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By

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EXECUTIVE SUMMARY: A SOCIOTECHNICAL SYNTHESIS

Video games are becoming a larger part of everyday society, and their greater impact requires studing the medium much more closely. Games can no longer get by with advancing purely in graphical clarity, but instead need to examine the human element in games. The technical portion of this thesis puts forth a new model of AI behavior to create more human-like AI in games, allowing for greater impacts of in-game actions. The STS potion examines their social impacts and player dynamics of Massively Multiplayer Online games to gain insight into some of the greater social considerations of game design. Both of these topics work together to add a layer of sophistication to game design by examining the often ignored human element of gaming and games design.

The technical thesis explored a new AI design paradigm to create more realistic game agents by using a psychological model as a design base, Maslow's Hierarchy. Game agents acting more closely to actual humans not only increases the immersion of the gaming experience, but more human-like AI can expand the design territory of gaming to cover realistic consequences of game actions. Maslow's Hierarchy makes an excellent test of the theory due to its widespread acceptance in psychology, simplicity of design, and being easy to adapt to a variety of game genres. A Maslow based AI system is implemented and examined in the context of an XNA game created for this project. The analysis considered the the believability of the AI within the system and the ease of implementing the Maslow Hierarchy within the game logic.

The examination of the AI resulted in some mixed conclusions. Implementing the actual AI proved more difficult than originally planned, which forced the removal of planned features for the game due to time constraints on the project. While the model

itself is easy to adapt to an AI, accommodating all possible needs listed in the Hierarchy required programming many additional game mechanics, turning the relatively simple game into a much more complex product. The Maslow agents did not produce significantly more organic or interesting behavior compared to scripted AI, with the exception of conflict resolution. While there is potential for improved behavior using Maslow's Hierarchy, the benefits of psychology-based AI systems for games are still unclear.

The STS thesis report looked at the social factors of games through intense analysis of player relationships and design decisions within Massively Multiplayer Online games, or MMOs. MMOs involve thousands of players competing and cooperating within a virtual space, making the genre one of the most socially oriented all all gaming. With greater emphasis on personal relationships in games, game designers are faced with the task of being social architects of their game worlds. The importance of designers and their new responsibilities is supported through a combination of psychological and sociological factors behind why people play MMOs and an analysis of several revealing incidents in recent gaming history.

One of the prime concerns of MMO design is “Avatar Capital,” a player's investment into their online persona. Acquiring avatar capital is an end goal for many players, and issues such as World of Warcraft's “welfare epics” show how game mechanics affect a player's capital and their interactions with other players. The massive global market and diverse playerbase of MMOs complicate design choices to prevent offending users or being caught under censorship laws in countries like China. Exploits and glitches also divide the playerbase and require special care on the part of the

designers to understand and resolve issues in a fair manner. These additional pressures require that designers carefully consider the reactions of the player and the game community when iterating and improving on their game, cementing their position as social architects of these virtual spaces.

Video games are no longer the realm of child's play, and are becoming more sophisticated and complex as time goes on. Designers must learn to understanding and appreciate human nature, both inside and out of their games. With new understanding of people and the place of games in society, designers will be able to advance their craft to unexplored territory and truly advance the medium in society.

Applying Maslow's Hierarchy to the

Creation of Realistic AI in Video Games

A Technical Report
in STS 4600
Presented to
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ABSTRACT

Artificial Intelligence is quickly becoming a area of interest for game designers and developers. While previously unable to handle complex game agents, increased processing power allows for much more sophisticated non-player entities that lead to more immersive game experiences. Bethesda's The Elder Scrolls IV: Oblivion is a recent failed attempt at implementing human-like AI through its Radiant AI system. Irrational and unexpected behavior in development builds of the AI forced developers to scale back on game agent complexity in order to release a stable game. Radiant's key design flaw was a lack of understanding of human motivation and decision making. By applying a psychological model to use as the base for an artificial intelligence, the decision making process of game agents will behave in more rational and believable ways to the player. An experiment is conducted to apply a psychological theory to AI design through the development of a simple game. Maslow's Hierarchy is chosen as the basic flow of the agent logic. The Hierarchy is selected due to its simplicity, widespread acceptance, and its easy adaptability to an AI design. The sample game is developed and the entire process is then analyzed based on its effectiveness in creating realistic behavior and its applicability to various game genres.

GAMES AND ARTIFICAL LIFE

Artificial Intelligence has been a crucial component in video games throughout its history. The use of logical agents to provide a challenging and engaging experience is a key factor that separates the design of video games from traditional games. AI controlled opponents and virtual environments allow for the competitive aspect of game play to transfer over to a single player experience that would otherwise not be possible.

Early games could not afford to implement sophisticated AI. Limited processing power left little room for complex decision algorithms and improved graphics were seen as a better investment. As technology improved, more powerful gaming systems allowed for much more complex non-player character behavior. Designers began to experiment with more complex logical agents, focusing on creating improved pathfinding, combat tactics, learning agents, and other improvements. Attempts to create realistic AI behavior, however, have fallen short. Bethesda is one of the more notable examples of a company attempting this undertaking through its Radiant AI system, first demonstrated in The Elder Scrolls IV: Oblivion.

Oblivion and its Radiant AI were set to revolutionize the games industry and the way players view game AI. The Radiant AI “imitates the impact of resource pressure, individual needs, and player interaction on a non-player character (NPC), resulting in a dynamic, procedural reaction” (Griffin, 2010, para 2). Non-player characters possessed their own personalities and goals, and could interact with the environment to satisfy their needs. Previews of the game excited players over the prospect of such a rich and dynamic world to interact with. When the game shipped, many were disappointed to find that

many of the advanced features of the Radiant AI were not present. It turned out that the full AI system ended up causing unexpected behavior, as elaborated on by Sanjeev(2006):

> 1. One character was given a rake and the goal “rake leaves”; another was given a broom and the goal “sweep paths,” and this worked smoothly. Then they swapped the items, so that the raker was given a broom and the sweeper was given the rake. In the end, one of them killed the other so he could get the proper item.
> ...3. In one Dark Brotherhood quest, the player can meet up with a shady merchant who sells skooma, an in-game drug. During testing, the NPC would be dead when the player got to him. The reason was that NPCs from the local skooma den were trying to get their fix, did not have any money, and so were killing the merchant to get it.
> ...5. In one test, after a guard became hungry and left his post in search of food, the other guards followed to arrest him. The town people looted the town shops, due to lack of guards.
>
> Bethesda worked to fix these issues, balancing an NPC’s needs against his penchant for destruction so that the game world still functions in a usable fashion. In-game there are over 1,000 different NPCs, not including randomly spawned monsters and bandits. The result is that the AI in the release version is much reduced, only featuring NPC schedules.

The behavior described above is impressive in terms of emergent game experiences, but its flaws are readily apparent. The responses of the agents are very erratic and exaggerated compared to normal human behavior (such as in case 1 and 5), and these responses in turn have negative impacts on elements of story and gameplay (case 3). While it appears that Bethesda considered all the elements necessary for proper human agents, the Radiant AI lacked in making natural choices to a human observer. The functionality is there but the psychology is not. This paper will attempt to address the issue of making human-like decisions by applying psychological principals to AI design.

To create a more believable human AI in games, there must be a fundamental shift in the perception of the AI and its place in the game world. If an agent is to be as human-like as possible, their behavior should be able to exist independent of the game itself. By

separating game mechanics from the high level decisions of game entities, the design not only retains more lifelike decisions but also becomes a more flexible design that can be reused in other games. Thus, the goal of this approach is to first make an AI system that replicates human behavior at a high level, then as the high level decisions are made, lower level game specific tasks can be implemented on a game-by-game basis. The purpose of this paper is to implement and evaluate this approach based on its feasibility, performance, and effectiveness.

Human behavior is an incredibly complex thing. A proper understanding of human thought processes and the logic behind a person's behavior can take years of study, and even then research is still ongoing. Creating a perfect model of human behavior is more likely to come from a fully synthetic brain than a clever AI programmer. Luckily, a perfect representation is not needed to be a believable representation. Applying a well-researched model of human behavior to a game AI provides a base to work off to create believable AI.

PICKING THE MODEL: MASLOW'S HIERARCHY

The psychological model chosen for this project is Maslow's Heirarchy of Needs. In his A Theory of Human Motivation, Abraham Maslow detailed his numerous findings on what drives human motivation. Of note is one of his more interesting propositions, that “human needs arrange themselves in hierachies of pre-potency...the appearance of

one need usually rests on the prior satisfaction of another”(Maslow, 1943, p. 370). This concept gave birth to the Maslow Hierachy, a tiered organization of human needs that demonstrate which human needs are dependent on others before they become motivational factors. The Hierarchy itself consists of five levels of human needs arranged in a pyramid. At the bottom of pyramid are Physiological needs, the most basic requirements of life such as food, water, and sleep. The next layer is Safety, ensuring that one possesses enough resources and stability in the near future to be confident of his or her future. The following three levels are, respectively, Love/Belonging, Esteem, and Self-actualization. As the bottommost needs are satisfied, higher level needs then appear to motivate the decision process. For example, someone “lacking food, safety, love, and esteem would most probably hunger for food more strongly than anything else”(Maslow, 1943, p. 373).

Maslow's Hierarchy is an excellent model for simulating human behavior in games. The model is simple enough for anyone to understand but its simplicity also makes it flexible. It already provides the conditions of high level decision making, and defines those conditions in a general enough manner to be applied to a wide variety of game types. The bottom two layers tie in extremely well with the common gameplay themes of survival against a harsh environment or enemy. Not all layers need to be implemented either, allowing games to select the particular levels their game addresses and dropping the rest without changing the basic decision model.

BUILDING THE HIERARCHY

To test the effectiveness of the Maslow-based model, an experimental game is developed using the principles of the design for the game agents. The game features a player-controlled avatar interacting with a 2D environment populated by various world objects and AI entities representing human farmers. Each agent is given a set of goals to accomplish that correspond to the first two levels of the Maslow Hierarchy, covering the most basic needs of survival and stable health. The game world is populated by houses and farmland that are property of the agents, and can be used to satisfy their needs. Both player and agents are able to alter their surroundings in a positive/constructive way and a negative/destructive way. Positive actions offer a benefit to needs, such as working farmland for food or planting new crops. Negative actions cause harm, such as destroying crops or harming other agents.

The experiment was developed using C# and the XNA 4.0 library. Ease of use and flexibility were the two main considerations when selecting language and library. The game consists of three primary classes: a main class to execute the game and update all the game objects at each frame, a Utility class that stores the condition variables used for evaluating decisions, and an umbrella class called Entity that handles information related to all in game objects. Entity is further broken down into Agent, Player, and WObject subclasses.

Agents are the game's AI entity and contain the implementation of the Maslow AI being evaluated. Each Agent possesses an instance of Utility that is used for tracking their

current state, and its values are used in the logic function to make decisions. The Agent class also includes two arrays of WObjects. The first array holds all of the agent's available knowledge about the world. Whenever a new object is sensed, it is added to the knowledge array. The second array consists of all WObjects that an agent is considered the owner of. Owned property takes precedence over unowned property due to its non-existent risk. While this array is somewhat redundant and could easily be integrated to the knowledge array, separating out the owned property from the total knowledge base improves readability and understanding of the code, however does result in additional memory usage.

The Utility class contains all the important information related to making decisions for the Agents. Utility contains two sets of condition values: an available amount of utility for each condition value (for evaluating the current state of an Agent/WObject) and a return amount for how much utility can be transferred in one game iteration (for evaluating a choice once a goal state has been specified). Whenever an agent uses an object, that object will return the gained utility based on the action taken, and the values are added to the agent's own utility. The values tracked include hunger, sleep, stored food, and threat. These are just the conditions used for this experiment, and an actual game application could have many more depending on the needs of the project and how detailed the decision process should be.

Due to limited resources, the sample game focuses only on the first two levels of Maslow's Hierarchy. The first level, Physiological, uses the hunger and sleep Utility to form its decisions. While the Physiological level covers a larger range of needs, food and

sleep are far more relevant to games than the others listed. The second level, Safety, relies on the food stores condition variable. Safety also covers a large range of needs, many of which could have game applications. The context of the example game made security of resources, in this case food, the best choice for second level decisions.

The threat metric stands separate, as it doesn't particularly fit into a specific level. Rather, it modifies the decision process of the other levels based upon the perceived risk of an action, object, or person. An agent eating its own food carries zero threat: there is no chance of a conflict for this action. However, eating another agent's food carries the risk of being seen, and the other agent retaliating in defense. Thus, unowned property has some level of threat. Threat helps make decisions based on the state of the agent, used to evaluate the risks of one option over another. Agents will not take a risky option unless a no-risk option is not available. This element of risk evaluation helps prevent some of the flaws of the Radiant AI. Violence is much closer to a last resort, and agents will fight to death only in situations where it would be reasonably be expected to do so.

These components combine together to form the decision logic of the agents. An agent will first check to see if its immediate Physiological needs are met. If the agent determines it is not in a stable state, it will attempt to satisfy its needs. It will look first for sources of food and rest that are owned by the agent. The greater the immediate need, the greater the risk the agent will take to satisfy its need, such as if an owned source of food cannot be reached in time, a nearby unowned source will be picked in order to ensure survival. Agents will first prioritize owned sources and efficient sources (those that give/possess the greatest utility), as long as they are within a reasonable range. Once

Physiological needs are met, the agent attempts to secure long term food sources. This is achieved through working farmland and planting new crops. The agent will work the farmland available to it until it runs out of its stored utility. If the amount of farmland is insufficient for long term stable survival, the agent will being planting new crops that will turn into farmland to fulfill the needs. When both levels are seen as being in a stable state, the agent stops acting. In a further experiment, it would be worthwhile to code some third level Social actions for the agent to perform, such as wandering around the game world and talking to other agents.

PUTTING MASLOW TO THE TEST

After the game's completion, it is run through several tests of agent realism and performance metrics. The game, as seen in Figure 1, uses simple colored blocks to identify different objects in the world. The red square is the player himself. Blue squares are agents and brown squares are agent homes. The dark green squares are farmland, with the lighter green representing land associated with a particular house. This land can be turned into farms if the agent chooses to do so.

The first run of the game revealed an oversight of the agent design that produced unnatural behavior: every agent took the same actions at the same time, causing the entire village to be synchronized. Every agent and object contained the same default values and use rates, which caused the identical behavior across agents. This prompted the addition of additional randomization of agent properties. Such properties included movement

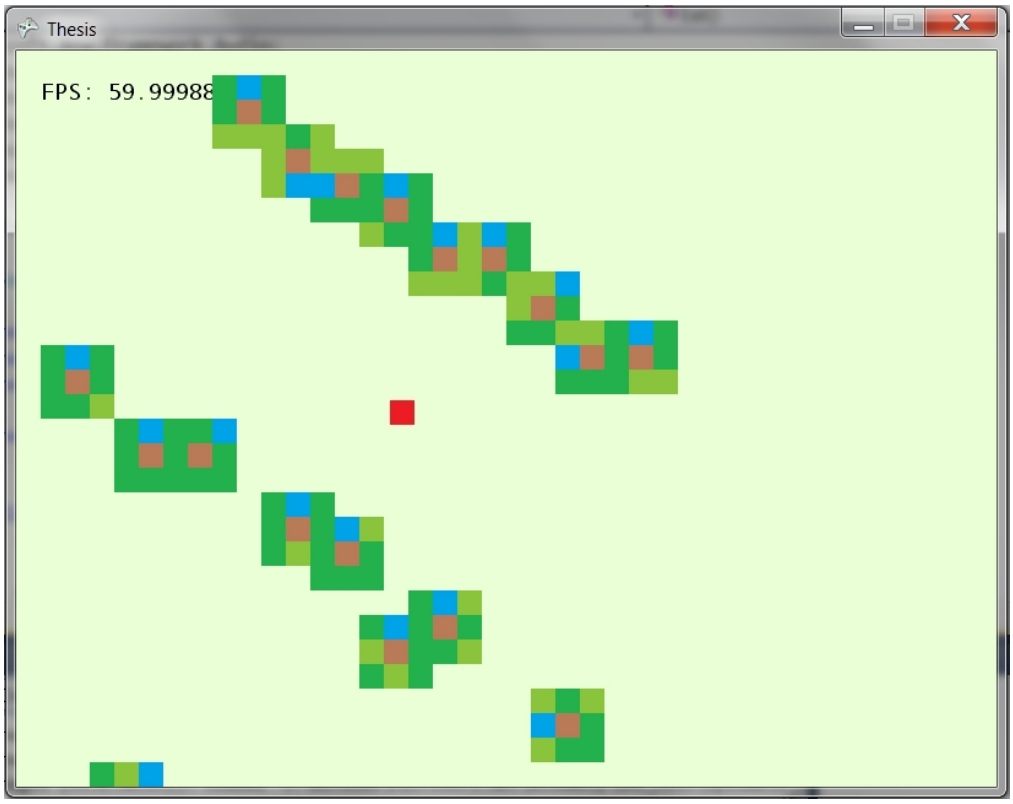

Figure 1: Game in progress (Domenic Tessari, 2011).

speed, work rate, resource usage, and others. This change also supports the overall theme of creating a realistic representation of human behavior. While this model assumes all humans follow the decision making outlined by the Maslow Hierarchy, individual requirements for each need vary from person to person. With reasonable variance of need requirements added, the simulation is run undisturbed for a period of time. The agents kept themselves in a steady state, working their own farms for food and sleeping when necessary. As expected from the stable game environment of this test, there were no unusual or unexpected behaviors and agents remained self-sufficient.

With property-owning agents working as intended, the next test sought to examine the agent behavior when resources were not so readily available. Additional agents were

added to the scene, but were not given a home or farmland. A few unowned pieces of farmland were also randomly placed about the map for these agents to use as a risk-free option. When the game first started, the 'homeless' agents wandered, looking for possible unowned food sources to minimize risk. When these agents became hungry, those that had found an open food sources used them up as much as possible. Agents that did not find an open food source or whose available sources weren't sufficient were then faced with choosing among all known food sources owned by other agents. Agents prioritized food sources where they would least likely be caught by other agents, such as when the owner was eating or sleeping, then running off once spotted by the owner. No agents seemed to reach a state where violence became a necessity, instead doing well enough by taking food at opportunistic intervals and looking for the open farmland when possible. These agents began falling into a set routine, taking familiar paths and stopping at the same sets of fields for food. An eventual set schedule produced sufficient food sources while minimizing risk, and the game world stayed stable. While the development of individual routines can be seen as a benefit of the AI's decision making, the effect is static in appearance to the player. If the agents perform the same set of actions at regular intervals, the Maslow AI resembles traditional scripted AI. Resolving the issue of regular schedules is a mark against the Maslow AI, as simple systems will then require additional components to keep the agent behaviors varied and interesting.

Player interaction with the game world is the true test of the merit of the Maslow Hierarchy. Providing player agency and having agents respond to player behavior is a key factor in both creating an engaging game experience and in creating a realistic AI.

Several games were played using two different types of player actions: growing open farmland for agents to use, and attacking agents/property. Agent responses to player actions were then observed.

The beneficial farmland creating player had a large impact for the first few farms created, then quickly suffered diminishing effects from each new one. New farms altered the routine of the homeless agents to take advantage of the new resource, as they were zero risk compared to the option of theft. However, once there were enough open farms to feed all agents, further fields had no additional effect. Limitations on the game world and its available mechanics and systems are an important consideration for beneficial player actions. Whenever a player does something to benefit an agent, the action taken moves an agent further up the Hierarchy, as he is helping satisfy a need. Thus, positive actions are inherently limited by the highest implemented level of the hierarchy. As higher levels are more difficult to implement, rewards for positive actions are also more difficult to include.

The harmful player produced much more engaging results. An initial attack was made against an agent's farm and home. The agent first tried minor attacks to scare the player away, like they would an unwelcome agent on their property. After continued attacks and destroyed property, the agent retaliated in full force, as failure to do so would spell the end of his livelihood. The agent is killed by the player along with remaining property. Attempts to destroy another agent's property are immediately met with desperate attacks, due to the increased threat associated with the player after having killed the other agent. As more agents were killed by the player, the remaining agents began to

flee in terror whenever the player was around because of his incredibly high perceived threat, as seen in Figure 2. Negative player actions are much more accustomed to the Maslow Hierarchy AI for similar reasons why positive actions are more constrained. Harmful actions move an agent downward on the hierarchy, where the bottommost levels are the most likely to be supported and the most commonly found levels in gaming. Since one cannot move off the hierarchy, the behavior stays believable as the bottom level is already supported by the AI system. The Maslow AI thus functions much stronger with destructive player actions and agents and environments that are intended to be attacked by the player.

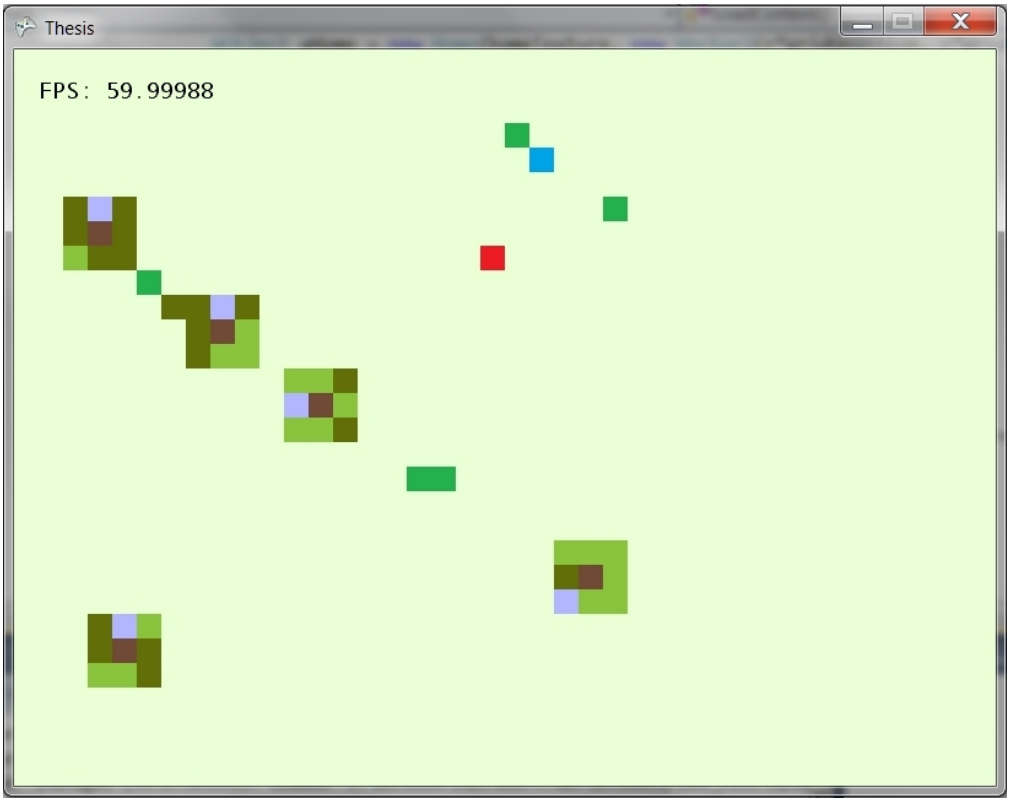

Figure 2: The lone surviving agent fleeing the player in terror. The pink, dark brown, and dark green squares are destroyed homes, farmland, and agents (Domenic Tessari, 2011).

REVIEWING THE THEORY

While the program produced mostly desired results, the experiment as a whole resulted in some mixed observations as to the benefit of the approach. For the evaluation, it is important to observe positive and negative aspects from the standpoint of a player playing the game as well as the programmer involved in its creation. For the Maslow approach to be valid, it must display the desired effects of a more believable AI while keeping the additional development time required low enough to be worth the added benefit.

The additional difficulties in programming the Maslow AI and its needed components result in a substantial drawback for the flexibility of the model. In order to even implement the approach, the game's mechanics must necessitate two or more levels of the hierarchy for the AI to act upon. A game such as a First Person Shooter would have a difficult time integrating more than one level. Even if a shooter could incorporate more than one level, the decisions made between levels would have very little game impact compared to the decisions made within a level, such as combat tactics. The hierarchy also doesn't address any of the inner-level decision making problems, and the inclusion of the condition metrics can complicate the inner workings of the AI more than simplify them. The sample game could have ignored the Maslow approach and simply had the agents move to locations at scripted or semi-random intervals, drastically reducing the development time of the game while arguably not sacrificing much in return.

The Maslow approach is not proven to be without merit, however. The game and the experience it attempts to provide need to suit the design goals of the Maslow AI in order to be used properly. Taking the Maslow Hierarchy approach requires a game that puts realistic human behavior as a key aspect of its design goals. It is not coincidental that the games that inspired the project are also the ones that most benefit. Oblivion, with its focus on breathing world that the player can immerse themselves in, can make excellent use of the Hierarchy for the residents of its world and avoid the self-destructive and irrational habits of the Radiant AI. The experimental game itself functions very much like an simplified version of Radiant, tracking multiple statistics and making choices to improve overall well being and satisfying player goals. Oblivion and games like it focus on interacting with human-like agents on a regular basis as part of its gameplay, justifying the design expense of the Maslow approach.

CONCLUSION

Using Maslow's Hierachy as a design paradigm is still in a very early stage. The experiment acted as an example of how to use the technique and to show that it can be used to design a game AI. However the simplicity of the experiment, both in terms of its use of only the first two levels of Maslow's Hierarchy and with its bare presentation and mechanics as a game itself, does not give sufficient evidence of the effectiveness of this design approach. Implementation difficulties hurt the potential for the Maslow model to

be used in simple games and many game genres. It still shows potential for games the take advantage of the psychological influence on its AI design, but there is no evidence yet to support its use in those games.

Discovering the potential of this new AI approach requires a more involved case study. Applying the Maslow design to a professional game that could utilize its advantages would provide the best case to observe the effects on development cost and added player experience. This scenario is nearly impossible to accomplish in an academic setting, so it will likely be up to the games industry itself to experiment with the concepts detailed in this paper. If nothing else, the idea of turning to psychology to improve game AI can be a valuable lesson for the future of innovative game design, even if Maslow's Hierarchy isn't the approach to handle it.

WORKS CITED

Griffin, E. (2010, November 14). Why Can't Open Worlds Be More Closed? *Bitmob.* Retrieved from http://bitmob.com/articles/why-cant-open-worlds-be-more-closed.

Maslow, A.H. (1943). A Theory of Human Motivation. *Psychological Review, 50,* 370-396.

Sanjeev, A. (2006, October 23). Radiant AI – This is awesome and freaky. Message posted to http://thoughtoutflux.wordpress.com/2006/10/23/radiant-ai-this-is-awesome-and-freaky/.

BIBLIOGRAPHY

Bernhaupt, R.. (2010) *Evaluating User Experience in Games Concepts and Methods*. New York, NY: Springer.

Dragert, C., Kienzle, J. & Verbrugge, C. (2011). Toward high-level reuse of statechart-based AI in computer games. *Proceeding of the 1st international workshop on Games and software programming (GAS '11),* 25-28. doi: 10.1145/1984674.1984684

Griffin, E. (2010, November 14). Why Can't Open Worlds Be More Closed? *Bitmob.* Retrieved from http://bitmob.com/articles/why-cant-open-worlds-be-more-closed.

Laird, J.E. (2002). Research in human-level AI using computer games. *Communications of the ACM, 45*(1), 32-35. doi: 10.1145/502269.502290

Lecky-Thompson, G.W. (2008). *AI and Artificial Life In Video Games.* Boston: Charles River Media/Cengage Technology.

Livingstone, D. (2006). Turing's test and believable AI in games. *Computers in Entertainment, 4*(1). doi: 10.1145/1111293.1111303

Maslow, A.H. (1943). A Theory of Human Motivation. *Psychological Review, 50,* 370-396.

Sanchez-crespo, D. (2003). *Core Techniques and Algorithms in Game Programming.* Berkeley: New Riders.

Sanjeev, A. (2006, October 23). Radiant AI – This is awesome and freaky. Message posted to http://thoughtoutflux.wordpress.com/2006/10/23/radiant-ai-this-is-

awesome-and-freaky/.

Stene, S.B. & Yildirim, S. (2008). A survey on the need and use of AI in game agents. *Proceedings of the 2008 Spring simulation multiconference (SpringSim '08),* 124-131. Retrieved from http://delivery.acm.org/10.1145/1410000/1400565/p124-yildirim.pdf?ip=137.54.19.75&acc=ACTIVE%20SERVICE&CFID=70640482&CFTOKEN=91281662&__acm__=1322864127_42e9c530cbde387d4e95ae228d7aefdf.

The Design And Social Challenges Of

Developing Massively Multiplayer Online Games

A Research Paper
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By

Domenic Tessari

November 17, 2011

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ABSTRACT

Massively Multiplayer Online Role Playing Games, otherwise known as MMORPGs or MMOs, are a fast growing sector of the entertainment industry with billions of dollars in revenue every year. With over 11.1 million players on Blizzard's World of Warcraft alone, more and more people are engaging in MMOs. The social aspect of the genre presents unique challenges to developers of the genre. Designers find themselves faced with attempting to appease a wide variety of players who enjoy and pay for their games. MMO players are drawn to the idea of advancing their characters, investing “Avatar Capital” into their online persona and developing a commitment to the game. Players also come from a diverse range of cultures and backgrounds that the game must remain sensitive to, and certain lucrative markets such as China can require extensive changes to the core game during localization. Programming oversights can also lead to complicated situations and game altering bugs and glitches, often complicating the integrity of the community and requiring a careful response from the designers. These problems require the designer to alter their position to that of a social engineer, taking on a new understanding of their players and the reasons people play to create a rich virtual world and keep the game profitable for the company.

THE RISE OF SOCIAL GAMING

Once the chosen pastime of a select few, video games are now a major part of everyday entertainment. Technology advisory firm Gartner Inc recently valued the games industry at $74 billion worldwide (Hinkle, 2011). The Nintendo Wii, Facebook, and the surge of mobile gaming platforms changed the concept of what playing video games and being a gamer means. The Wii gave non-gamers a new way to look at how games are played and who can play them, changing up the control scheme to something much more intuitive and engaging for the average person. Facebook and mobile gaming turned games into quick, convenient, and, most importantly, social affairs. These technologies shifted the view of games from the stereotypical domain of children and computer nerds to being a pillar of modern social interaction. This shift in public perception of games and social play creates new challenges and responsibilities on the part of the games designer. One of the genres most heavily affected by this social shift is the one that forms its foundation on social play: the Massively Multiplayer Online Role Playing Game.

Massively Multiplayer Online Role Playing Games, often shortened to MMORPGs or simply MMOs, are a rapidly growing sector of the games industry, and one of the most unique genres of gaming. These games feature massive virtual worlds to explore, typically challenging players with difficult quests and intimidating monsters to defeat. Such encounters are frequently impossible to complete alone, forcing players to work together to overcome the obstacles and reap their rewards. The existing focus on teamwork and socialization in MMOs amplifies the new focus on gaming as a social activity. The importance of player interaction and community put MMO designers into a

difficult and often unfamiliar position of social architect for their games. As a social architect, these designers are now responsible for managing the social systems in their games, working to grow and shape the online community that surrounds their games in a constructive manner. In order to tap into the lucrative MMO market, designers find themselves needing to embrace their new position to develop a successful online world.

The creation of a successful MMO is a daunting task. Producing a large scale game world to handle millions of players on dozens of servers across the world takes impressive amounts of time, money, and technical skill. The network coding needed to support so many players all interacting with a server at the same time is a rough undertaking for even the most experienced programmers. Producing thousands of different assets to populate the game world requires hiring a small army of artists, and even when the world is populated, purchasing the servers and associated infrastructure adds further costs. Gaming analyst Michael Pachter estimated total costs for the upcoming Star Wars: The Old Republic at $80 million (Curtis, 2011, para. 2), with costs expected only to rise in the future.

Even if a game possesses the talent and financial backing, it still faces many other difficulties along the way. Niche and experimental titles that stray from the established formula are too risky for the costs involved, so the game must be able to simultaneously differentiate itself and maintain familiar qualities. While not overly saturated compared to other game genres, there exist several well established brands that seem impossible to overcome in market share. World of Warcraft, the current leader in MMOs, recently claimed 11.1 million active subscribers (Cifaldi, 2011, para. 1). Even if the game does

well on initial sales, the subscription based pricing model common to the genre requires players to keep playing and paying in order to sustain a profit. The need for customer loyalty is a defining feature of this industry compared to other titles, and necessitates constant post-release support through regular content updates and expansion packs in order to retain subscriptions and keep the game alive.

Constant development may seem like a downside, but it also offers designers a way to learn from mistakes and improve the game on a regular basis. Players will commonly leave the game when they are bored or a change is made they dislike, but rejoin and begin paying again with a new update that grabs their attention. Keeping the players happy and engaged is the key to making an MMO a success, and games of its type are expected to change and grow over time to suit the needs of the players supporting it. Designers work with a demographic in mind, but the people playing might not end up being the ones the designers had in mind. The nature of the genre allows the developers to observe their players and understand how they interact, molding the game around its triumphs while learning from their failures.

At the core of the challenges for an MMO designer is understanding the players themselves. The business model and the multiplayer component of the genre force the designer to take on the role of a social engineer. The social aspect of MMOs is its defining feature. Players are expected to work as a team, supporting each other to overcome difficult monsters or other game content that cannot be handled alone. Players will create 'guilds,' forming a group that regularly plays and communicates with each other, often sharing in-game or out-of-game interests that define their group. Each server

that hosts a virtual world has its own subset of players, and these players and guilds will develop reputations on their particular game servers and within the greater community based on their skills or behavior.

This report examines the difficulties of the MMO designer in his role of social engineer of the game and its greater community. While every game and situation will require its own solution, the examples and observations presented will identify common problem areas that designers are likely to face and provide a guideline for resolving such issues in the future.

WHY THEY PLAY

Social dynamics in games are often obvious. The MMO requires teamwork to do anything of significance. Farmville is reliant on interacting with other other player's farms to proceed. However, these components are intentionally designed to foster a social element and player interaction. Game systems themselves can possess unintended social consequences. Understanding that all designs can contain a social element is an extremely important concept for designing a socially driven game environment. Christopher A. Paul analyzes one of the most prominent examples of the unintended effects of design in his article “Welfare Epics? The Rhetoric of Rewards in World of Warcraft” (2010).

The term “welfare epics” came from Blizzard Entertainment's own Jeff Kaplan,

Lead Content Designer of World of Warcraft (WoW). Kaplan, better known as Tigole, used the phrase during Blizzard's 2007 conference to describe the new player-versus-player (PvP) rewards that were implemented in a recent update to the game. Player-versus-player content include game activities where players directly compete against each other instead of computer controlled opponents. Describing the new reward system as “welfare” set off a storm of controversy within the community, sparking debate on the nature and value of rewards in WoW. Paul observes the power of the word “welfare” and the implications associated with it to explain this sudden burst of outrage. It revealed a sharp divide in the behaviors and desires of WoW's player base and left WoW's designers with a difficult question of how to satisfy their diverse playerbase. While the use of “welfare” was originally limited to describing the player-versus-player rewards, in the following years the term encompassed all manner of in game rewards that are seen as relatively easy to obtain compared to the traditional rewards from difficult monsters that required teamwork.

Originally, players obtained high end equipment only through 'Raids', where a group of up to 40 players would work together to defeat powerful computer controlled enemies. When defeated, the group would be rewarded with several pieces of high end equipment to be distributed among the players. 'Epic' equipment commonly features unique and impressive looking armor and weapon models, making them highly desirable for both creating a stronger character and as a visible symbol of the player's skill and strength. Epics are the second highest level of equipment quality and rarity, and were originally extremely rare outside of Raids. This status contributes to what Paul identifies

as “Avatar Capital” (p. 164). Acquiring, maintaining, and preserving the value of a player's own avatar capital drastically effects how they view the game and respond to the choices made by the design team.

The addition of Epic equipment as a PvP reward drastically changed the prominence of Epic items, which now could be gained gradually in groups of 5 players of less instead of the 20 or 40 person raids. Players questioned the value of PvP rewards in the past, but it was not until “welfare epics” that the debates began to escalate. Many people, particularly those who live in capitalist societies like the United State, view welfare as mostly benefiting the undeserving, lazy, or unskilled. These feelings carry over to a belief that welfare can also imply that someone is inferior or not good enough to receive higher end equipment, and that using these items is shameful even if the game allows them to be obtained in such a way. The heated feelings behind the term 'welfare' ignited a long subdued debate among the playerbase on who is deserving of such items and how they should be obtained.

Paul's analysis of the culture surrounding the rewards in Warcraft gave new insights into why people play and how the structure of rewards can change in the course of an MMO's lifespan. In part, his review exposes the core “conflict of interest” between four parties: the two types of players, the designers, and the directors and/or investors supporting the project. According to Martin and Schinzinger (2010), a conflict of interest occurs when a professional is in a role that requires exercising good judgment on behalf of an employer or client and the professional has some additional interest that could affect their judgment in serving the client or employer (p.137). When faced design

choices, developers try to best serve the needs of the various types of players, along with company investors. Jeff Kaplan's use of “welfare epics” also show that designers themselves have interests, their own ideas on how they believe the game should be run and played. Their own preferences of what makes for good gameplay can color their perception of the state of the game and the will of the players. However, designers must not give into to every player demand, as they still possess the expertise and knowledge to know what goes in to making a balanced and enjoyable game experience that the common player lacks.

The welfare epics debate is an excellent source for beginning to understand the types of decisions that designers face when dealing with how to further develop and expand upon the game. MMOs have a more diverse group of players then probably any other genre, and understanding the needs and expectations of those players is the key to creating a successful and long lasting game. The value players place in the rewards they receive also gives new insight into the reasons that people play, and the importance of rewards in modern gaming.

What is interesting to observe is that throughout the debate and within Paul's article itself, the words 'work', 'labor', 'time', 'effort', and 'difficulty' are all frequently used but 'fun' is noticeably absent. The acquisition of rewards and status items are seen as the ultimate goal of play. When the rewards are devalued, players express their anger and dissatisfaction with the game now that the benefits are too easy to obtain. This connection between player satisfaction and the value of rewards is the crucial point of difference between MMO and normal game design. The core gameplay does not drive the players of

an MMO on its own, but is instead driven by the secondary systems to keep players invested in their character, and by extension, the game itself. Developing, cultivating, and maintaining avatar capital for each player is just as much the work of the developer as it is the player. The acquisition and value of avatar capital is an essential component in MMO design, and one that designers must be aware of for success.

DEMOGRAPHICS AND CULTURAL DIVIDES

The designer needs to consider who the players themselves are in addition to the newfound understanding of why people play and enjoy MMOs. With the increased importance of international releases, a designer needs to be able to visualize the wide range of people and cultures that will participate in his or her game. Being sensitive and knowledgeable of outside cultures helps to cut down on development costs by preventing negative press and extended development time. Cultural misunderstandings and stereotyping can alienate sections of the playerbase and decrease sales and subscriptions. Issues also arise from foreign censorship laws, requiring significant changes to the game in order to be released in overseas markets.

China is one of the most important markets in online gaming. As of 2009, China stood as the largest online gaming market, contributing one third of total revenue for the online gaming industry (Yan, 2010). The amount of potential dollars in the Chinese market is important for an MMO's overall financial success, but it is not as easy as a

simple localization. China and other Eastern countries require time management features in MMOs to help combat their growing epidemics of online gaming addiction. Censorship laws and cultural differences from Western views can stop a major release at the gate, requiring extensive changes to avoid controversy or to even be allowed to sell the game in the new country in the first place. While potentially lucrative, handling a Chinese release of a new MMO requires particular understanding and consideration of the rules and beliefs involved.

World of Warcraft and the Warcraft franchise clashed with China in the past. Before the release of WoW, Warcraft III introduced the Pandaren, a race of anthropomorphic panda bears. Originally, Pandaren were dressed in samurai outfits and wielded Japanese weaponry. Chinese players took issue with Blizzard, angry in seeing their beloved national animal adopt Japan's cultural history. While Blizzard later redesigned the Pandaren to follow a Chinese aesthetic (Harper, 2007, 10:10 AM section), the incident reveals how a seemingly harmless stylistic choice can become offensive. Stereotyping and inappropriate grouping of cultures and races can lead to more issues like the Pandaren, and designers must be aware of the risks when they design a setting or character with an unfamiliar culture in mind. Blizzard could have easily avoided the Pandaren controversy with a little extra research into Chinese and Japanese culture and history.

Chinese censorship laws and regulations also stand in the way of a successful release. Large sections of games may need to be completely redesigned, substantially adding to the cost and production time of the game. Designer and producer clash here,

and must work together to determine of the product will be successful enough to warrant the necessary changes. In a dramatic case, Blizzard delayed World of Warcraft's expansion pack, Wrath of the Lich King, by several years to meet censorship requirements (Yang, 2010). Displaying skulls and skeletons is forbidden in Chinese media, which posed a massive problem for the expansion as it heavily focused on an evil undead army and morbid aesthetic. Almost every asset in the game had to be altered or replaced before it was finally approved for sale in China, two years after the US release. While meeting the standards proved an expensive and difficult process, the potential in the Chinese market and the power behind the Warcraft brand drove developers to take the initial cost and collect the revenue of Chinese sales.

Figure 1: The changes made from US (left) and Chinese (right) releases range from subtle edits to complete overhauls (Yang, 2010).

BUGS, GLITCHES, AND EXPLOITS: ADDRESSING EMERGENT BEHAVIOUR

The size and complexity of MMO development, along with the sheer number of people playing at any given time, means that the game might break or evolve in ways the designers never intended. While many are clearly in need of a fix, some bugs can have unique unintended consequences on the players and the game world. Analyzing exploits and the way players use them can help designers with their design decisions. Observing the impact of glitches can help resolve future issues that arise give new ideas to developers for ways to advance the game in the future.

Players abusing glitches for personal benefit is nothing new to MMOs. Most glitches come from abusing client/server interactions falsify data and do things like teleport from place to place. These bugs are quickly resolved as violation of the Terms of Service for tampering with the data stream. But some exploits can be game supported, and are much more controversial. Players finding a loophole in the game code to give themselves an edge cause a less clear-cut ethical considerations.

CASE STUDY: ENSIDIA

A high-profile example comes from the Warcraft guild Ensidia. Ensidia is a top level raiding guild, and competes against other similar guilds for the bragging rights of being the first group of players in the world to defeat the newest and hardest bosses. One of the hardest encounters in a recent Warcraft expansion, The Lich King, became a very

high profile encounter for top level raiding. Ensidia claimed the first victory over the Lich King fight, but found themselves in controversy. During the fight, Ensidia used a glitch that caused platforms that fell during the fight to reassemble themselves when a certain item was used near them, drastically reducing the difficulty of the encounter. Blizzard took action after discovering Ensidia's use of the glitch, suspending the accounts of all players involved and revoking the credit for their accomplishment (Waxpaper, 2010).

The Lich King incident presents an unusual problem of responsibility between the designer and player. It is easy to rationalize blame against both parties. The programmers let the Lich King platform bug slip by, and proper playtesting would reveal the trick as it involved a rather common game item used by many players to maximize damage. Ensidia had enough game knowledge to know that the rebuilding platforms were not an intended part of the encounter, but used them anyway to greatly simplify the fight. Other guilds stated that they knew about the exploit, but decided to not make use of it. While on questionable grounds, Ensidia's use of the glitch did not involve any outside tools or hacking and relied entirely on the holes in the game itself, and it can be said that they were merely using all the tools available to give themselves an advantage. This situation posed an important question for the designers: does Ensidia deserve the recognition for their achievement, or do the unwritten rules of player honor and respecting the designer's vision overrule their victory? To better answer this question, and future issues, designers can step outside their genre and look elsewhere for inspiration in how to resolve this and other conflicts.

LOOKING TO FIGHTING GAMES

Glitches and maintaining a community are familiar territory to another game genre, Fighting Games. The Fighter scene is heavily community driven, and its players are always looking for the newest trick to give them an edge in tournaments. While game-stopping bugs are quickly banned, some glitches end up being embraced by the tournament scene of a game, being seen as a benefit that provides a more engaging experience for the players involved. One example is Kara Throwing in Street Fighter III, which used an oversight in the game engine's input handler to extend the range of a character's throw attack(“Kara Throwing”, 2007). The technique required fast hands to pull off, only really benefited certain characters, and didn't break or completely unbalance the game, so the community accepted it as a normal part of play. The development team even programmed Kara Throws as a supported feature of Street Fighter IV, due to the popularity of the technique in the previous game.

MMOs differ from Fighters in that the bugs can be addressed, and are expected to be addressed and corrected by the development team. The Fighting game community and tournament organizers managed to resolve issues with bugs and glitches without patches or updates. MMO designers can better improve their judgments concerning questionable bugs by observing the choices made by the Fighting community on their own exploits. Game designer and avid Fighting game fan David Sirlin outlines his often quoted views on bugs and competitive play in a section of his article “Playing to Win” (2000). In his article, Sirlin states that the exploit requires action when it would fundamentally

undermine the game's base concepts. (Boundaries of Playing to Win section, para. 3). He cites Akuma, a secret character from Street Fighter II, as too game breaking to allow in tournaments. Akuma is nearly unbeatable by the regular character roster, and his attacks are unlike anything else in the game. Picking Akuma, even if intentionally programmed in by the designers, is likened to playing an entirely separate game and not Street Fighter II.

Akuma and Kara Throwing show two different responses based on the intensity of the exploit. Kara Throws are a mostly equal technique, available to both players, and do not fundamentally change the game. Players enjoyed this unintended consequence, and the designers adopted it as part of official design. Removing the bug but converting it into a controllable feature keeps the players happy while returning game control and balance to the designers. The game-changers, like Akuma, require a stronger and harsher response. Characters like Akuma are clear deviations from intended play and design, even if intentionally programmed in. The glitch Ensidia used is closer to Akuma than to Karas: it undermined the fundamental purpose of being the hardest challenge in the game. By revoking Ensidia's victory, the encounter could again be approached on fair terms for the rest of the players and allowing a new 'official' best for beating the fight in a legitimate fashion. The response preserved the nature of the contest of skill between top players and demonstrated that the more intense bugs will not be tolerated if abused in such a way.

CLOSING REMARKS

MMOs stage a unique setting for people around the world to interact and share experiences with one another. Game designers find new challenges and problems every day, trying to find the best solution for all involved. Balancing the social aspect of an MMO is an essential part of the job, as turning a profit depends upon maintaining and expanding a loyal community of players. But as games develop further into mediums of social interaction, designers must grow into their new role as social architects of these online worlds. By understanding the new-found responsibilities of their title, game designers can create even better worlds for players of all types to interact and grow together.

WORKS CITED

Cifaldi, F. (2011, August). World of Warcraft Subscriptions Continue to Decline, Though More Slowly. *Gamasutra*. Retrieved from http://www.gamasutra.com/ .

Curtis, Tom. (2011, May). Analyst: EA Investor Roughly $80 Million in The Old Republic. *Gamasutra.* Retrieved from http://www.gamasutra.com/.

Hinkle, D. (2011, July). Report: Game industry worth $74 billion in 2011. J*oystiq*. Retrieved from http://www.joystiq.com/2011/07/05/report-game-industry-worth-74-billion-in-2011/.

Kara Throwing: Street Fighter 3 Third Strike (2007, December 4). *EventHubs.* Retrieved from http://www.eventhubs.com/guides/2007/dec/04/kara-throwing-street-fighter-3-third-strike/

Martin, M.W., & Schinzinger, R. (2010) *Introduction to Engineering Ethics* (2nd ed.). New York: McGraw-Hill. (Original work published 2000)

Paul, C.A. (2010). Welfare Epics? The Rhetoric of Rewards in World of Warcraft. *Games and Culture, 5(2),* 158-176. doi: 10.1177/1555412009354729

Sirlin, D. (2000). Playing to Win, Part 1. Retrieved from http://www.sirlin.net/articles/playing-to-win-part-1.html

Waxpaper (2010, February 8) The Facts About Ensidia's “Lich King Scandal.” *ZAM.* Retrieved from http://wow.allakhazam.com/story.html?story=21498

Yan, H. (2010, June). China's online game revenue tops the world. *China Daily.* Retrieved from http://www.chinadaily.com.cn/bizchina/2010-06/23/content_10010928.htm

Yang, M. (2010, August). Pics: What's Changed in Chinese Version Wrath of the Lich King. *Chinagame*. Retrieved from http://chinagame.178.com/201008/75942001505.html

BIBLIOGRAPHY

Bernhaupt, R.. (2010). *Evaluating User Experience in Games: Concepts and Methods*. New York, NY: Springer.

Cifaldi, F. (2011, August). World of Warcraft Subscriptions Continue to Decline, Though More Slowly. *Gamasutra*. Retrieved from http://www.gamasutra.com/.

Consalvo, M. (2009). Hardcore Casual: Game Culture Return(s) to Ravenhearst. *Proceedings of the 4th International Conference on Foundations of Digital Games*. Orlando, Florida: ACM, 50-54.

Curtis, Tom. (2011, May). Analyst: EA Investor Roughly $80 Million in The Old Republic. *Gamasutra.* Retrieved from http://www.gamasutra.com/.

Dyck, J., Pinelle, D., Brown, B., Gutwin, C. (2003). Learning from Games: HCI Design Innovations in Entertainment Software. *Proceedings of Graphics Interface.* 237-246

Erickson, T., & McDonald, D.W. (2008). *HCI Remixed: Essays On Works That Have Influenced the HCI Community.* Cambridge, MA.: MIT Press.

Fritsch, T., Voigt, B., and Schiller, J. (2006). Distribution of Online Hardcore Player Behavior: (How Hardcore Are You?). *Proceedings of 5th ACM SIGCOMM Workshop on Network and System Support for Games*. Singapore: ACM, 16.

Hinkle, D. (2011, July). Report: Game industry worth $74 billion in 2011. J*oystiq*. Retrieved from http://www.joystiq.com/2011/07/05/report-game-industry-worth-74-billion-in-2011/.

ISO. (2000). *9421-9 Ergonomic requirements for office work with visual display terminals (VDTs) - Part 9: Requirements for non-keyboard input devices*. International Organization for Standardization.

Jørgensen, A.H. (2004). Marrying HCI/Usability and Computer Games: A Preliminary Look. *Proceedings of the Third Nordic Conference on Human-Computer Interaction.* Tampere, Finland: ACM. 393-396. doi:10.1145/1028014.1028078

Kara Throwing: Street Fighter 3 Third Strike (2007, December 4). *EventHubs.* Retrieved from http://www.eventhubs.com/guides/2007/dec/04/kara-throwing-street-fighter-3-third-strike/

Kirkpatrick, G. (2008). Controller, Hand, Screen: Aesthetic Form in the Computer Game. *Games and Culture, 4,* 127-143.

Kuittinen, J., Kultima, A., Niemel, J., and Paavilainen, J. (2007). Casual Games Discussion. *Proceedings of the 2007 Conference on Future Play*. Toronto, Canada: ACM, 105-112.

Kultima, A. (2009). Casual Game Design Values. *Proceedings of the 13th International MindTrek Conference: Everyday Life in the Ubiquitous Era*, Tampere, Finland: ACM, pp. 58-65.

Martin, M.W., & Schinzinger, R. (2010). *Introduction to Engineering Ethics* (2nd ed.). New York: McGraw-Hill. (Original work published 2000)

Natapov, D., Castellucci, S.J., and MacKenzie, I.S. (2009). ISO 9241-9 Evaluation of Video Game Controllers. *Proceedings of Graphics Interface 2009*. Kelowna, British Columbia, Canada: Canadian Information Processing Society, 223-230.

Paul, C.A. (2010). Welfare Epics? The Rhetoric of Rewards in World of Warcraft. *Games and Culture, 5(2),* 158-176. doi: 10.1177/1555412009354729

Pheatt, C. and Goering, S. (2010). Programming User Interfaces Using the Nintendo Wii Remote: Tutorial Presentation. *Journal of Computing Sciences in Colleges, 25,* 306-307.

Sirlin, D. (2000). Playing to Win, Part 1. Retrieved from http://www.sirlin.net/articles/playing-to-win-part-1.html

VGChartz. (2011). *Software and Hardware Totals* [Data set]. Available from http://www.vgchartz.com

Voida, A., and Greenberg, S. (2009). Wii All Play: The Console Game as a Computational Meeting Place. *Proceedings of the 27th International Conference on Human Factors in Computing Systems*. Boston, MA, USA: 2009, 1559-1568.

Waxpaper (2010, February 8). The Facts About Ensidia's "Lich King Scandal." *ZAM.* Retrieved from http://wow.allakhazam.com/story.html?story=21498

Yan, H. (2010, June). China's online game revenue tops the world. *China Daily.* Retrieved from http://www.chinadaily.com.cn/bizchina/2010-06/23/content_10010928.htm

Yang, M. (2010, August). Pics: What's Changed in Chinese Version Wrath of the Lich King. *Chinagame*. Retrieved from http://chinagame.178.com/201008/75942001505.html

As the gaming industry grows, more and more emphasis is being placed upon realism in games to provide enjoyable and believable experiences. Most developers and consumers look to graphics improvements to make the great leaps toward life-like games, but one feature of modern games can make the experience truly believable is artificial intelligence, or AI. In gaming history AI has often been limited to moving along set paths or having a very limited behavior set. It is only recently that gamers have become tired of enemies that stand perfectly still for the player to attack them or townsfolk who stand in one set spot all game. More advanced AI allows for more tactical scenarios in combat with enemies that take advantage of cover and flanking or to complete the feel of a whole new world populated with believable characters with their own goals and ambitions. In my technical topic, I will look into new design approaches to game AI, attempting to create more realistic and enjoyable agents within the game world.

In addition to the new focus on fidelity and realism in games, a more radical shift in the games industry has taken hold within the past few years, the massive growth of the casual games market. The gaming demographic has split into two major categories, "Casual" and "Hardcore," each with a wildly different expectation of what games should offer and what kind of game experience they enjoy. This new dual market has left game developers and publishers in a difficult place, now forced to make design concessions to either group while rarely being able to tap into both. The long and short term effects of the casual market's effect on the games industry is still unknown, but it is still possible to draw conclusions on what might happen, and what developers can do to combat the difficulties of competing interests. My STS topic will examine the casual gaming market, its rise and effects on the gaming industry, and what the future might hold. In my

research, I hope to find a way to reconcile the differences and provide suggestions on what to do for the best interest of the industry.

DEVELOPMENT AND DESIGN OF RESPONSIVE AI SYSTEMS IN GAMES

Artificial Intelligence is a field that has fascinated people for decades. Advancing beyond the realm of computer science theory, AI has permeated popular media and culture as a symbol of the unlimited power of technology, creating sentient machines to ease the lives of their creators or nefarious systems intent on bringing the destruction of man. In reality, though, we are far from either such extreme, but great strides are being made every day in the design of intelligent computing systems.

For my thesis, I will develop and test a variety of AI designs within the context of a game environment, evaluating the performance of each AI iteration as a realistic representation of human behavior. Each system will be designed and tested in parallel, sharing certain common behaviors in functionality while varying in the utility and decision making processes implemented. The individual AI systems will then be placed into a game environment, where an assortment of Players will interact with the environment and the agents within it, altering the world and observing the changes that their behavior causes. These players will then provide feedback on the AI, reporting on how realistic the AI was and how it impacted their play experience. In creating this AI, I hope to learn more about the design, development, and effectiveness of game AI, as well as the effects of a well developed AI on a player's overall experience.

The primary factor in the creation and design of the AI rests upon the foundation of human behavior laid out in Maslow's Hierarchy of Needs. The Hierarchy of Needs

describes how human's set priorities in their life in order to meet the most crucial need before moving on to a higher level. It consists of 5 separate stages of decreasing importance to survival and happiness: physiological, safety, love, self-esteem, and self-actualization. For my AI, I will adopt Maslow's Hierarchy as a guideline to the design of the AI, and to how the agent makes its decisions. Traditionally in game design, an agent will be developed as its role as a non-player character (NPC) within the game structure, giving precedence to certain specific game mechanics first even when it would be unnatural for a person to normally behave the way the NPC is behaving. In my approach, the game mechanics required of the agents will be integrated into the behavioral model, as opposed to dominating it. The Hierarchy will also be used to guide the development process of the agents, prioritizing the creation of decision trees and possible actions by starting from the essential needs and working up. In the event of time constraints, this strategy will allow for a functional AI to be tested even if every desired feature cannot be included. This alternative approach to AI design is intended to create a more realistic decision making process within each agent, and ultimately improve the player experience.

The game itself will be a 2D environment containing agents, props and set pieces, and the Player character. To remove the barrier of engine design, the game will be developed using C# and the XNA 4.0 library, which allow for rapid development of small scale games. The game environment will resemble a small town, with the agents acting as residents of the community. Agents and Player alike will be able to interact with, create, and destroy various features within the game world, such as farmland or buildings. Utility metrics will be kept both for individual agents and the game environment as a

measure of “success” for each level of the Heirarchy implemented in the game. The Player character that users will directly control will be able to create and destroy aspects of the environment or even agents themselves, allowing the user to alter and change the environment as he or she sees fit and to observe the response of the agents to their changes. The overall complexity and variety of the environment and its contents will ultimately be determined by both feasibility and time constraints.

The overall success of each AI design will be measured by the experience it elicits from the players of the game. Each player will record their thoughts on the AI, noting agent behaviors on how believable their choices were, how well they responded to the player’s actions, and overall enjoyment of the game. These metrics will demonstrate both how well the agents emulated human behavior and how much they added to the user’s experience. This divide will also allow a small glimpse into how a realistic AI system can alter a game experience, and if such a change is even for the better.

THE RISE AND IMPACT OF THE CASUAL MARKET IN THE GAMES INDUSTRY

With the launch of the Nintendo Wii, a large section of the general public was now finding themselves entrenched in the gaming market that was previously thought to be of interest to only a small subset of the population. Combining a family friendly marketing campaign with a new, more intuitive control scheme, the Wii won over young and old alike. Combined with the immense popularity of cell phone games thanks to the success of the iPhone and Android OS, a new term has gained prominence in the gaming community to describe this massive influx of new players: “casual gamers.” In my STS

report, I will examine the emergence of the casual games market in how it has shaped the games industry, the way people play games, and society as a whole.

It appeared that the Wii would be a uniting force in the gaming industry, legitimizing games as something to be enjoyed by everyone, and the stigma of games as an activity for geeks and shut-ins would be dispelled. Kids would buy the system for their parents and grandparents, seeing it as a great way to bridge the generational gap between gaming youth and adults who still referred to any gaming device as "the Nintendo." Rather than unite, however, the Wii and the interest in games with broad appeal created a schism in the gaming markets. When looking at the top selling games for each modern system, this division becomes apparent. According to vgchartz.com, 9 out of 10 of the top selling Xbox360 titles are rated "Mature," all featuring violent content, while the Wii's top sellers do not see a Mature game until spot 39 with Resident Evil 4. The demographics in gaming are becoming distinct enough that a new language be used to describe this sudden split in markets.

"Casual" gaming is born, along with its opposite, the "hardcore" gaming market. The two terms are frequently used throughout gaming press and media, though their exact distinction is unclear. Kuittinen et al. attempted to define and explain the terms in their conference paper Casual Games Discussion (2007). One way they describe casual games is "easy to learn, simple to play and offers quick rewards with forgiving gameplay," (Kuittinen et al., 2007, p. 2). Hardcore gamers, in contrast, "play games that are extremely competitive [and] require a greater degree of involvement." In addition, the paper goes on to explain the ways that the terms can be applied and the different interpretations and meanings that can be attached to it. A gamer can play a hardcore

game in a casual way, such as playing Call of Duty a few hours a week on Easy, or play a casual game with a hardcore mindset by trying to break a world record in Bejeweled. What ultimately matters, though, is how the game industry views the two segments as part of its audience, and how that audience in turn views its own groups.

From this division of casual and hardcore markets, there is a strong debate in gaming discussion channels over the direction of the industry. The competition between game consoles has always been around, with the "Console War" generating strong devotion for particular ways to play games. Now, however, rather than framing the issue as Sega vs. Nintendo, it has become hardcore vs. casual, with the Wii and facebook games being the poster children for casual gaming and the 360, PS3, and PC supporting the hardcore base. This competition between the two types of players has lead to outrage by each group whenever they meet at a common game, with every change in the game formula being seen as concessions to one side and abandonment of the other. Most apparent is with the popular MMORPG, World of Warcraft, initially became so successful due to being a fairly forgiving experience when compared to endless amounts of time and effort required for similar games like Everquest. However, the influx of casual players has caused the implementation of other design decisions designed to make the game even more accessible, leading to conflict in the game community over the implementation of "welfare epics" (Paul, 2009), among other design choices.

The Wii's success has encouraged other companies to invest in the idea of alternate control schemes as well. The Kinect, Microsoft's newest Xbox 360 peripheral, has taken the motion controller to the next iteration with cameras that track the entire body, using the motions of the player as input. Sony came out with its own Playstation

Move, a new control system for the PS3 that tracks movements of the “wand” controller through a camera to perform on-screen actions. The Kinect in particular has been a major success, breaking the Guinness world record for “fastest selling consumer electronics device,” (Chace, 2011) despite the steep price tag and down economy. Kinect's success supports the Wii's popularity as not just an isolated phenomenon, but a call from the public at large for new ways to control and experience games. Investors will be pushing for the next big thing in game control technologies, shaping the future of the industry with the products they feel will be the newest craze.

In my research, I will examine the attitudes and history in an attempt to explain why this intense competition has arisen between the two types of players, and what can be done, if anything, to reconcile the differences and advance the industry and games as an accepted medium of entertainment. The Wii and casual gaming has introduced a new wave of players to the gaming market and changed people's expectations of games and gamers to bring it to a level of acceptance similar to those of film and television. But the idea that certain types of “serious” games are only for the hardcore gamer is still widespread, limiting the new market to a small subset of gaming experiences. If the reasons for these ideas and the driving force behind dividing the game market in such a way can be uncovered, it could lead to new ways of thinking about the games people play and gaming in society. Combined with the results of the technical research, it will be seen if these new ways of playing that will dominant the market in the near future will indicate a weakening support for the traditional games that diehard fans know and love.

ANTICIPATED RESULTS

In developing my AI, I hope to test my new approach to realistic artificial intelligence in game design. Through this research, I plan to learn more about what makes a fun game AI, and how realistic AIs impact gameplay for players. This knowledge can be passed on through the games industry, fundamentally changing the way game AI is designed in the future. While I observe the effects of the casual gaming market, I hope to answer some of the hard questions surrounding the issue, deciding if the markets can be reconciled at all and advising on the future of the industry surrounding both types of gamer. Together, it is my hope that my research will shape the industry for the better, advancing on the increasing impressive technology and potentially reuniting and legitimizing gaming as something everyone can enjoy.

BIBLIOGRAPHY

Kultima, A. (2009) Casual Game Design Values. *Proceedings of the 13th International MindTrek Conference: Everyday Life in the Ubiquitous Era*, Tampere, Finland: ACM, pp. 58-65.

Russel, S. & Norvig, P. (2009). *Artificial Intelligence: A Modern Approach* (3rd ed.). N.J.: Prentice Hall.

Kuittinen, J., Kultima, A., Niemel, J., and Paavilainen, J. (2007) Casual Games Discussion. *Proceedings of the 2007 Conference on Future Play*. Toronto, Canada: ACM, 105-112.

Fritsch, T., Voigt, B., and Schiller, J. (2006) Distribution of Online Hardcore Player Behavior: (How Hardcore Are You?). *Proceedings of 5th ACM SIGCOMM Workshop on Network and System Support for Games*. Singapore: ACM, 16.

Bernhaupt, R.. (2010) *Evaluating User Experience in Games Concepts and Methods*. New York, NY: Springer.

Yildirim, S. & Stene, S.B. (2008) A Survey on the Need and Use of AI in Game Agents. *Proceedings of the 2008 Spring Simulation Multiconference.* San Diego, CA: Socitety for Simulation International, 124-131

Lecky-Thompson, G. W. (2008). *AI and Artificial Life in Video Games.* Boston, MA: Charles River Media/Cengage Technology.

Consalvo, M. (2009) “Hardcore Casual: Game Culture Return(s) to Ravenhearst. *Proceedings of the 4th International Conference on Foundations of Digital Games*. Orlando, Florida: ACM, 50-54.

Voida, A., and Greenberg, S. (2009) Wii All Play: The Console Game as a Computational Meeting Place. *Proceedings of the 27th International Conference on Human Factors in Computing Systems*. Boston, MA, USA: 2009, 1559-1568.

Paul, C.A. (2009) Welfare Epics? The Rhetoric of Rewards in World of Warcraft. *Games and Culture, 5,* 158-176. doi:10.1177/1555412009354729

Charsky, D. (2010) From Edutainment to Serious Games: A Change in the Use of Game Characteristics. *Games and Culture, 5, 177-198.* doi: 10.1177/1555412009354727

Chace,Z. (2011, March 11). Kinect: Fastest Selling Consumer Electronic Device. *NPR*. Retrieved from http://www.npr.org/2011/03/11/134448272/Kinect-Worlds-Fastest-Selling-Consumer-Electronic-Device

Livingstone, D. (2006). Turing's Test and Believable AI in Games. *Computers in Entertainment, 4(1), article 6.*

VGChartz. (2011) *Software and Hardware Totals* [Data set]. Available from http://www.vgchartz.com

Mu ller, J. P. (1996).*The Design of Intelligent Agents: A Layered Approach.* Berlin: Springer.