have been numerous predecessors to it in a series of games. This allows for returning players to very quickly grasp the controls it may also be a reason for the grouping of different buttons to fit the original control scheme in earlier instalments.

3.3.2 Movement
Super Mario Odyssey uses both the contextual and motion controls to make the movement feel as intuitive as possible for the player. Motion controls may not be for everyone due to their lack of accuracy but it is great for people who don't play that many video games, as it is much easier to grasp controls that mirror actions that the player themselves are performing.

The movement in Mario feels great because of the way it initially looks simple but once the player becomes more experieneced they begin to realise how deceptively deep it is. The player may start by running and jumping but the player quickly discovers that by combining the hat throw ability with the midair dive they can gain another jump. They can then expand further than that by starting the combination off with a triple jump. This huge depth hidden under the surface of Super Mario Odyssey is what makes its movement so rewarding and fun for the player to interact with.

3.4   Summary
All of the key players that I have used as examples can be counted as a major success in both the controls and implementation of their movement system. However this does not mean that they don't come with their flaws.

Table 1: A breakdown of the key players pros and cons

Game	Advantages	Disadvantages
Spider-Man	- Conservation of momentum - Realistic swinging - Contextual movement allows for continuation of the players flow	- Because the emphasis is on big macro movement, moving small amounts to get to locations can be difficult and annoying - When in combat the web swinging feels cumbersome rather than fun
Sunset Overdrive	- Using shooting and movement in combination has a great feel - Combining movement and attack options feels fluid and fun	- Certain movement options being locked behind skills feels redactive rather than productive - The character begins to slow quickly as they grind, this can feel like a penalty for focusing on shooting
Super Mario Odyssey	- The use of Cappy during gameplay adds a huge amount of contextual depth to movement - The ability to combine different moves in a fluid and cohesive way makes Mario feel extremely responsive to player input	- Having motion controls can feel unresponsive and inaccurate to more skilled and precise players - Certain players can become confused by the numerous contextual movement options and when each apply.

3.5   USP

There were a few things that all of the key players had in common, these were the conservation of momentum and the fact they were easy to learn but had deeper options as the player improved. Two of the games also used contextual buttons in the controls to make the movement more intuitive and also make the most of the fewest possible buttons. Each game also leverages the fact that it has an interesting method of transportation that isn't just walking or running from point to point.

3.5.1 Spider-Man

Spider-Man has two main unique selling points. Firstly, Spider-Man is one of the only examples of a swinging mechanic that has been fully implemented and realised. The swinging feels realistic, as if the player is actually swinging through the air, and coupled with the great contextual control scheme it is very easy for a player to become immersed and enter a cognitive flow state ([10] Csikszentmihalyi 1992).

The easier it is for a player to maintain their momentum while moving the better the game feels to play. Breaking the players momentum puts the brakes on their progress and fun. The fact that Spider-Man avoids breaking the players immersion and conserving their momentum is also a key factor in the success of the movement.

3.5.2 Sunset Overdrive

A key focus of Sunset Overdrive was providing a slick combination of skateboard like mechanics in the grinding and tricks that you can do, with a well paced third person shooter. This combination of a third person shooter with interesting movement makes the game extremely unique and also fun to play. By using rails as predetermined routes, the player has a way to build up momentum and still having a solid platform to shoot off of. This brilliant combination of high octane movement as well as interesting interactions gives Sunset Overdrive an incredible hook to keep players interested in the core loop of gameplay.

Another key part of Sunset Overdrive's appeal is the ability to smoothly start moving again after a large bout of slower fighting. It means that players aren't forced to find a way back to the endless fun of grinding on roof tops. They can just use the numerous movement options straight from the ground and find their own way back.

3.5.3 Super Mario Odyssey

By having Cappy, Mario's hat 'sidekick', interact directly with how Mario moves around the world makes the entire system much more exciting and unique. By allowing the player to move freely around the world with no invisible walls, it creates unique experiences for players willing to push the movement system to the edge of its ability. This ability for the combination of freeform exploring coupled with tight controls and a deceptively deep movement system creates a fantastic experience for each player. Super Mario Odyssey provides a mechanic that no other game has leveraged quite as well and that is what lead to its major success as well as it being regarded as one of the best examples of movement in video games, as shown by the breakdown provided by Allegra Frank in this polygon article. ([5] Frank 2017)

Also the heavy use of contextual buttons help to make Mario easy to control, with so few things to remember the player can very quickly become adept at using the movement system. The learning curve allows for a low barrier for entry, especially when combined with another unique point of this game the motion controls, however this low barrier to entry does not stop more experienced and driven players from performing ridiculous feats of dexterity and skill (Not a small achievement in the slightest).

3.6   Technologies/Approach

3.6.1 Contextual Buttons

In these examples a clear way to use the controller and the way it is mapped to its fullest extent is by using contextual buttons. When used correctly, contextual buttons can increase the fluidity of the game as well as the ability for the player to enter cognitive flow. The way that Spider-Man uses its swing and run button is an example of when best to use contextual buttons. If a game has two actions that it should seamlessly transition between, a contextual button could be used to aid player immersion. By having similar actions mapped to the same button you can increase the effective amount of controls. An example of this is in Super Mario Odyssey, where they utilized only four core buttons to create a plethora of different interactions.

3.6.2 Physics in movement

By using realistic physics interactions within the movement system the game can use the player's personal experiences to create an intuitive play environment. If a game does not respond in a way that the player expects, it can cause a disruption in the immersion of the user. Effectively utilising in game rules and physics is key to creating a cohesive experience for the player.

3.6.3 Environments and movement

By creating the environments around the movement options rather than creating movement around the environment leads to more cohesive gameplay that feels better to the end user. All of the key players explored above are clear examples of that approach to movement and the environment that it is utilized in.

4. CONCLUSIONS

When considering movement systems in games the focus should always be on player immersion. The movement and control system should always be in aid of this overall goal. Giving players a focused but deep list of performable actions that are relevant to the context of the overall game is critical to its success.

Without good control mapping any movement system, no matter how well executed, is lost because the player will not become immersed. They will be trapped in a loop of trying to work out the controls. The same is also true for the inverse, without a well crafted movement mechanic the controls will feel inadequate as both systems relate so closely to one another.

For smaller development budgets creating a well tested movement system may be hard and take more resources than appears necessary originally. However, creating a bespoke movement system specifically for the context of the game is paramount to its success. If the studio can't afford many iterations on the same system because of budget issues this study shows that starting with the movement and testing little and often can allow for the game to feel more coherent in the end.

Further research could be done in this field by delving deeper into the psychology of cognitive flow and how a control scheme and movement system aid in true player immersion. A deeper study of cognitive flow is given in *Flow: The Psychology of Happiness*. ([10] Csikszentmihalyi, M. (1992)). By using cognitive flow, not only can you achieve an overall better system, but you can also improve the progression of your movement and when to introduce new movement options to the player.

Another branch of research that could be investigated further is the creation of accessible movement and control interactions for players of all levels of ability. Creating controls and movements that can be performed by players with a disability without sacrificing any of the complexity is an area of study that could provide far more content for a study similar to this. (Bierre 2015)

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