Female Portrayal in Games through Costumes: Designing and Creating Appealing Armor for Female Players

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FEMALE PORTRAYAL IN GAMES THROUGH COSTUMES: DESIGNING AND CREATING APPEALING ARMOR FOR FEMALE PLAYERS

A Thesis
Presented to
the Graduate School of
Clemson University

In Partial Fulfillment
of the Requirements for the Degree
Master of Fine Arts
Digital Production Arts

by
Nancey Fang
May 2022

Accepted by:
Dr. Eric Patterson, Committee Chair
Professor Insun Kwon
Professor Tony Penna
Abstract

This thesis details the design, development, and creation of variations of more functional female armor designed for games with the female audience in mind. The goal is to empower female players by designing and creating strong armor that is not sexualized and that women can enjoy. I want to show that women can be portrayed as strong and powerful in games by designing armor that is equivalent to their male counterparts. Due to the gender imbalance in the video game industry and player base, it seems that female players aren’t catered towards when most games are created [13]. Many studies show that female characters are more sexualized than male characters while also being underrepresented [15][24]. Many times this is reinforced by the female characters’ costumes and armor designs. Female characters are much more likely to expose skin and wear inappropriate clothing than their male counterparts [15]. These design choices can alienate women from playing certain games or getting into video games entirely.

There are negative effects that can arise from the stereotypical female portrayal and under-representation in games, such as lowering self-worth and body esteem [8][6]. It may also encourage stereotypical treatment of women and lead to negative views towards women’s capabilities [41][8]. Instead, having more inclusive and representative portrayals of female characters can encourage more females to play video games and potentially join the gaming industry, thus balancing both the video game industry and player base.

This thesis researches female preferences in games, highlighting the differences in character preferences between male and female players. Studies show that female players are more likely to choose same sex characters than male players [47]. Female players are more likely to be annoyed by oversexualized female characters than male players, but interestingly enough, female players also are more likely to play games with attractive characters in the game versus male players [25][39]. This shows how important gender identity, representation, and appearance are to most female players.
This paper will also cover my female armor process from the research, initial concepts, and the entire in-game-model creation along with the tools used. The designs are heavily inspired by historical, female armor, and female armor in media that have been praised for empowering women, such as “Horizon Zero Dawn” and “Avatar: The Last Airbender”.
Characters have always been my favorite part of games and stories growing up. So, naturally I’ve been drawn to creating character art rather than environments or props. I believe that characters are a strong storytelling tool and way to relate to the audience. I have always gravitated towards strong female characters in games and shows. Seeing female characters I relate to in games and shows has always uplifted me, and I want to spread that to more girls, especially since they are underrepresented.

Ever since I was very young, I have played various video games with my little brother and older sister. However, my sister and I were always discouraged from playing by our parents while our brother was given a pass. They stated that girls shouldn’t play as it is only for boys. Classmates would also make comments about how different and weird it was that I liked games so much. These cultural norms and stereotypes just reinforce that only males should enjoy games. Along with that, seeing mainly male casts and characters with the few female characters being one dimensional or oversexualized, that could be a reason why there is a gender imbalance in games. I always wanted more girls to share my interests growing up but many of them were turned off by how much of a “boy’s club” it was along with the sexualization of many women in games. So, I want to encourage more girls to play video games and make female characters that girls will enjoy.

Thus, I want to create female armor designs that are equally as protective as the male ones for a female audience. I decided on armor specifically over general costumes because I want to empower women and help them feel strong. Generally, female armor is less practical and more sexualized than their male counterparts. I want to encourage more strong female characters through the armor designs that are equal to the male designs. I want the designs to not alienate and oversexualize women. While there are unsexualized, functional, female armor designs already, such as the armor from “Horizon Zero Dawn”, “Avatar: The Last Airbender”, and “Metroid”, they are in
the minority. My goal is to make designs with women and girls as the primary audience to encourage girls into the video gaming space.
Acknowledgments

Thank you to my chair, Dr. Eric Patterson, and committee members, Professor Insun Kwon and Professor Tony Penna, for all the feedback and help! I really appreciate all the support and guidance throughout this entire process and my time at Clemson as a graduate student. Thanks to all my dear friends and family that have supported me as well. I’m grateful for all the friends in Digital Production Arts that I’ve made from my time here.
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Chapter 1

Introduction

This thesis document is about designing female armor designs for video games that are appealing with the female players in mind. I believe the female player base is an untapped market, as most video games are made by males and catered towards males. This thesis covers the history and gender demographics of the gaming industry and differences in female and male costumes in games. The goal is to encourage more women to join the video gaming space and empower them by designing more functional, armor that they would enjoy, since currently female characters are more likely to be oversexualized than male characters [15]. I wanted to create armor that is more equivalent to the male armor in games. The sexualized design choices can alienate female players, so this thesis concerns female preferences in female video game characters and the differences in male preferences.

Using my findings, I’ve created various female armor designs that are catered towards women and not oversexualized. The designs are created with research and feedback on female preferences in female character designs. The designs are also inspired by female armor in media with good female representation, such as “Horizon: Zero Dawn” and “Avatar: The Last Airbender”. They are also influenced by historical armor worn by female warriors. The designs are then turned into 3D game models, starting with high poly modeling. The models are then re-meshed, UV unwrapped, textured, rigged, and finally, posed and rendered in engine.
Chapter 2

Background

2.1 History and Demographics of Gaming

Video games have come a long way since they first started being available to the general public in the 1970s with the release of the Magnavox Odyssey and the first home computers [35]. Now, it’s a huge industry that generates more revenue than the film industry. In 2016, the film industry had a global revenue of 49 billion USD, while the games industry generated 101 billion USD [29]. In 2019, the film industry generated 101 billion USD, surpassing 100 billion for the first time according to the Motion Picture Association [34]. However, the games industry stays ahead with 150 billion USD [45]. The gap between the two industries grows as COVID-19 hits, causing the film industry to lose 32 billion while the game industry thrives with a global revenue of 174.5 billion USD [5]. So, video games are now a big part of many people’s lives and continues to be a big industry.

When the game industry first started, there were more male developers and barely any female developers. From 2003 to 2005, the percentage of women working in the games industry in total increased from 7 percent to 10 percent [26]. Even now, there’s still a gender imbalance. According to statista.com, women only represent 30 percent of the workforce in the games industry in 2021 [12]. While this is a significant increase since the start of the industry, there is still a very big gap. This is likely due to the fact that the computer science and software development field is also dominated by males, as the game industry is a subset of it.

Like the video game industry, there is a gender imbalance in the player base as well. During
Figure 2.1: Video Game Industry vs Film Industry Global Revenue

Figure 2.2: Female Percentage in Game Industry and Video Game Player Base
the early years, in the 1980s, the entire gaming market was only around 5 percent female [33]. However, more females are playing games now, and the percentage of female gamers has been fluctuating from 41 to 48 percent in the past decade [13]. According to statista.com, 45 percent players are female in 2021 [13]. While the percentage seems rather equal, it doesn’t tell the whole story as there are more women in certain genres of games versus others.

A survey by Quantic Foundry shows off the percentage of female gamers in various genres, as seen in Figure 2.3. The Match 3 and Family/Farm Simulation genres have the highest percentage of women at 69 percent while the next highest is considerably lower with Casual Puzzle games at 42 percent [46]. The variance in the percentage of female players is very large, from 2 percent

![Figure 2.3: Female Percentage in Each Game Genre from Quantic Foundry](image-url)
to 69 percent, which can cause the overall statistic of 45 percent to be misleading. This can be dangerous as it may cause developers to develop their games as normal, without thinking of their female players. There are outliers within each genre as well. Within MMOs (High Fantasy), the game “World of Warcraft” is an outlier having a 23 percent female player base which is substantially lower than the 36 percent group average [46]. There are also games that have a substantially larger female average within their genre, such as “Star Wars: The Old Republic” is at 29 percent versus the 16 percent average in Sci-Fi MMOs, “Assassin’s Creed” at 27 percent versus the 14 percent in Open World Games, and “Dragon Age: Inquisition” at 48 percent versus the 26 percent average in Western RPGs [46]. Quantic Foundry hypothesizes that the reason why the genres lower in the graph have less female players is because those games tend to involve playing with strangers online and have less female protagonists [46]. This shows that there are opportunities to attract more female players within genres with a smaller female player base.

This gender imbalance can influence many game design choices. It can explain why female characters are underrepresented in video games. An analysis by Diamond Lobby compiled 100 games released in the last five years, from 2017 to 2021, and found that 79.2 percent of main characters is male and 66.5 percent of game characters is male [24]. Their analysis found that 27.7 percent of game characters are female, while 31.7 percent of games have only male characters and 5 percent of games have only female characters [24]. This imbalance can also lead to most design choices being catered towards the male audience and the male gaze. For example, Lara Croft, from the original

![Figure 2.4: Lara Croft over the years.](image)
“Tomb Raider” (1996) game, and her ample breast size was initially a mistake and became a joke in the office [25]. It then became one of her defining features for many years to come until the 2013 “Tomb Raider” game changed her design.

Decisions and portrayals motivated by the male gaze can alienate female players or even female non-players who are interested in trying out video games, as we will see in the next section about female preferences. Though, recently developers have been trying to improve this and make more relatable and less objectified female characters. Examples of this change include Aloy from “Horizon: Zero Dawn” and the 2013 change of Lara Croft in “Tomb Raider” [16]. These changes are made to include women and take their preferences into account.

2.2 Female Preferences

There have been studies to determine the differences in male and female preferences in games, particularly over gender and sexualization of characters. Surveys and studies have shown that female players prefer to play characters of the same gender more than male players. In a survey run by Quantic Foundry with almost 3,000 participants, it showed that female players strongly preferred a character of the same gender. Seventy-six percent of female players prefer playing a character of the same gender, while only 48 percent of male players and 38 percent of non-binary players prefer playing a character of the same gender [47]. In the online game, “League of Legends”, researchers have also found that female players tend to choose avatars of the same gender more than male players [4]. Female players also are annoyed more than men when they see oversexualized women in media and games. Experimental evidence even shows that sexualized portrayals of women in video games may discourage women from even playing [25]. Female participants of the study consistently chose to play games that feature a nonsexualized female protagonist versus a sexualized one. In another study by Reinecke, Trepte, and Behr, it was found that women preferred female characters but not hypersexualized ones [25].

In a Korean study, female players choose who their favorite female characters are in Blizzard’s game, “Overwatch”, along with the characters they play the most. The number one character participants chose as their favorite was D.Va, who is a Korean woman in the game [21]. The study brings up a point that a reason why D.Va was so popular was because the study was conducted among mostly Koreans. Ana was the second favorite choice and also the character the participants
Figure 2.5: Character Gender Preference by Player Gender [46]

Figure 2.6: D.Va and Ana from “Overwatch”
played the most [21]. While most reported to play characters based on capability rather than appearance, the female participants seemed to prefer non-sexualized characters like Ana, who is a 60 year old woman.

This may show that women like to see characters that they can relate to and have things in common with, as seen in the Korean Overwatch study with D.Va being most participants’ favorite character. They’re more likely than men to choose same gender characters and appear to like less sexualized characters. However, interestingly enough, women are significantly more likely to play a game with attractive characters than men according to a study [39]. This is also mirrored in studies of “League of Legends” and “Overwatch” players. Many female players state that they play certain characters because of how attractive and visually appealing they are [4] [21]. This trend is also seen in some feedback for the Amazon Games Studio’s MMO game, “New World”. In many forums and online discussion sites, such as New World’s forums and Reddit, it seems like many players, of all genders, were disappointed by the lack of good female model customization and armor options [23] [17]. Many complained that the female face options were masculine and not very attractive. Also, they criticized the female body being too masculine with the armor being ill fitting. It seems like some of the complaints from women are that the armor seems to be designed for male characters which then are shoehorned on to the female characters, meaning that female players seemed like an afterthought.

So, it seems that creating a conventionally unattractive female character isn’t what women typically want or will make them more likely to pick up a video game. Social Identity Theory may explain why some women have a negative attitude towards video games. Social Identity Theory is built on the basis that individuals categorize themselves into groups based on perceived similarities. People also tend to rank others in their shared categories or groups as more positive [40]. Individuals would naturally want to see their groups portrayed positively in media because it leads to a positive self identity [25]. So, seeing how media represent their groups in a certain can give an indicator about a group’s standing in relation to other groups [25]. Maintaining a positive self-concept by seeing their own group members in media can motivate many behaviors like selective exposure to media. So, when women see many negative depictions of female characters in video games, they may avoid playing games entirely [25]. Seeing female characters being portrayed negatively, especially when compared to male characters may make women see games as negative.
2.3 Differences in Female and Male Costumes

There are many clear differences in how female characters and male characters are portrayed. Female characters are more likely to show skin than male characters and more likely to be sexualized. This has been backed up by multiple examinations of characters in games. In one examination by Downs and Smith, female characters were more likely than male characters to be nude or wear sexualized and improper clothing [15]. In another analysis of female characters as sex objects by Beasley and Standley, of 47 randomly selected games, only 13 percent of characters were female and they were more likely to be in low-covered clothes and bare arms [7]. They found that 70 percent of female characters in mature-rated games and 46 percent of females in teen-rated games had abundant cleavage, 86 percent were wearing revealing necklines, and 48 percent did not have sleeves [8]. Whereas with male characters, only 22 percent had no sleeves and 14 percent had revealing necklines [8]. Overall, female characters are more likely to be showing more skin and sexualized compared to male characters.

In games where you can choose your gender with customization, there are generally the same costume themes for each gender. Many times the costumes are tweaked and changed depending on the gender of the character and the oversexualization of female characters is evident. “TERA Online” (2011), a massively multiplayer online role playing game (MMORPG), is one of the games that has a stark difference in their male and female armor sets. Figures 2.7 and 2.8 show costumes from TERA.

![Figure 2.7: Pirate Armor Costumes from “TERA Online”](image)

Figure 2.7: Pirate Armor Costumes from “TERA Online” [43]
Online that are pirate themed and steampunk themed respectively. The two older looking female characters in the pirate costumes are showing abundant cleavage, wearing low cut shirts, showing off their midriffs, and wearing bikini bottoms. The male characters, while some are also wearing low cut shirts, are much more covered up. They do not show off any skin outside of their chests. The steampunk themed costumes has an even bigger noticeable difference. All the female characters, even the younger looking girl, are exposing cleavage and wearing bikini bottoms. This time, all the male characters are completely covered from the neck down.

The female characters’ costumes are oversexualized because they seem to be catering towards a typical male audience. Even the differences in body types between the male and female characters are evident. The male characters have a bigger range in body types from skinnier to bigger and broader, while the female characters are all thin with small waists and emphasized busts, with the exception of the one younger girl.

It appears that in more recent games, like “Monster Hunter Rise” (2021), there is less sexualization in female armors, though there are still interesting design choices to point out. Looking at Figure 2.9, the female armors are more likely to show off skin, mostly around their chest, stomach, and thighs which accentuates the female body. Their faces are also less likely to be obscured.
Figure 2.9: Armor sets from “Monster Hunter Rise” with the male and female versions [18]

compared to their male counterparts. Generally, female characters have less and lighter armor that shows off more of their body. However, there are some armor sets in the game with very few differences between the male and female versions, as seen in Figure 2.10. These armors cover both genders equally with some design changes to make them either more masculine or feminine. The only major difference is that in the Alloy S Armor Set, the helmet does not obscure the female character’s face as much.

This brings up another big difference between the male and female designs. The female character’s faces are much more likely to be less obscured than the males’. Out of all of the armor sets, 142 total, the six in Figure 2.11 are the only ones where the female armor completely covers the head. There were not any armor sets that obscured the female character’s head more than the male character’s head.

There are also a few male armor sets that seem to expose as much skin as the female armor sets, as seen in Figure 2.12. Interestingly enough, the Utsushi (Hidden) S / Medium S Armor Set has the male version show more skin on their body, having exposed shoulders and arms, than the female version, which is completely covered from the neck down. However, again, the female character’s
Figure 2.10: Armor sets from “Monster Hunter Rise” with the male and female versions. These appear more equal in their designs [18]
There are many reasons for these design choices as stated before, women generally do like to play as their own gender and still have a feminine appearance. However, looking at armor designs from these two games, it is clear that female armor expose more skin, are less functional, and more sexualized.
2.4 Side Effects of Sexualizing Women

There has been studies and theories centering media, such as television, advertisements, and magazines, and its effect on individual’s self image and worth. It has been shown that exposure to idealized images of the female body negatively affects young girls’ and women’s self worth [8]. This seems to be reflected in video games as well, since video games vastly unrepresented women along with oversexualizing them. In a study conducted by Barlett and Harris, college-aged women and men from the Midwestern United States played a video game that displayed muscular or thin characters for 15 minutes and then completed a post-game body image evaluation. Results from the study showed that both men and women had significantly lower body esteem after the play session [6]. For the women, there was a decrease in positive feelings towards their body and a small decrease in their feelings of sexual attractiveness, while there was not a significant change in their body satisfaction scores, which is associated with negative thoughts about the body [6]. Though the insignificant change in body satisfaction in women versus men having a negative change should be handled with caution because the questions used to gauge body satisfaction were different for men and women.

Having sexualized and stereotypical portrayal of women in games may also perpetuate gender stereotypes and traditional gender roles. Just like how media can negatively affect people’s body image, media can affect people’s views on women and reinforce gender stereotypes. A study by Ward and Friedman examined the effects of exposure to stereotypical media. Television scenes of women portrayed as sex objects were shown to adolescents, and it was found that those who watched the stereotypical media were more likely to report to believe in gender stereotypes and condone stereotype-consistent treatment of women [41]. To see if the same results would happen with video games, Behm-Morawitz and Mastro conducted a study, having groups play a sexualized female character, non-sexualized female character, or no video game at all. The results of the study showed that participants who played the sexualized character reported less favorable attitudes towards women’s cognitive abilities than those who did not play a game or the non-sexualized character [8]. Women participants who played the sexualized character reported less favorable attitudes towards women’s physical capabilities than women participants in the other two groups [8]. However, the male participants of the study did not report a difference in attitude towards women’s physical capabilities regardless of sexualization [8]. These studies seem to show that having stereotypical
portrayals of women can affect the players’ views and beliefs of women and reinforce traditional
gender stereotypes.

2.5 Benefits of Inclusive Character Design

While sexualizing women have negative consequences, there are many benefits to having
inclusive character design and closing the gender gap. Many game publishers seem to believe that
making inclusive game design choices will lead to less sales, due to alienating their male players.
However, the opposite is actually true. A study by Burch and Wiseman in 2015 shows that 70 to 85
percent of American male adolescents want to see more adolescent females play video games [31].
Also, “Horizon Zero Dawn”, a game featuring strong female protagonist and cast has been critically
acclaimed and sold over 20 million copies as of November 28 2021 [22]. This shows that having
strong, nonsexualized female characters can be enjoyed by the male players as well and is just as
profitable.

As mentioned before, women are more likely to choose to play female characters and char-
acters they relate to. Having more inclusive character designs and bringing more women into the
creative roles will appeal to women and encourage them to play video games [42]. Along with enjoy-
ing video games, seeing women in the industry will encourage more women to join the game industry
and close the gender gap. Some may wonder if gender gaps in industries is even an issue. It turns
out, in a study by the Equal Opportunities Commission, it was discovered that occupational segre-
gation based on gender or race is the strongest influence on young people’s career choice [42]. So,
many people tend to choose jobs that seem to represent their own gender. This segregation damages
both individuals and the businesses and economy because it contributes to skills deficits, which has
been recognized as an issue by the government [42]. For example, there’s been a consistent shortage
of programmers in the games industry that women could be filling if more women were interested
in the industry [42].

Another benefit of inclusive character design is increased revenue. An example is the mobile
game, Candy Crush Saga. It generates over a billion dollars every year, mainly through the players
who spend money on the app. Sixty percent of players are women, many of whom spend thousands
of dollars on the game, individually [42]. As mentioned before, with “Horizon Zero Dawn”, appealing
to a wider audience can also lead to increased revenue, as the game is appealing to people of all
genders. There is potential to earn more money if game developers appeal towards women as well as men.
Chapter 3

Related Work

3.1 Works with Non-Sexualized Female Armor Designs

When discussing female armor, bounty hunter Samus Aran from “Metroid” (1986) is a character that will definitely come up. Samus is even considered the first playable female human character in a video game [20]. Samus’s armor is her power suit, which is a full body mechanical covering that has a more masculine shape to it, with accentuated, broad shoulders, as seen in Figure 3.1. When Metroid was first released, her gender was a secret. The accompanying game manual even referred to Samus as “he” [36]. She was believed to be male, and the way her true gender was revealed was by beating the game fast enough, where Samus takes off her helmet. It was a first to have a female human protagonist, and it especially meant a lot that Samus was portrayed as very strong. However, the developers had five different endings to the game, depending on how fast the players beat it. The slowest time will just have Samus in her suit, without revealing anything, and the fastest time will have Samus take off her entire suit, revealing her in a bikini. The first sprite in Figure 3.2, is the reveal in “Metroid,” and the other two are endings for the sequels. In an interview with the “Metroid” developers, it was revealed that making Samus a woman was a decision made in the final stages of development when they wanted different endings depending on completion time [11]. They wanted something that would shock players and someone suggested making Samus a woman [11]. It seems like the developers decided to sexualize Samus because she was a woman by revealing her body to the players as a reward. Despite the sexualization at the end of the game, making Samus a woman was a step in the right direction for having more female representation.
Figure 3.1: Samus’s power suit in “Metroid Prime”. [30]

Figure 3.2: Samus Aran in the top endings of “Metroid”, “Metroid II”, and “Super Metroid.” [2]
A video game that has been praised for its female armor designs is Guerrilla Games’ “Horizon: Zero Dawn” (2017). The story follows a woman named Aloy, who has been outcasted from her tribe as a baby. She travels and fights to discover her past and find out why she was outcasted. Aloy is portrayed as a very strong female character within a matriarchal society. She wears practical armor and clothing and is not sexualized at all [44]. Her armor is layered and protective with many different types of materials. Even though Aloy is conventionally attractive, with a fit body and attractive face, she is not objectified. An interview with the director, Mathijs de Jonge, he said that while they wanted have a female protagonist, they wanted her to be an interesting character first and foremost [44]. Aloy was treated like a human being without any drawn attention to her gender. She’s not the only female character in the game who is portrayed this way either. The secondary female characters are dressed appropriately and have strong roles. Aloy and the other female characters of Horizon: Zero Dawn are great female representations in video games, which led to the great success of the game.

Another piece of media that has strong, female armor designs is the television show, “Avatar: The Last Airbender.” The main two female armors worn in the show are Princess Azula’s royal armor and the Kyoshi Warriors’ uniform. Azula often wears her royal armor as a status symbol, but it is also protective as it covers her chest and shoulders. The armor fits her design visually and also reinforces her narcissistic and confident personality. The Kyoshi Warriors are a group of only female
fighters. Their attire is also well protected and designed. They wear heavily armored green kimonos and wield fans as weapons. They also wear metal headdresses and make up similar to those worn by kabuki actors or traditional Chinese opera singers. “Avatar: The Last Airbender” has many strong female characters and the armor designs to match.

3.2 Historical Female Armors

Throughout history, there have been women warriors that fought alongside men. In the Medieval period, while rare, there are several references to women engaging in armed conflict, such as noble ladies-turned-military commanders, Countess Jeanne de Penthièvre [10]. Despite these references, there’s actually no known surviving images of a woman in armor from this period [10]. Even the most famous female warrior, Joan of Arc, who had armor commissioned for her from French King Charles VII, does not have an illustration of her donned in armor [10]. However, there are descriptions of women in armor from that time period that mention how masculine the women are in their armor [14]. They were also described as wearing hauberks, the chain mail shirts that protected the arms, torso, and upper thighs [14]. It seems that the women wore similar or the same armor as the men.

Onna-Musha, also known as Onna-Bugeisha, are female warriors in pre-modern Japan that fought alongside samurai men [28][32]. According to written references and drawings, they typically wore traditional kimono with samurai armor on top, similar to the men during that time. [9][38]. Much like medieval armor, most the Onna-Musha in history tend to just wear the same armor as the males.
3.2.1 Real Life Armor

While in many games and media have female armor that have chest plates that are molded to the breast shape, it is very impractical and even dangerous for the women wearing it to combat. The reason behind the rounded shapes of armor is to deflect and redirect blows away from the body [37]. Having a valley in the middle of the chest would guide sword and arrow blows directly to the sternum and heart [37]. Even if the weapon has to penetrate the armor first, it is still not a design flaw and can cause more harm to the woman versus using a normal rounded armor.
Also, realistically, armor has to be layered on top of protective padding to absorb blows [37]. Having nothing and just skin underneath armor can be uncomfortable and does not provide as much protection, which is very common in armor designs in video games. In Figure 3.6, the female armor in “World of Warcraft” leaves major body parts, such as the chest, arms, stomach, and thighs, unprotected. Even some armor pieces do not have padding underneath to provide more protection.
Chapter 4

Design and Implementation

This chapter will detail the research and inspiration of how the designs are created, along with how the model was created. Many of the inspirations were taken from the related works talked about in the previous chapter. To see the design studies done and images of various steps of the game model creation, see the Appendix.

4.1 Character Design Process

The first step in the design process was researching which armor that was generally praised for having non-sexualized female designs, such as Aloy from “Horizon Zero Dawn”. Other designs include the Kyoshi Warriors from “Avatar: The Last Airbender” and Titania from “Fire Emblem: Path of Radiance.” The common design elements between these are that they do not emphasize the female figure or show off excess skin, while not hiding femininity. The designs are also practical, as they have armor layered on top of cloth and protect major body parts. Another inspiration to the designs are historical armor that women wore, which are very similar to the armor men wore. Many research findings were also kept in mind, as women tend to not prefer sexualized female characters. Women also seemed to like more attractive characters that represent their own gender.
4.2 Concept 1

The first concept, shown in Figure 4.2, is an armored costume based on the Kyoshi Warriors and the Onna-Musha’s gear, as seen in the reference images in the Appendix. I’ve decided on the character being a close-ranged fighter, using a naginata, a Japanese pole arm. The costume is a kimono with layered samurai armor on the chest, shoulder, around the thighs, and forehead band. I also gave the design hand and forearm armor, as the character would be in close combat, mainly using her upper body and arms to swing her weapon around. I wanted to make the costume practical while keeping the costume feminine, since women prefer to play as a character that reflects their gender. I did not sexualize or expose body parts since most women are bothered by impractical, sexualized portrayals of women. I wanted the design to be more protective than the “bikini armor” that is seen in many games. For the colors, I chose a light, pale yellow with a gradient that gets darker at the bottom. I generally kept the brighter colors towards the top part of the costume, emphasizing the head and chest areas.
4.3 Concept 2

The second concept, in Figure 4.3, is a western, medieval styled armor designed for a close-ranged, sword fighter. A lot of inspiration was taken from real life medieval armor and armor from the game “Dark Souls.” Like the first design, this character would mostly use her upper body and arms to swing her sword. So, the majority of her armor is on her upper body. The chest plate is rounded and somewhat form fitting to show off the female form. The gold lining detail within the torso armor was placed to give an illusion of a waist line and a touch of femininity while not compromising the shape and efficacy of the armor. The hip plates also emphasize the hip silhouette while still providing protection. There are leather gloves and boots along with chain mail underneath the armor and shoulder plate. The cape around the armor is to add more materials to the outfit, so it is not mostly metallic. I later designed and modeled an open-faced, head covering for this costume to give more protection, as this is made for close combat and to keep the design appealing for female players.

Figure 4.3: Armor Design 02
4.4 Implementation

Once the concept designs were decided, the game ready model process started. The programs used for these game models were ZBrush, Marvelous Designer, Maya, Substance Painter, Procreate, and Unreal Engine 4. The general work flow of this game ready model was to create a high poly model with the details, retopologize the model, create UV maps, bake the maps, hand paint the textures, rig and then render in engine. I usually like to start with a high poly model and then retopologize rather than with a low-poly model is because I find that it is easier to make major changes to the model without worrying about the topology.

There are some differences between creating a model for a game versus films. Game models are rendered in real time while films are pre-rendered scenes. Due to this, game models usually have to be optimized in their topology and file sizes to be able to run well within a game engine. The following sections will go over what the process of each step is like and how they’re optimized for games.

4.4.1 High Poly Model

To start, a high poly model was created in ZBrush, along with Marvelous Designer. A female base model was used as a starting point, and I adjusted the proportions to make a more athletic build so it would make sense why she was wearing armor. Then, the costumes were blocked in to match my concepts. The hard surface armor pieces and lower body clothes of the Onna-Musha costume were made in ZBrush. The kimono part of the costume was created and simulated in Marvelous Designer. The kimono was then imported to ZBrush for more clean up. I also detailed the pieces so this model can be used later to bake maps for the low-poly. The high poly can still be tweaked after the retopology and UV mapping process, if there are changes that need to be made. So, the next step after the high poly is mostly done is remeshing/retopology.

4.4.2 Remeshing and UVs

The remeshing, also known as retopology, is a step of the game asset process done after creating a high poly model. Since the high poly models are really dense in poly count due to the details, it is not optimized for game engines or animation. Usually, models created only in ZBrush have heavy topology without loops that support deformation, so they can not be used in animation
Figure 4.4: Armor Design 1 High Poly Sculpt

Figure 4.5: Armor Design 2 High Poly Sculpt
Figure 4.6: Head Topology

Figure 4.7: Costume 1 Topology

Figure 4.8: Costume 2 Topology
or games. So, to make the model usable for games, remeshing is necessary to make the model lower poly and ready for rigging and animation. When retopologizing, optimizing poly count and keeping it low makes it easier on the game engine. Another aspect to keep in mind is having supporting loops and rings in the topology for deformation. For example, you’d want loops going around the eyelids and mouths to support the movement.

For the remeshing process, I used Autodesk Maya’s quad draw tool. It uses the highpoly model as a reference and new polygons are drawn on top of it. Generally, you want to keep everything as quads, polygons with four sides. Though having triangles in places that don’t have major deformations tends to be okay and can be used to reduce poly count. In game engines, all the quads are eventually converted to tris. Also, it is generally good to have an even polygon density throughout the mesh so one part isn’t more dense than another, unless there is an area of more importance, such as the face.

Some other tips for remeshing is that you want to keep the major silhouette or the pieces to keep interesting shapes of the high poly, while the edge loops that don’t affect the silhouette can be gotten rid of to save poly count and optimize game performance. Separation of meshes is also generally good to make the textures look clean, though it may add a little more to the overall polycount. For example, if there is a belt on top of arm, the belt can be a separated piece of geometry from the arm. It helps the textures by making the separation in textures (arm and belt) rely on the geometry rather than the resolution of the texture maps. As seen in Figure 4.9, I applied separation of meshes and geometry to the rope on the shoulder since it is near the head and an important area of the model. I did not apply it to the shoes since the area near the bottom of the model is not as important and not viewed as much. As you can see, outline of the rope on the shoulders are cleaner.
After the retopology is done, it is time to UV unwrap and map the model, which was also done in Maya. For this project, the head model was separated from the body, as I wanted to be able to switch the costumes in and out. So, the head and hair was UV unwrapped and mapped separately. The costumes each are packed in one UV tile to save space as these are game ready models. The main aspects to keep in mind for UVs is to make sure the seams are in places that are not seen as much, such as the back of the head, and give the more important parts, such as the face, more space in the UV tile. Also, it’s generally good practice to make the UV borders as straight as possible to prevent aliasing effects when texturing. Once the UVs were unwrapped and packed, it’s time to move on to baking maps and texturing.

4.4.3 Bakes and Texturing

Once the UVs are prepared, I could texture the model. First, the model is imported into Substance Painter and various maps were baked down from the high poly model from the beginning to transfer the details. An ambient occlusion (AO) map, normal map, curvature map, and thickness map are baked from the high poly. These maps can help with texturing later by affecting smart materials or overlayed on top of materials with different blend modes.

After the maps were baked, I decided to lay down the basic colors and materials of each piece. The clean topology of the armor pieces makes it simple to apply the blocks of color by using masks so they do not affect one another. Once that is all set, I exported the albedo or color map as an image to open the model for painting in Procreate on my iPad. Procreate was originally just
Figure 4.11: Substance Painter Preview of Textures
a digital painting app but there was a recent update that allows 3D models to be textured. Since I was already really familiar with the brushes and more comfortable with painting in Procreate versus Substance Painter, I decided to try out Procreate’s new feature to take inspiration from League of Legends’ hand-painted, low-poly style. I only changed the albedo map of the model because I preferred to use Painter to alter the other channels, such as metalness and roughness. After the colors are hand-painted, I import the map back into Painter and tweak them and other channels to fit my design. After the maps are done, the next step is rigging the character models.

4.4.4 Basic Rigging and Animation

There was only a basic rig applied to the game models due to the lack of time and knowledge as my focus is on 3D character modeling and art. A basic rig was applied to acknowledge an important part of the character, game-asset creation process. Almost all character models would have to be rigged in order to be animated and used in games. The rig was created by first putting the character and costume into an auto rigger. I decided to use the website Mixamo, as I was the most familiar with it. It is used by importing the model and placing markers at the chin, elbows, wrists, crotch, knees, and ankles. Then, Mixamo will automatically create a rig for the model. It is not perfect, especially when there are many separate pieces to the model. However, it does give
a good base to start with. I then tweaked the weight paints in Maya to fix odd deformations and make sure the rig is working at a basic level. However, there is no cloth simulation added to the rig. Once the rig is complete, I can import the model back into Mixamo and apply a preset animation to it. I chose a basic walk animation to show case the rig and the deformation of the model’s topology. Once all of that is complete, the next step is to put the final model and animation into the game engine!

4.4.5 Rendering in Engine

During the texturing phase of the model creation, the textures and surfacing was checked in the game engine, Unreal Engine 4 (UE4). The low-poly models were imported into UE4 and the texture maps were applied. The roughness and colors were tweaked in Substance Painter based on how it looked in the engine. The light set up in the UE4 scene is a diffused dome light and key light that does not have any harsh lights that makes a lot of deep shadows. The ability to render and animate the models in Unreal Engine 4 also shows that it is low enough and optimized for games. Now, the game models are complete!
Figure 4.14: Costume 1 Model and Textures in Unreal Engine 4

Figure 4.15: Costume 2 Model and Textures in Unreal Engine 4
Chapter 5

Conclusions and Discussion

This project is based on interpretations of existing research, articles, and academic publications. My initial ideas and designs for the character designs was to avoid sexualization by avoiding showing off any feminine shapes of the female characters. I originally was going to have a more bulky, unfitted shape, similar to male characters wearing armor. However, after the research about female preference, I decided to change my approach. Seeing how female players prefer to play as characters of their own gender with a pretty big emphasis on an attractive appearance and appearing as female, I wanted to make the costumes more form fitting and feminine while not sexualizing them.

I feel the designs are successful in not oversexualizing the female body while being feminine, so female players can self-identify with them. The designs are also well armored to empower women and show that the female characters can be as strong as the male ones. I also gave the female characters a more athletic build, to fit the character and make sense that they’re able to carry around armor and fight. However, the designs’ effectiveness is hard to judge without a proper study or survey to see what female players think. Along with that, further research with more costume designs of varying levels of sexualization and having participants rank and give their opinion could yield interesting results.

The project is also successful in creating low-poly game models. The poly count is low so they can be used in games. The texturing style also replicated the “League of Legends” low-poly style. The texture files were 2k resolution to keep the file sizes low. The low-poly topology was also successful in being able to be deformed and animated.

A limitation with this project is that there was not a complete rig done for the costumes.
and characters. The game models were put into the auto rigger, Mixamo which was cleaned up in Autodesk Maya. There was not any cloth simulation or dynamics applied to the game models. Even though there was not a full rig, the animation applied showed that the topology of the model is still able to handle deformations. Another possible limitation is that the costume designs made were rather safe and realistic. The shapes and designs could have been exaggerated and pushed more to show that nonsexualized costumes are not always “boring” and can still be fantastical.

There’s also possible contradictions in the female character design preferences research findings and my concept designs. There is a balance of not oversexualizing female characters and having appealing character designs with a choice in having armor. For example, having a female character’s head uncovered would make it easier for female players to self-identify and find the character attrac-

Figure 5.1: Costume 1 with the Naginata weapon
tive versus having the head covered. However, in close combat, having a head uncovered would not be as practical. So, it is a tricky situation finding a good balance between aesthetics and practicality for player enjoyment. One possible solution to finding a balance in a game would be to have the player have the choice to show the headgear on their character while still keeping the defensive stats, making it protective. This would give the players the choice in how they want to represent themselves. After this issue was brought up, a head covering and weapon for the costumes were modeled and textured to give more context to why the characters are dressed the way they are, as seen in Figures 5.1 and 5.2. More images concerning the naginata weapon and helmet designs are in the Appendix.

The purpose of this thesis is to show that having female-centric designs can pull in a wider audience and not alienate the already existing male player base. The goal is to also encourage females into the gaming space and possibly the game industry as well, which are both male dominated. I want to have more designs that are female-centric and show that women should be kept in mind when creating games. Overall, I hope there will be more diverse and female-centric designs in games, as I think there is a lot of potential. I hope my designs efforts and research here can encourage more inclusivity for character designs in the future.
Appendices
Appendix A   Design and Creation Breakdown

Figure 3: Armor Studies of Avatar: The Last Airbender and Fire Emblem: Path of Radiance

Figure 4: Armor Studies of Horizon: Zero Dawn
Figure 5: Inspiration and References for Costume 1

Figure 6: Inspiration and References for Costume 2
Figure 7: Cloth Sim for Costume 1

Figure 8: Cloth Sim for Costume 2
Figure 9: UV Checker for Costume 2

Figure 10: Weapon and Headgear Concepts
Figure 11: Standalone Naginata Render
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