Exploring Human-Centered Design Through Video Games

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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

What is Gaming Like for Non-Gamers?

After the thousandth try and death at a single level of Cuphead "Player 1" began to wonder why it was so addicting to simply press "retry?" They had spent hours on a game that did not have a reward at the end other than the sense of satisfaction of having beat it. Although they had years of prior experience playing other titles, everything from Halo to Super Mario, this experience did not seem to give much of an advantage when it came to this particular game. It was frustrating, yet intriguing which got Player 1 to thinking what this game would be like for non-gamers. After doing some research they found a video on Youtube that might give some answers (Razbuten, 2019). This video inspired them to think on the matter more and finally came up with this question. How do users learn in a virtual space? Human-centered design is often put in the backburner when we consider the entire production process of a product or piece of software. The aim of this paper is to prove that human-centered design is a crucial piece of product development and should be placed at the forefront of innovation. This concept is analyzed by putting a particular focus on how game developers design games with a set of wildly different users in mind and how those users interact with games using a mental map of their own that typically varies by level of experience. Co-production as well as Actor Network Theory is useful in this case because user-centered design can be analyzed in terms of its evolution over time and how society has fluidly changed its epistemological understanding of its own mental map.

Base Level Technological Understanding and Beyond

The overarching question is, in essence, how people of different backgrounds learn how to use new technologies, whether that be mechanics or general understanding, in a virtual

environment. This paper is able to answer this question by exploring the influence of prior experience, gamification non-game interfaces, and the learning curve associated with putting forth non-standard interfaces. By taking a dive into these concepts one is able to support the notion that human-centered design is one of the most effective ways to innovate and ultimately retain users. To answer the initial questions posed, mainly observation was utilized through an experiment and subsequent surveys. The experiment conducted allowed for observation of subjects with varying gaming experience levels in order to assess their approach to problem solving in s video game the subject has never played before. In this experiment, ten university students were approached and asked to play a game they had never played before for 20 minutes without any assistance from the conductor of the experiment. A few things were taken note of such as, how far they got in the level, how many times they died in the game, and how they rationalized their decisions in certain areas of the game. Each participant was asked to complete a short survey following the session to give an indication of their level of experience and difficulty with the game as well as some demographic information.

What is User Experience and Why Should We Care About It

There are several points to unpack in this section to fully understand the problem at hand. Topics such as, what user experience (UX) is and why it is important, how video games utilize these UX ideas, what types of games and gamers there are out there, and how previous experience and mental maps play a role in influencing design.

Fundamentally, user experience design is the idea that, instead of creating a product that has emerged directly from the brain of an engineer, we can include the actual user of the

prospective product as a guide for feature implementation and basic structure. After all, if the user cannot figure out how to use the product then there is no point in making it. By implementing UX ideals such as prototyping, user testing, and heuristic evaluations, we can make a product better before spending an immense amount of money just to have it potentially flop on the market. UX designers have a few principles they follow to make sure these failures do not happen as often. Most of these principles boil down to giving the user control, maintaining consistency, keeping an information hierarchy, allowing for accessibility, and providing information to the user (Grass, 2019).

"Human-centered Design (HCD) is a philosophy that focuses on the people affected by a problem and includes their perspectives when designing solutions." (Argyle, 2019) Human centered design is an important part of development of technologies; however, it is not always regarded as such. The benefits of putting effort into understanding the user before implementation is proven to be advantageous, yet most companies still skip the crucial step of user testing. "When done well, a human-centered approach fuels the creation of products that resonate more deeply with an audience — ultimately driving engagement and growth" (Media, 2013). (*Gamasutra—Intuition, Expectations and Culture: Learning from Psychology to Build Better Game Interfaces*, n.d.) As evidenced through general analysis of the relationship between technologies and our society, empathy and relatability go a long way in driving customer engagement and increasing positive brand experience.

Video games can be a great example of good versus bad human-centered design. Nintendo is a prominent company in the game development business and are known for games that are friendly to users of all levels of experience. This is not to say that other companies such as 2K or EA do not make games that appeal to wide audiences, just that their core group of users

tend to be more on the experienced side of the spectrum purely because of the game style they typically choose to create. There are many different types of games out there, but we will focus only on first person shooters (FPS), role play games (RPG), and platformers (both 2D and 3D). FPS games are those which have the user play from the viewpoint of the character armed with some sort of weapon that is then used to avoid or eliminate enemies; some examples of these include Halo and Call of Duty. RPG are very similar to FPS in the sense that there can still be that element of having a weapon and eliminating enemies, but they do not necessarily need to be played in the first person; some games like this are Pokémon and Animal Crossing. Platformers are exactly what one might expect them to be, games that are structured with platforms in which the character jumps on them to complete certain tasks and moves forward toward a goal, this is also considered a subset of RPG and often but not always make the player move to the right as the story progresses; Super Mario is a great example of this mechanic because its storyline is built to progress exclusively by overcoming obstacles that arise by moving to the right. These types are the games most widely cover those that are popular right now, in the experiment conducted in this paper analysis was done on only one platformer game that exemplifies many of the traits discussed above.

Co-production and the Development of Mental Maps

The framework discussed in this paper is of co-production. This STS framework is important when discussing the topic of human centered design with a lens on how game design utilizes those principles and takes advantage of already established mental maps of the average person in our society. According to Sheila Jasanoff, co-production is “not only about how people

organize or express themselves, but also about what they value and how they assume responsibility for their inventions." (Jasanoff, 19). Our society simultaneously molds what technologies look like and takes inspiration from already existing technology to further shape development of new technology. As Jasanoff stated, it is important to be responsible for what we put out there and one way to do that is through human centered design. Don Norman, an expert on the subject of user experience, would probably agree with the idea of co-production.

Don Norman in "The Design of Everyday Things" explained these topics in a relatable context through talking about the design of doors. He gives an anecdote about one particular door he saw once walking into an office building that was aesthetically beautiful because it was all glass but had absolutely no indicators of where you should push it, where the hinges were, or how it worked at all. He goes on to say that this happens all the time in everyday life, some product designs are simply not user friendly. He defines indicators as visual features of a product that allow the user to infer what they should do. This concept is particularly important in the context of video game design because often experienced players are able to guess any games mechanics based on what they can see on the screen. For example, if platforms are viewable, it is apparent that there must be a jumping mechanism. Norman goes further to explain something he calls affordances as a predefined idea of a thing, "...the term affordance refers to the perceived and actual properties of the thing, primarily those fundamental properties that determine just how the thing could possibly be used." (Norman, 1990).

Many game developers take advantage of this thing Norman called "affordances" to create successful games that would meet the expectations of both people who already play games and less successfully those who do not. Shirinian refers to this concept as "cognitive baggage" (Shirinian, 2020). This is done through natural mappings of controls and ideas matching the pre-

existing mental maps of the player. If someone has played games for a while, it is usually safe to say that they know what is possible in a game; things like running, jumping, attacking, the idea of a health and stamina bar, and forward direction of the story. Some of these things still translate to those who do not play as often, but generally manifest in their mental maps in a less concrete way. Someone who is inexperienced might correctly interpret hearts on the screen as health, or know to jump because they can see something they want to retrieve is out of reach. These are just a few of the ways that video games use indicators to educate a player on how to play.

Using the Experience of Users to Make Learning Technology More Enjoyable

It seems that, in general, many different types of people learn through trial and error. The method of trial and error seems to work for everyone because this is, to some extent, how most skills are learned. Although this approach seems to work for most people, the efficiency of trial and error may be questioned. It may be true that anything can be learned by attempting it repeatedly but there are often cases where there is a faster way to achieve the same level of understanding. In conducting research on learning efficiency, it became apparent that some friendly instruction is not only a good way, but an efficient way, to introduce people to new pieces of technology. In the case of video games, it makes sense that learning from someone else is an effective approach because games, after all, are meant to be shared. But in the case of other products and interfaces, the feasibility of having a physical instructor is significantly lower. Often, this issue is combated by providing virtual tutorials or tool tips of the interface which act as the instructor.

Some of these previously mentioned elements designed to aid the user, frequently appear in video games. When observing ten undergraduate students of different experience levels play 20 minutes of a game called Hollow Knight, it was concluded that the controls were mostly not too difficult to learn within the time frame but the storyline and purpose of the game was not immediately apparent. Hollow Knight utilizes the same basic game mechanics as most platformers: moving left and right with the joystick, jumping using 'a', and attacking using 'x'. This is an example of cognitive baggage, "…baggage accumulates over time, after seeing many different examples with the same standard features." (*Intuition, Expectations and Culture*, n.d.). In the first few minutes of the game, these controls are displayed through text on the screen but only if the user does not figure them out first. Basically, some of the subjects immediately tried all the buttons to get a layout of what they were and were not able to do within the space of the game, and some did not try them at all until instructed to do so. This spoke to the level of prior game experience and was later confirmed once the subjects completed the survey when asked "what is your current level of familiarity in regards to playing video games?" About half of the subjects self-reported lower levels of expertise, which coincides with notes taken during the observation. By having the option to display helpful information about the mechanics of the game, the creators of Hollow Knight are able to appease both beginners and more experienced players by not including a mandatory tutorial but still having the opportunity to learn the controls if they were not already familiar. This speaks to similar tools of understanding used in the interfaces of other complex pieces of software such as, any Adobe program (Photoshop, Illustrator, After Effects) and most Integrated Development Environment's (IDE) (Pycharm, Eclipse, Spyder).

Something interesting and unique to the Hollow Knight experiment that came about during observations is the fact that it contains a non-linear storyline, unlike most platformers. This became most apparent when the participant was faced with the decision of continuing right or left. Both options seemed viable, considering both pathways were clear. The idea that both paths are completely valid options may not always be apparent to first time players, the idea of exploration develops over time with more game specific experience. This skill of spatial exploration is more often learned than innate. “Spatial exploration is a core component of play in a rich and diverse range of modern video games.” (Si et al., 2017).

By spending more time on the game, it can be said with certainty that the player must explore both directions eventually due to the non-linear nature of the game. Even though there was no indication that either left or right was the ‘correct’ way to go, most people continued to the right without much hesitation. Why is this? It seems at first arbitrary to pick right instead of left, or up instead of down. In reality this has to do with not only in-game experience, but life experience. A majority of the US population is right-handed (Scharoun & Bryden, 2014), cars are driven on the right side of the road, a working clock turns to the right (clockwise). All these things contribute to the way people of different backgrounds, but similar life experiences, subconsciously make predictable decisions. The choice to make a right instead of a left is so seemingly unimportant that when asked, most participants weren’t sure why they chose that direction, they said that, “It just felt like the right way.” However, about a quarter of the participants either, seriously considered or chose, to continue to the left side of the map. The most popular reasoning for this was that they had previously played games that were similar to Hollow Knight and having the option to go left meant that they should explore this portion, which should in theory be a shorter path than the right, before continuing through the story line.

This was in the hopes of being rewarded by some sort of bonus content (easter-egg) left by the developers, which is not uncommon for games like Hollow Knight. The point being made here is that people are heavily influenced by specific experience, in this case that of playing similar types of games, and subconsciously influenced by life experience, such as that of being right-handed. The term "tacit knowledge" is useful here as it pertains to, "…that which one has known for so long/learned through such repetition that no recognizable mental effort is required to recall and apply the knowledge." (Alexander, 2017). This precisely what was observed of some of the more experienced participants of the Hollow Knight experiment, the controls were familiar from years of previous game-play and therefore seemed to be second nature to some of the players. Thus, it seems likely this sentiment should be extended and engineers of all types should be able to use the influential nature of prior experience in the planning and implementation of their products to create a more fluid and natural experience for new users. The idea of co-production comes into play here in terms of the influence that exterior experience (and therefore technologies) have on the way people think about technology and approach learning the features of a brand-new interface. Simultaneously, the users have direct influence on the interface in terms of whether a certain feature, or amalgamation of features, are intuitive and makes sense for the purpose they were set out to fulfill. A term coined "Gameflow" is the idea that, "..a game needs to support player concentration, provide a challenge that matches player skills level, support the development of player skills and mastery, allow the player a sense of control, provide clear goals, provide appropriate feedback, and support the experience of immersion" (Iacovides et al., 2015). This coincides with the concept defined earlier in the paper known as human-centered design and applies to other sorts of interfaces as well as games. All good interfaces

provide the following: feedback to the user, clear goals, a sense of control, and a general understanding of what tools are available.

Prior experience seems to be most advantageous when it comes to game mechanics. People who play games more often are more likely to be able to learn how to play new game faster since they have the foundation of what typically can and cannot be done within the virtual space of a game. Once that initial barrier of learning the controls is broken, only then can the actual approach to problem solving be assessed. The jumping mechanic in Hollow Knight is one that stumped a lot of people, since in this game the player is able to use long and short jumps by holding or tapping the 'a' button. This is not necessarily intuitive, even for the participants who were a bit more experienced. Learning how to jump accurately proved to be a challenge for every single player. This essentially took away time they could have used to explore the game within the 20 minutes they were allotted. Although, it could be argued that learning how to use the controls of a game is also tied to learning the objective of the game. But when the learning curve for just the mechanics is too steep, people start to lose interest.

There is a sort of threshold for the amount of information that should be given to the user when they are learning how to use a new piece of technology. In the case of video games there are certain elements that are expected. Those such as: the character being controlled, a health bar, and some sort of indication of objective. One may be able to throw in additional elements to differentiate the game from others but there is a fine line between ingenuity and information overload. In the Hollow Knight experiment, there was some confusion about the health bar that more or less got cleared up over spending more time playing the game. Hollow Knight uses a traditional life system that utilizes icons to indicate how many times the player can receive damage before having to start over at a specified checkpoint. Although this system is standard

for most titles, there is an extra mechanism that is not as common that basically allows the player to re-heal by charging up a bar triggered by defeating enemies. This sounds confusing but really does make sense in context of the game. The initial introduction to this re-healing system was a typical one, text indicating the action you could take and a visual demonstration of that action. Most of the participants showed initial understanding but then forgot to utilize it to their advantage. In other words, they learned they were able to re-heal but only remembered to actually take that action once they were close to failure. It might be effective to implement reminders of the actions the player can take. But again, adding too much visual stimuli may be overwhelming to the user in any scenario, especially one that already demands a high visual to motor reflex response which is typical in video games.

The previous observations are all indications that games may be a good way to introduce people to new technologies because they provide a motivation for learning, efficient means of understanding mechanics and how they tie into the underlying purpose of the technology, and clearly defined goals set for the user. One way that these ideas can be implemented in non-game interfaces is through gamification, "Games transform tedious and repetitive activities into oriented and designed paths through the introduction of challenges and a progression system." (Idone Cassone, 2017). Using mechanics such as those of a reward system or goal implementation feature can go a long way in making something tedious more interesting. This concept can be explained in *Reality is Broken,* "…in clearly defined, demanding activities that allow us to see the direct impact of our efforts." (McGonigal, 2011.)

It is, however, important to note that "...when a concept becomes ubiquitous, it falls into danger of being used with little historical reflection and concomitant foresight." (Johnson, 2010) So as to say that the term "human-centered design" has as of late become loosely defined to fit

any model, when in actuality one must carefully consider the implications of its use for it to be a successful tool in the implementation of new technologies. This is why the idea of co-production becomes so important, because the way society interacts with and acknowledges technologies and technological terms is crucial to the impact it makes on those making advancements in those particular areas and using those principals. In the case of human centered design, this concept has morphed so much over time simply through the changing of strategies used in user experience research. The innately iterative nature of interface design is one that works well in conjunction with co-production.

Limitations

There were a few things the contents of this paper were limited by. Considering the timeline of instantiating the idea and then actually writing the paper was relatively short, the sample size for the video game experiment simply was not met. This normally can cause a lot of statistical problems when assessing results. The sample was also not as diverse as it should have been since the majority of the participants were undergraduate engineering students, one could imagine how thought processes between major types could be interesting to analyze. However, since the experiment was purely observational, parts of the results were still able to be extracted for discussion. Due to the constricted timeline, a few parts of the experiment had to be cut out. The intention was to have the participants play three different styles of games and compare the ways each game was approached and challenges faced within each. But availability of participants and the conductor of the experiment did not match up in time. This could have been a valuable piece of the analysis since uniqueness is found in every interface, and showing how people respond to different forms of stimuli in games could be helpful in building a case for best practices. Seeing

as learning the controls on an Xbox controller seemed to be a challenge to most, assessing adeptness at keyboard-based games may have been interesting in terms of observing differences in the learning curve.

Impact of Human-Centered Design

Ultimately it can be concluded that people learn most reliably through trial and error. Through this research, one can conclude that although the statement above is true, there are ways to make the process of learning new technologies more efficient and enjoyable. When direct instruction is not available, the developer of whatever the technology may be (software, game, product) may decide to implement tool tips or tutorials when introducing the user to a new feature. In these instances, the developer must keep the threshold of information amounts and its variation between interfaces. Information overload can be checked through user testing in all circumstances. Developers of all types of technologies must find ways to flatten out the learning curve of their products, otherwise users start to lose interest and the product will become obsolete. If the user is too frustrated by the product they may not continue to use it, which is why human-centered design should be put in the forefront of the innovation process.

Appendix

Survey Questions-

Major?

Level of gaming experience?

Difficulty with Hollow Knight

What did you find difficult about it, if anything?

Amount of time spent playing games in the past 6 months?

Do you feel like you had sufficient time to learn the objective of the game?

What types of games have you played before

How enjoyable did you find Hollow Knight?

How easy did you find learning the controls?

In your opinion was there enough in game instruction?

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