Video Games and HCI: A comprehensive evaluation of UI / UX design in video games

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INTRODUCTION

Video Games have been an important form of software for a very long time. The first video games were developed as early as the 1950s. Since then, video games have come a long way and have undergone various improvements, in their technology, graphics, and UI (User Interface) / UX (User Experience) design. Like all other aspects, Human Computer Interaction (HCI) in video games has evolved a lot over time. At the time of its release, Pong [16] was considered a revolutionary game, however, in today's date, there are many evident problems with its interface and the overall UX in general. Video games are very different from other forms of software and one must take care of many other aspects when designing for a game. Aspects like gameplay can be drastically affected from little changes in the user interface of a game. This paper is a comprehensive research paper on the most prominent papers discussing HCI in video games and summarizes the key takeaways and results. This paper focuses on UI and UX design in video games and guidelines that govern good design for the same.

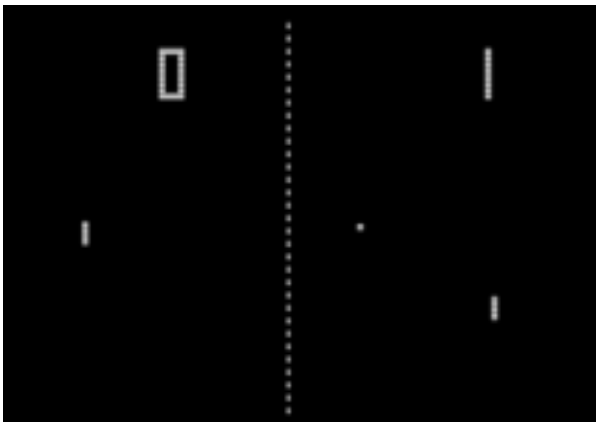

Image 1: A gameplay screenshot of Pong

Image 2: A screenshot of Injustice 2 for mobile

KEY RESEARCHERS

There have been many prominent researchers in the topic of the intersection of HCI and Video Games. Although not the most popular ones, but the most appropriate researchers that have published papers on this topic include researchers like Pippin Barr, an Assistant Professor in the Department of Design and Computation Arts at Concordia University in Montréal, Daniel Johnson, a researcher at the Queensland University of Technology, Jesper Juul, an Associate Professor at The Royal Danish Academy of Fine Arts - The School of Design among many others.

Most of the work by Pippin Barr includes research and publications on the relation between HCI and video games. Two of his papers have been used for my research, "Play as Human-Computer Interaction" [5], and "Human–computer interaction and games" [1]. Jesper Juul has done work focussing on the relation between gameplay and user interface. His paper used for my research is on "Easy to Use and Incredibly Difficult: On the Mythical Border between Interface and Gameplay"[3]. Daniel Johnson's paper on "Effective affective user interface design in games" [2] is also referenced in my paper, which discusses user interface design in various types of games.

There is one other paper that is discussed in my research. "Heuristic Evaluation for Games: Usability Principles for Video Game Design" [4] by David Pinelle, Nelson Wong and Tadeusz Stach is a set of

heuristic guidelines for designing video game UI's, similar to Nielsen's heuristics.

These papers are carefully chosen as they cover a wide variety of problems concerning HCI and video games, ranging from the need for good UX to a formal description of how to design a user interface for a video game. Collectively, these papers provide key insights on solutions to these above-mentioned problems and issue guidelines for implementing a good UX for video games.

KEY RESEARCH RESULTS

When you look about generic UI / UX guidelines, it is ideal for the same to be as simple as possible. This cannot be done for a video game as a minimal UI will render the game unplayable. Simple elements like documentation can change the way a game is played by a user. Aspects like gameplay and user experience go hand-in-hand and changing one affects the other. That is why there needs to be additional guidelines for designing user interfaces and experiences in video games. The papers discussed above summarize key results about how we can comparably perceive video games as any other form of software and how we can design good user experiences for games.

HCI and Value Theory

Pippin Barr proposes an important concept of quantifying actions done by users in video games, called value theory. Since decision making is an important part of HCI in general, this theory helps evaluate how certain UI elements affect the perception of gameplay actions in games. He uses the definition of a value by Milton Rokeach [11], which states "a value is an enduring belief that a specific mode of conduct or end-state of existence is personally or socially preferable to an opposite or converse mode of conduct or end-state of existence." He then discusses about values in the game Tetris, where 'maximizing points' is considered a key value of the game. Players would then perceive that value differently and then perform some respective actions in the game, e.g. someone may prioritize clearing multiple rows of blocks rather than a single row with one block in order to maximize points gained by placing that block. These values also differ by genre, since in a game like Counter Strike: Global Offensive, an action like Play would incur actions like walking on a map and looking for opponents to kill. This shows that a value can also trigger multiple actions.

Some values are also more important than others in different games. As discussed by Barr, role-playing games prioritize values of Play, Progress, and Well-being of the character as essential values to shaping gameplay and affecting user decisions.

Sometimes, certain values get undermined by the genre itself and it becomes hard to evaluate how value theory could be applied to those games in order to research about HCI. Many open world games, like Grand Theft Auto V, give the user complete control and freedom over how to play the game. Although there is a story progression in those games through missions, users may choose to not do those in succession, or not do them at all and enjoy the open world. Many users are proven to just enjoy exploring the map in an airplane or other modes or air transportation. This amount of freedom also allows users to do other actions, like randomly shooting civilians and chasing the police, which also calls into question the mental impact of these games. Therefore, in these games, values like Play and Progress, which are considered fundamental values, are blurred in their definition.

Values may not be entirely independent of each other in games as well. In games like League of Legends, values like Play may include moving the character across the map, however, the Progress value may guide those movements along the map, for example, in order to break turrets, kill objectives etc. In games like these, skill also becomes an important factor that guides gameplay, as a new player of the game may not do objectives like kill the 'Baron Nashor', which is considered essential by highly skilled players.

Barr also discusses how activity theory is applied to conduct research on how certain values can be modeled and applied to HCI and UX research in video games. The example given was of a "terrorist elimination" activity in the game Counter Strike, which included a motive, a goal or outcome and subject which could interact with tools to achieve this goal.

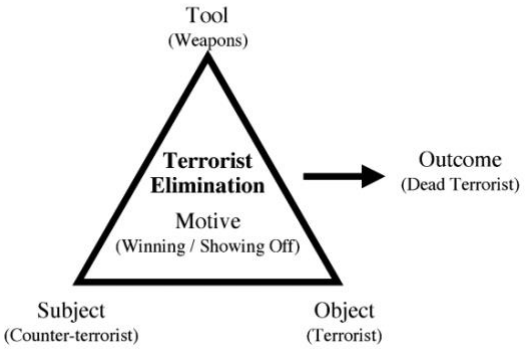

Image 3: An activity model for the "terrorist elimination" activity in Counter Strike [1].

The results of these papers by Pippin Barr provide key insights on how to study games from an HCI perspective. His proposition of video game values and value theory for video games helps look at games as not

only media but also software. His paper also focuses on the fact that games are different from other forms of software and while he "acknowledges that this is by no means the entirety of the distinctions or similarities between the two… It is only by developing [theories like value theory] that we will begin to understand the interfaces and the interactions that take place in video games." [1]

Gameplay vs. User Interface

"Video games are easy, and video games are difficult. Video games can be notoriously challenging, but even challenging games often have easy-to-use interfaces. Now, what is the difference between ease of use and challenge? Where does the easy interface end, and where does the difficult gameplay begin?" [3]. Jesper Juul outlines the key differences between gameplay and interface in his paper and shows how the two are related to each other and how changing the interface can affect gameplay and vice-versa. These subtle differences in interfaces prove to be crucial in defining gameplay across a wide variety of genres. It is also important that he discusses interface as both the hardware and software components of a game.

He then discusses about the Street Fighter game, where controlling the character is easy, but controlling him right is the difficult part. In this case, the interface is easy to use but the gameplay is difficult. This also calls into question the aspect of skill. While controlling the character right may be an important part to win against a skilled opponent, you might be able to get away with just spam-clicking the 'punch' button or repeatedly executing one combo and win against a new player of the game.

Image 4: Street fighter II.

This concept of controlling a character right using easy interface is even more pronounced in the game League of Legends, mentioned before, since there are many aspects to the game that more skilled players are able to do relatively easily as compared to beginners, especially since most of the advanced controls and gameplay techniques are not straightforward.

Image 5: League of Legends - Player moving when the move command (Right-click) is called.

Some aspects of a game's UI also affect how a game is supposed to be played or how it ends up being played. E.g. The game Angry Birds 2 has an indicator depicting what path the bird would take. This path helps users accurately position the bird to maximize points and achieve goals like completing the level with one bird. This is directly related to value theory and how its perception changes with different gameplay elements. In this specific case, removing the indicator would not make the game unplayable, but it would certainly make it harder to score. Again, with more skill, there will be higher chances of scoring better and faster.

Image 6: Angry Birds 2 indicator.

There are some games, as discussed by Juul, in which there are aspects of the game which neither fall into gameplay nor interface. The example given by him was of Chess in which, although there is easy interface and relatively easy gameplay, the user is required to know a lot of rules about how the pieces are supposed to move in order to good play decisions. It is hard to distinguish if this memorization of rules in a game is a part of gameplay or not. [3]

Game designers also have the liberty to choose what counts as UI and what could be considered a gameplay feature. For example, in the game Grand Theft Auto III required users to navigate around town to find their way, whereas in the next installment of the game, GTA IV, there was a map introduced, which changed how the game was played. In these cases, it is also difficult what

could count as an inefficient interface and what is simply gameplay. This paper by Jesper Juul therefore summarizes the key differences between gameplay and interface. While there are some games like Chess in which additional rules to the game affect how the game is played, there is a clear definition of what counts as a good user interface for video games and how we can cleverly use some aspects of the interface to create enriching gameplays.

How to design good UX

"One of the main goals in video game design is to entertain and engage the user. This can involve several aspects of design, including game story, pacing, challenge level, and game mechanics." [2] Video games are therefore, different from the average desktop application in the various aspects mentioned above. The papers by David Pinelle et al, and Daniel Johnson et al dictate some important user interface design principles specific to video games and formalize these design principles into heuristics.

An important concept, as discussed by Daniel Johnson, is flow. "Flow is a state in which one is happy, motivated and cognitively efficient." [2] There are several elements that dictate proper flow in a video game. Interestingly, this is one of the aspects of game UI design which can apply to most genres of games with minimal changes. Components as trivial as the ability to complete a task and the directions given to complete said task, all govern the flow of the game. A good flow includes one where all these components are clearly and efficiently detailed.

An interesting analysis of inconsistency was done by Johnson, in which he argued that there are limitations to the number and type of input available to perform actions in a game. E.g. in the game of Fortnite, the button to shoot a gun on the PC (Left-Click mouse) is the same as the button to honk when you are riding a quad-bike (called the Quadcrasher in game). It is obvious why this level of inconsistency may be prevalent in consoles, where the number of buttons available for input are limited, but this is also present in PC games as shown above, where there is an abundance of buttons available for use and you can also add more buttons by using different hardware peripherals. Having said this, this also helps develop a certain level of muscle memory across all types of games. For example, it is 'common' knowledge that across all shooting games, the left-click mouse button is supposed to be the button you press to shoot (at least in the default scenario). This paper by Daniel Johnson has similar points of research to the paper by David Pinelle, which formalizes some heuristics for designing UI / UX in games.

The paper by David Pinelle looked at reviews from GameSpot to find common problems in user interface design in games and then conducted research to arrive at a set of heuristics for making a game UI. [4].

1. Provide consistent responses to the user's actions.
2. Allow users to customize video and audio settings, difficulty and game speed.
3. Provide predictable and reasonable behavior for computer controlled units.
4. Provide unobstructed views that are appropriate for the user's current actions
5. Allow users to skip non-playable and frequently repeated content.
6. Provide intuitive and customizable input mappings.
7. Provide controls that are easy to manage, and that have an appropriate level of sensitivity and responsiveness.
8. Provide users with information on game status.
9. Provide instructions, training, and help.
10. Provide visual representations that are easy to interpret and that minimize the need for micromanagement.

Note that some of these heuristics are similar to Nielsen's heuristics [20], like "Provide consistent responses to user's actions" or "Provide instructions, training and help". There are also some heuristics that are specific to video games like "Provide unobstructed views that are appropriate for the user's current actions", while there are some heuristics that can be applied some other software as well, like "Provide intuitive and customizable input mappings". All together, these heuristics provide crucial information to keep in mind when designing UI's for video games.

"Games often provide minimal information to the user, they employ context dependent commands, and they allow the user to make a variety of errors. Knowledge of the contraventions of usability guidelines which effect flow in games can be used to inform the design of non-leisure software applications." [2]. These papers do a good job of providing a set of guidelines to design effective and clear user interfaces for video games.

DISCUSSION

All the papers mentioned above collectively answer many important questions about video games and how to design good user experiences for them. Video Games are very different from other software because not only are they 'used', they are also played; the designers must keep that in mind in order to provide a good user experience to players. All papers cover many areas of game UI design and cover many aspects to what makes

a game usable and / or playable. One paper looks at the limitations to user interface design, another one looks at how game-play is shaped by user interface elements, another one discusses design methodology for video games and another one formally recognizes heuristics for video game UX design. We looked at the key results from each of these papers mentioned. We also used examples of games from outside these papers (like League of Legends and Fortnite) to show how these concepts tie in to games prevalent today, if these problems still exist and ways to design good UI / UX around these problems.

OPEN AREAS OF RESEARCH

One interesting area of research on HCI and video games could include how different games map to different platforms and different types of hardware. As of today, there is a huge variety of platforms where we can play video games, ranging from the PlayStation 4 (PS4) to the Nintendo Switch to even mobiles. In order to bridge the gap between different consoles and create a larger player base, several companies are now creating games that are not just available on all major consoles, but are also playable on mobile. A perfect example of this is the game Fortnite, which is available on every gaming platform that exists today. It will be interesting to research on the relation between different types of controllers and how different platforms affect the playability of a game.

Image 7: Input mapping for a PS4 controller in Fortnite.

It will also be an interesting area of comparison when comparing different controllers to each other. For example, an Xbox One controller and a PS4 controller are exactly the same in their button mapping and placement, however, their buttons are named differently (the A on an Xbox One controller is exactly the same in function as the X on the PS4 controller). This calls into question the aspect of muscle memory while playing games and it would become difficult to switch from one console to another for a user. Therefore, it will be interesting to see research on different types of controllers and how they would tie in to the research discussed above. There would certainly be some areas of research discussed above which may need to be modified to account for multi-platform video games, especially when comparing touch and non-touch input devices.

Another area of research that could be done based on the research discussed above is the user interface design of video games in VR and AR platforms. A Virtual Reality (VR) platform allows for 360 degree viewing angles and since there is a lot of gesture support in games in those platforms, it could be fascinating to see how certain UI elements affect VR gameplay.

Image 8: Beat Saber Gameplay for PlayStation VR

When evaluating user experiences for VR video games, it is important to consider if the entire virtual space could be used for displaying UI or a 2D space could be mapped to the VR platform. Some obvious problems that could occur with using the entire space could be that the process could become cumbersome while there could be an issue that the UI is rendered in a space 'behind' the person and the user may need to take time to find the UI. Research on these issues of VR and AR platformers could provide key insights on how the guidelines for designing good user experiences for video games could come into play.

CONCLUSION

After looking at all papers, we are given a good overview of how HCI in video games has evolved over the years and the common HCI principles that govern it. There needs to be a balance between standard UI design principles like visual feedback etc. and game design elements like mismatch between camera view and user actions, AI issues, bad input mappings etc. Since UX research and HCI is a vast topic, there is not one 'correct' method to design good user experiences for games. These papers provide strong guidelines based on years of research by distinguished researchers which, when applied along with personal creativity, helps create unique and revolutionary designs. With the introduction of new technology like Augmented Reality, it is inevitable that there are more usability issues that will come up in these new technologies, some of which have not even been discussed yet. Nonetheless, HCI in video games in a huge and

booming area of research in HCI and will continue to evolve over the years.

REFERENCES

1. Pippin Barr, James Noble, and Robert Biddle. 2007. *Video game values: Human–computer interaction and games*. Interacting with Computers 19, 2: 180–195. http://doi.org/10.1016/j.intcom.2006.08.008

2. Daniel Johnson and Janet Wiles. 2003. *Effective affective user interface design in games*. Ergonomics 46, 13-14: 1332–1345. http://doi.org/10.1080/0014013031000161086 5

3. Jesper Juul and Marleigh Norton. 2009. *Easy to use and incredibly difficult.* Proceedings of the 4th International Conference on Foundations of Digital Games - FDG 09. http://doi.org/10.1145/1536513.1536539

4. David Pinelle and Nelson Wong. 2008. *Heuristic evaluation for games*. Proceeding of the twenty-sixth annual CHI conference on Human factors in computing systems - CHI 08. http://doi.org/10.1145/1357054.1357282

5. Pippin Barr. 2007. *Video game values: Play as Human-Computer Interaction*. Ph.D. thesis. http://www.pippinbarr.com/videogamevalues/files/Pippin_Barr_PhD_Thesis.pdf

6. Capcom. Street Fighter II. Capcom (Arcade). 1991.

7. Rockstar Games. 2004, October. Grand Theft Auto: San Andreas. Developed for PlayStation 2.

8. Rockstar Games. 2001, October. Grand Theft Auto III. Developed for PlayStation.

9. Rockstar Games. 2013, October. Grand Theft Auto V. Developed for console.

10. Rockstar Games. 2008, October. Grand Theft Auto IV. Developed for console.

11. Rokeach, M., 1973. The Nature of Human Values. The Free Press.

12. Riot Games. 2009. League of Legends. Developed for PC.

13. Epic Games. 2017. Fortnite. Developed for PC, PlayStation 4, Xbox One, Nintendo Switch, iOS and Android.

14. Rovio Entertainment. 2015. Angry Birds 2. Developed for Android and iOS.

15. NetherRealm Studios. 2017. Injustice 2. Developed for Console and Mobile.

16. Atari Inc. 1972. Pong (Arcade).

17. Beat Games. 2018. Beat Saber. Developed for PlayStation VR.

18. Valve Corporation. 2012. Counter Strike: Global Offensive. Developed for PC.

19. Valve Corporation. 2000. Counter-Strike. Developed for PC.

20. Nielsen, J. *Severity Ratings for Usability Problems*. http://www.useit.com/papers/heuristic/severityrating.html, 2007.