

How do Video Games create a realistic atmosphere and how can this be improved?

Creative Computer Games Design
Harry Phillips - P149639

Declaration by Candidate

I hereby declare that this dissertation is my own work and has been submitted exclusively to the University of Wales Trinity Saint David for the purpose of being marked. All research, studies quotes and anything else from other people used in this dissertation have been acknowledged as the work of other people and referenced appropriately.

A handwritten signature in black ink, appearing to read 'J. Phillips', with a large, sweeping flourish at the end.

Date: 10/12/2019

Abstract

This document explores the methodology into how to create a realistic atmosphere in video games, including proof of games using this methodology, as well as exploring more technological methods into how video game developers achieve this, i.e. modelling, texturing, etc. To create immersion, first, the developer or creator must understand how it is formed and maintained throughout a video game. A study took place in 2007 where a group of psychologists came together to explore a theory on how an immersive experience is formed. The study is called "*A Process Model of the Formation of Spatial Presence Experiences*" (Wirth et al., 2007). In this study, instead of using the word immersion, it is replaced with the word presence. Then this methodology is applied to games made within the past two decades, a few games are looked at, breaking them down into two different categories, the media characteristics, in this case, the media characteristics would be video games, and the second being the player's characteristics. After analysing examples of video games, the document will look at technology over the past decade and the numerous new techniques used by game developers to help increase the production value of a game, especially towards creating the realistic atmospheres they desire.

Contents

Abstract	3
Contents.....	4
Table of Figures	5
1. Introduction	6
2. The Formation of Realistic Immersion in Video Games.....	7
2.1 Spatial Presence.....	7
2.2 Media Characteristics:	9
2.2.1 Richness:.....	9
2.2.2 Consistency:.....	11
2.3 Player Characteristics:.....	13
3. The Breakdown of Realistic Immersion in Games	15
3.1 Narrative	15
3.2 Audio and Music	17
3.3 Textures and Animation	19
4. The Improvement of Realism in Video Games	22
4.1 3D Scanning	22
4.1.1 White Light Scanning.....	22
4.1.2 Blue Light Scanning	23
4.2 Lighting and Textures	24
4.2.1 Dispersion	24
4.2.2 Scattering.....	24
4.2.3 Reflection.....	25
4.2.4 Refraction	25
5. Conclusion.....	26
6. Further Work	26
References:	28
Bibliography:	32

Table of Figures

Figure 1 – Spatial Presence Diagram from “ <i>A Process Model of the Formation of Spatial Presence Experiences</i> ” (Wirth et al., 2007)	3
Figure 2 – Screenshot from <i>God of War</i> (SIE Santa Monica Studios, 2018)	8
Figure 3 – Screenshot from <i>Call of Duty: Modern Warfare</i> (Infinity Ward, 2019)	9

1. Introduction

In this document three key topics will be discussed on the foundation of immersion in games, specifically looking at how to form realism in an immersive gaming experience. The first being how does someone create a believable realistic atmosphere and how does one keep this consistent throughout the game, in the first chapter we will look into a 2007 study by Wirth et al. where this is explored more. The second topic will be about breaking down current and past examples of games, for example, *Call of Duty: Modern Warfare* (Infinity Ward, 2019) when this has been done successfully, including examples where in some cases it is not done so well and why this may have happened. Then finally what techniques and methods are being used or can be used within the game development process to improve the realistic factor within games, whether this is to enhance graphics, improve the quality of animations, have more engaging narratives, etc.

2. The Formation of Realistic Immersion in Video Games

2.1 Spatial Presence

To create immersion, first, the developer or creator must understand how it is formed and maintained throughout a video game. A study took place in 2007 where a group of psychologists came together to explore a theory on how an immersive experience is formed. The study is called “*A Process Model of the Formation of Spatial Presence Experiences*” (Wirth et al., 2007). In this study, instead of using the word immersion, it is replaced with the word presence. In this study, the psychologists create a diagram to help visualise what they are suggesting. (Figure 1)

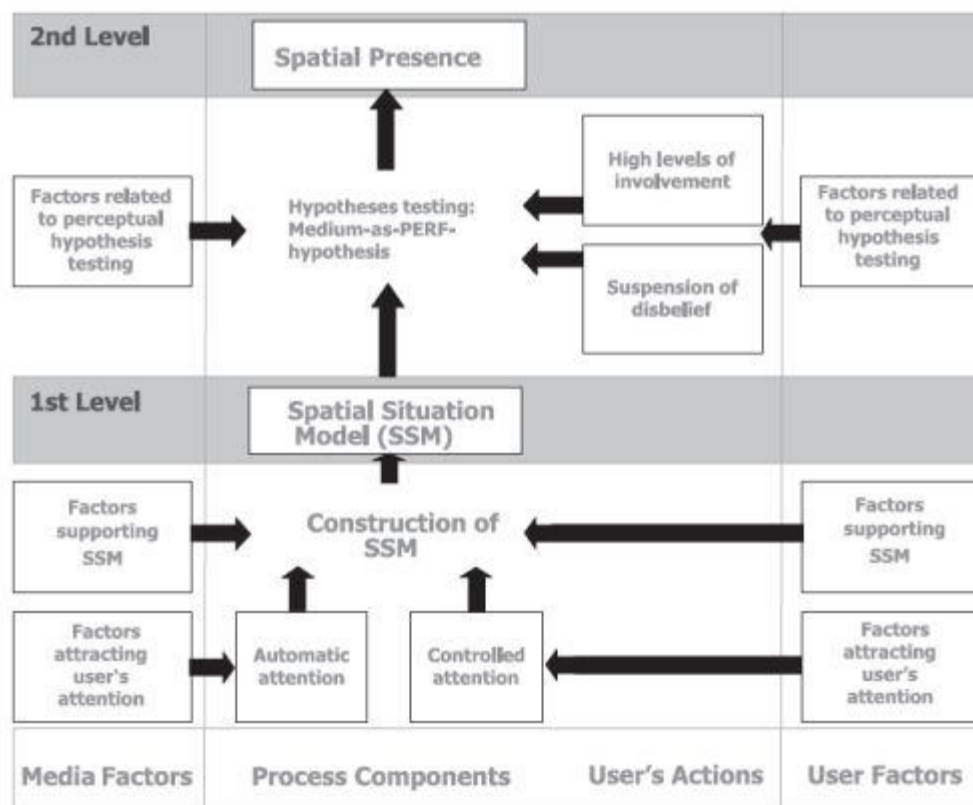


FIGURE 1 - Spatial Presence Diagram from “*A Process Model of the Formation of Spatial Presence Experiences*” (Wirth et al., 2007)

The diagram suggests that there are two separate levels towards the formation of Spatial Presence (Immersion), the first level “is the construction of a mental model of the (mediated) situation that includes space-related information (in a sense, on this level, users deal with the

questions “is this stimulus a space/room? “And “if yes, what kind of space/room is it?”).” (Wirth et al., 2007). Putting this in different terms, this first level informs us that the audience/players, when exposed to the media, will begin questioning its validity, for example, say they are looking at a space-themed game, they would be unconsciously or consciously be looking for spaceships, planets and other things which one would stereotypically find in the environment. The second level “refers to the actual formation of Spatial Presence, which emerges from the SSM through the confirmation of a specific perceptual hypothesis, the so-called “medium-as-PERF-hypothesis” (PERF=primary egocentric reference frame; in a sense, on the second level, users deal with the question “am I located in this space/room?”).” (Wirth et al., 2007) this level suggests that after experiencing the first level of questioning the media base, they then question their own involvement within the environment, asking if they are currently in that room/space.

Various factors have a large impact in both of the levels of Spatial Presence, Jamie Madigan (Madigan, 2010) also researched into “*A Process Model of the Formation of Spatial Presence Experiences*” (Wirth et al., 2007) and structured the information into two different factors towards forming Spatial Presence, the media characteristics, in this case, the media characteristics would be video games, and the second being the player’s characteristics. Both characteristics have sub-factors within them and these will be explained in more detail in the next few paragraphs. The following terminologies/sub-factors by Jamie Madigan will be used in the following paragraphs.

2.2 Media Characteristics:

The media in question are video games, they contain different methods which help build an immersive atmosphere, these different methods can be grouped into two different categories; richness and consistency, both of these are crucial factors towards producing a realistic world for a game, if any of these factors are not made the right way, the game will feel empty and inconsistent with the player's mind set of the game.

2.2.1 Richness:

Richness within video games relates to; multiple channels of sensory information, completeness of sensory information, cognitively demanding environments and a strong and interesting narrative/story/plot. (Madigan, 2010) Sensory information is a term not known to many, this terminology means the brain collects information based off of their senses. With video games, there are three ways in which a player may take in information, through sight, touch and hearing.

Multiple Channels of Sensory information; this means the more senses the player experiences within the game world, the better experience they will have. For example, when a train is involved in the game, it is expected for the 3D model to resemble the likeliness of said object, in mind with the art direction of the game. Hearing the train making a noise, for example, the player can hear the pistons move when it is gaining acceleration and hear the steam as the player can visually see it escape a pipe. The model must be coloured/textured to resemble the object, this however, may change due to in-game events or the overall art style of the game itself. Also, back to the point of the model resembling the likeliness of the object, it must also move correctly, for

example, the pistons and wheels of a train must move in unison, this depends on how realistic the developers want the model to look.

Completeness of Sensory Information; this means that there are no gaps within the game world where the player may question it's input or output, for example, the player is in a city/town however there are no NPCs to be seen, the player will begin to question this if there is no reason given via narrative or by other means. This breaks the immersive atmosphere which the game is aiming to achieve, a good example of a game that achieves this is *Red Dead Redemption 2* (Rockstar, 2018). This game does a good job with completeness of sensory information, the towns and large city in the game are filled with pedestrians and wildlife which fits the genre and stops the player asking questions that would break the atmosphere for themselves. Also, the environment helps support sensory information, as long as the environment is consistent and keeps towards the stereotypes of the genre, in this case, with *Red Dead Redemption 2* the environment must be rural with low signs of large city developments with exception with the city in this game. The player will immediately know what the Wild West must look like due to stereotypes, and when the game keeps to these stereotypes, there will be no room for questions.

Strong and Interesting Narrative; narrative is immersive to different people and it depends on the genre the player/audience is interested in, for example, people who like old western films and stories about the wild west will be drawn more towards the narrative story of *Red Dead Redemption 2*, however, compared to people who are interested into futuristic stories involving space may find it hard to connect with the narrative. Narrative is very useful with building an immersive atmosphere, as it builds

a structure to the game and gives them a reason for completing missions, especially when these missions build upon the character development of the protagonist.

Cognitively Demanding Environments; this means the player will be using a lot of their mental brainpower to analyse and engage with the world environment and the in-game events that take place, the player's brainpower will be focused so much on navigating and exploring the in-game world that they will not have time to notice any problems or bugs (if any) that are in the game. This factor does support the previous one, completeness of sensory information as it distracts the player for a time from any gaps within the games' atmosphere.

2.2.2 Consistency:

A game must have certain elements within it to keep consistent throughout its playtime, as if this does break, it will confuse the player with the main objective and remind them that they are playing a game.

A lack of Incongruous visual cues; this means anything that will obstruct the immersive atmosphere the game is trying to achieve, for example, almost every game has a HUD (heads up display), tutorial messages, damage numbers, notifications, etc. These mechanics within the game break the immersive atmosphere and force the player out of their ERF (egocentric reference frame) "An ERF is defined as a mental model of the world that is organized from a first-person perspective (Mou & McNamara, 2002) and contains at least the immediate surroundings (Radvansky, Spieler, & Zacks, 1993; Freksa et al. 1999; Sholl, 1999, see also McNamara, 1986)." (Wirth et al., 2007) breaking a player's ERF will remind them that they are playing a video game.

Consistent behaviour from things within the game world; this means that in-game items, characters, creatures and other objects in the world behave as the player would expect them to. These all must also make sense within the game world and stay true towards the stereotype that the player may first think of the world, for example, collectable items within games must make sense otherwise the player may question their validity within the game and will not do the task of collecting them. In *Red Dead Redemption 2* (Rockstar, 2018), the collectable items are given meaning, before the player first discovers of the existence of them, they are introduced within an in-game cinematic cutscene, introducing a character related to the collectables who proceeds to task the player to collect them for a reward. Having this before introducing the ability to collect them, gives the player more of an incentive to explore the world, making the experience more immersive and realistic.

An unbroken presentation of the game world; this can relate back to a lack of incongruous visual cues when these do appear, they cause the player's ERF to vanish. This happens during loading screens, in-game menu's and tutorials as when these occur, the game is the thing which is taking control of the game, leaving the player to not feel as engaged as they once were, also when the ERF vanishes, they have nothing to immerse themselves into, breaking the immersion of the game. A good example of a game which tackles this issue is *God of War* (SIE Santa Monica Studios, 2018) as where a normal loading screen or cutscene would go to a black screen beforehand or after, in *God of War* there are rarely any loading screens as most of the cinematic scenes and angles were filmed in a continuous camera shot using motion capture to increase the realism. This technique greatly helps keep the spatial presence consistent and improves the player's engagement, making the world feel more believable.

Interactivity with in-game items in the world; this can also be classed under the “richness” list above as Jamie Madigan suggests it “could probably fit under the “richness” list above, but I include it with consistency because it's another way of giving the player feedback on actions and a sense of consistency between various parts of the environment.” (Madigan, 2010) Following on from this, the player would expect consistency interacting with things like NPCs whether it being for quests or for more knowledge of the game world, operating machines and tools which the player would be using along their journey through the game.

2.3 Player Characteristics:

There are not as many richness or consistent factors enacted by the player than there are by the media, however, this does not undermine the importance of the player’s input towards their own immersive experience. Player’s will be drawn to different games based on their own personal preference, this point is also covered in the narrative section, under the richness category of media characteristics.

Another type of player base are people who want to believe in the illusion of the game, deliberately ignoring atmosphere breaking features or factors within a game for the simplicity of enjoying the game, this is known as the “Suspension of Belief”, this terminology means to “Temporarily allow oneself to believe something that is not true, especially in order to enjoy a work of fiction.” (Lexico Dictionaries | English, 2019) In terms of fiction in terms towards video games, the game itself is the fictional context, so players will deliberately ignore things that do not make sense in a video game, for example, an alien spaceship being an interactable vehicle in the Wild West.

Other types of players are people who role-play their characters more while in the game world, “researchers have also pointed to a concept they call "involvement" which is a media user's desire to act in the make-believe world, to draw parallels between it and his life, and to effect changes in it according to their own design.” (Madigan, 2010) This suggests that there are players who go an extra step to immerse themselves by believing they are the character they are playing as and then act out their character in a stereotypical way.

3. The Breakdown of Realistic Immersion in Games

Now that we understand how an immersive atmosphere is achieved to form a realistic game, it should be clearer to see in video games when developers have used these factors and characteristics to create realistic games, this can be achieved through narrative, game mechanics, visuals, personal meanings towards the player and more. However, there have been times when games have failed to achieve this and we will look into the reasons why this may have happened including some good examples as well.

3.1 Narrative

An example of a game that does a great job at immersing the player is *God of War* (SIE Santa Monica Studios, 2018), the 8th game in its series, although some audiences call it the 4th. This



FIGURE 2 - Screenshot from *God of War* (SIE Santa Monica Studios, 2018)

single-player action/adventure hack and slash video game was very successful on release and won Game of the Year by numerous media outlets and award shows. A unique selling point *God of War* has is the narrative, a critical richness factor towards a realistic game, the game continues the storyline of the main protagonist Kratos after the events of the past games, the player follows Kratos and his son Atreus across the Nordic mythological world battling monsters and gods with their goal to scatter his wife's ashes on the highest peak. What makes

the game immersive is how the story is told, the player follows Kratos throughout his journey, as both he and his son evolve into better people. Cory Barlog, the director and writer of God of War said: “I wanted to reimagine the gameplay, give players a fresh perspective and a new tactile experience while delving deeper into the emotional journey of Kratos to explore the compelling drama that unfolds when an immortal demigod makes a decision to change.” (Barlog, 2018) This is different to the previous games and may come to a surprise to reoccurring players of the series as Kratos was driven by pure hatred and rage in the previous titles, five years since the last game, the player now follows Kratos as he struggles with the past allowing players to feel sympathetic and supportive to him, no hatred as some players may have felt towards his past actions, this narrative may be conflictive towards the consistency of the characters themselves, however, the narrative supports this change by giving the player a reason to why it is happening, this narrative plot also stops a broken representation of the game world as players would be confused to why Kratos is acting differently with no reason. This narrative can also be compared to Joseph Campbell’s the Hero’s Journey template wherein one part of the hero’s journey, they will be challenged and temptation will be thrown at them to sway them from their path. (Campbell, 2003)

There are in some cases where a game does not achieve the immersive reaction the developers were hoping for with their story, *The Walking Dead: Survival Instinct* (Terminal Reality Inc, 2013) for example. On release, this single-player first-person post-apocalyptic shooter game did not do well with reviews and ratings, with the highest rating being 5/10 by Game Informer (Reiner, 2013) and the lowest being 1/5 by Giant Bomb where Alex Navarro proclaimed the game to be “an abysmally rushed game of barely connected ideas that brings the player little more than frustration and disappointment” with “no meaningful information

or commentary on the characters it revolves around.” (Navarro, 2013) This suggests that due to there being very little character development and background information being told within the game, a breach of completeness of sensory information, it made it hard for players to feel more emotionally connected to the main protagonist, Daryl Dixon as he leads his group of survivors along with his brother Merle throughout a zombie apocalyptic world. The game is based off and canon to the AMC TV show *The Walking Dead*, Daryl Dixon is one of the survivors within the group whom the audience follow in the show. Norman Reedus and Michael Rooker did reprise their roles as Daryl and Merle for the game, giving it more authenticity and realism, however, this alone does not make a game realistic. One thing to take into consideration is the actor’s performance as it is a different environment when doing a voice to a role compared to physically being in the situation and acting it out.

3.2 Audio and Music

Moving onto music and sound effects within games, a good example of a game which uses audio effects to enhance the immersive feeling in their game is *Call of Duty: Modern Warfare* (Infinity Ward, 2019). On release, this game was very successful with ratings being as low as 3/5 stars by US Gamer (McCarthy, 2019) and the highest rating of 4.5/10 by Hardcore Gamer (Dunsmore, 2019), this game has been critically acclaimed to be more original towards their previous titles within their ongoing *Call of Duty* series, this can be seen in numerous factors, visually, audibly and more, these factors can be seen as a part of multiple channels of sensory information, the sound effect of the gun, the model design and animation as well as the textures applied to the model show this.



FIGURE 3 - Screenshot from *Call of Duty: Modern Warfare* (Infinity Ward, 2019)

A good example of consistency within the franchise can be found in the audio options menu in *Call of Duty: Modern Warfare* 2019, players are given the option to change the hit-marker sound to classic, the same sound effect can be is used in their early titles, this may reignite an episodic memory to fans of the franchise who have played their older titles, an episodic memory is when “...an emotion is induced in a listener because the music evokes a memory of a particular event in the listener’s life (often referred to as the “Darling they are playing our tune” phenomenon).” (Mossberg, 2008), this use of audio will stimulate nostalgia, specifically more towards reoccurring players of the franchise. *Call of Duty: Modern Warfare* (2019) uses adaptive music and audio cues, specifically when the player is injured (Figure 3), during this event the player’s in-game audio is slightly muffled in conjunction with the in-game HUD appearing blurred, dimmed with colour and blood splatters appearing around, these effects complement each other and come together to build an immersive atmosphere where the player would feel tense, anxious and on high alert. Non-linear audio cues and effects have been used in other games in the industry, for example in the *Resident Evil 2* (Capcom, 2019) remake, the game developers used non-linear audio to stimulate fear, non-linear audio is when sounds “exceed the normal musical range of an instrument, or the vocal cords of a living creature.” (Amplifon, 2019)

3.3 Textures and Animation

Textures and animation are important factors towards making a realistic game environment, and throughout the years game developers have surpassed the audiences expectations with creating some amazing worlds by doing so, a good example of a game company who have achieved this are Quantic Realms, in 2006, the French game developer released the demo trailer *Heavy Rain: The Casting* (Quantic Realms, 2006), this was a short reveal for a project they were working on. The reveal was a huge success, critics claiming it as “an impressive "surprise" demo at this year's E3, Heavy Rain grabbed the attention of a lot of curious show-goers thanks to its excellent visuals, believable actress, and the fact that it's an all-new adventure game from the same folks that brought us 2005's award-winning Indigo Prophecy.”

The company already having a following due to a previous successful title alone shows good promise towards their future work and it paid off, *Heavy Rain: The Casting* was a success, Thierry Prodhomme, lead character designer of the demo at the time, during an interview talks about how animation was used to portray emotion to the character and how difficult this was “Creating emotion on a virtual actor requires the combination of many elements. Graphics or animations are just some of them. We tried to work on the lighting, the directing, the script, the animation of hair, her tongue, and her fingers. It is really the consistent combination of all these elements that create emotion.” (Nix, 2006) This suggests due to the animation and graphics, mainly the animation as Prodhomme states, was able to create an emotional impact from the audience, this is a vital step towards spatial presence and to a realistic experience, this can also relate to the suspension of belief. At the time, this change in animation was a big leap into creating a more realistic character animation, therefore increasing the immersive atmosphere in the demo, however at the time people could also

argue how uncanny the demo looked due to the animation, it was not completely perfect as some movements of the face were not right, making some sequences of the demo slightly off-putting.

Following their reveal, in 2010 the game surpassed being a demo and released as *Heavy Rain* in 2010 (Quantic Dream, 2010), the game received good reviews with a high of 9.5/10 by Game Informer (Juba, 2010) and a low of 7/10 by Edge (Edge, 2010), however, two years later in 2012, Quantic Dream released a new tech demo called *Kara* (IMDb, 2012) which showed off an impressive performance to viewers showing enhanced graphics at that time, including motion capture technology improving the animation quality and believability of the tech demo. A real actress was used in development as she wore the motion capture suit, having this increases the realism factor towards the audience, allowing players to connect to the character more, which also builds off of the narrative. This demo has a uses a good idea of sensory completeness and use of multiple channels of this, using the graphics, animation, sound and audio to build a believable world and the narrative complements this and vice versa. Six years later, in 2018, Quantic Dream released the game *Detroit: Become Human* (Quantic Dream, 2018) with Kara, the character from the 2012 demo, reprising her role as a main protagonist within the story-driven adventure game. Comparing the 2018 release compared to the 2012 demo, the quality of animation including graphics are phenomenally better in *Detroit: Become Human* (Quantic Dream, 2018), this was probably due to the use of 3D scanning creating a realistic facial model of the characters, increasing the quality and detail of the game. In the next chapter, more will be discussed on 3D scanning and other techniques that are used to make realistic looking models and assets.

From looking at numerous examples of games within the past decade, all of these games do possess some of the elements mentioned by Madigan, i.e. multiple channels of sensory information, etc. (Madigan, 2010) and also following the diagram (Figure 1) created by Wirth et al. (Wirth et al., 2007) meaning that the diagram is still viable and useful towards creating a realistic atmosphere for games, now we will look at how game developers achieve this throughout their development process.

4. The Improvement of Realism in Video Games

Now that we have a general knowledge of games with realistic effects and factors, now we will look into how this is achieved, looking at technology over the past decade and the numerous new techniques used by game developers to help increase the production value of a game, especially towards creating the realistic atmospheres they desire.

4.1 3D Scanning

3D scanning is heavily used in the game industry, and is very good at when creating a realistic game environment, it is a non-destructive method which copies the shape of a physical object and distributes it into a 3D digital form using laser light. There are two known ways of 3D scanning, including many others, however, these two methods are popular, and they are white light and blue light scanning.

4.1.1 White Light Scanning

White light scanning “uses a camera mount, tripod, or robot and enables a “point & shoot” style workflow that minimizes setup and programming” (Capture3d.com, n.d.) this method of scanning is less time consuming and allows for quick results, this method of scanning also uses all lights of the spectrum. Due to this type of scanning not needing to physically touch the object it is scanning, when obtaining the results, there will be no need for any rescaling or sizing issues compared to CMMs. “CMMs require that a probe touches an object’s surface in order for a measurement to be gathered.” (Capture3d.com, n.d.) This causes the problems mentioned earlier, causing more time to be used fixing the scale and shape of the model. This method would be used on large scale objects and/or objects that do not have many irregular shapes and complex figures when these models are in-game, the player will not be able to get

close to them if the player were able to get close to them however, the player may notice some abnormal surfaces of the model, breaking the immersive atmosphere of the game, so these are normally placed outside of the player's explorative areas.

4.1.2 Blue Light Scanning

Blue light scanning is very similar to white light scanning however there are some slight differences, it is said that blue light scanning produces results with higher quality, precision and accuracy than white light scanning. Blue light scanning uses a narrower wavelength, "The narrow wavelength of blue light helps enable better filtering of interference from ambient light." (Capture3d.com, n.d.) Due to this, when using this method for scanning objects, there will be no issues with natural light or particles i.e. dust being included within the scanning. This method would be used for producing smaller models, including facial scanning as modelling realistic faces is a troublesome and time-consuming task, for example, for a Virtual Reality game, if the developers are going to be needing realistic looking hands for the controller models, they would use blue light scanning to achieve this. Overall this method will be used for producing models which the player will be getting close to when exploring the game world as well as interacting with.

To summarise 3D scanning, it is a very useful technique for producing high-quality models whether these are placed close or far away from the player. However even though this method is less time consuming than creating models from hand, it is an expensive process as the equipment needed is not cheap.

4.2 Lighting and Textures

Another process within the games industry that enhances the realism of a game itself are the textures and lighting. If a model looks highly detailed and looks stereotypical to the game world they are in, the player will have a higher chance of believing into the illusion that the game world is real, leading them to be immersed more into the game.

A method within the gaming industry has been used for almost a decade, but in recent years, it has become more popular and has delivered game-changing results, this method is called Ray-Tracing. Ray-Tracing is a rendering technique used to render light and shadows with a scene, whether this scene is a still image or moving. This technique is very good and creating realistic scenes and making textures stand out more than they were before, however, the disadvantage for using this method is that it is reliant on high-end hardware, meaning it is very expensive and causes games to run on a lower refresh rate. It is also able to replicate various optical effects, such as dispersion, scattering, reflection and refraction.

4.2.1 Dispersion

Dispersion in games can either be through sound or light, a great example of dispersion, in general, would be with a light prism, how one ray of white light enters a prism and disperses in multiple rays of colours. In video games, this would be seen as blurred vision when the player may be injured or when the player is looking down the scope of a weapon.

4.2.2 Scattering

Scattering is similar to reflection however instead of reflecting into one direction, light would reflect into different paths, for example, in a game a ray of light may hit a broken piece of glass, because the surface is not smooth the light will reflect and

scatter into different directions, applying this to a different object, this would also happen to a crystal, due to the object being transparent allowing light to pass through.

4.2.3 Reflection

Reflection in games would consist of seeing light, sound and water reflect off of another surface, for example, a puddle of water in a game would reflect an image based off of the angle the player's camera is facing said puddle. If the water is still the image will be clear and not broke up, but to increase the realism of the puddle, the image would become dispersed once an object hits the puddle, causing a ripple effect. Lighting will also be reflected off of shiny and metallic surfaces.

4.2.4 Refraction

Refraction in games also can consist of light, sound and water refraction. "In physics, refraction is the change in direction of a wave passing from one medium to another or from a gradual change in the medium." (Gregersen, n.d.) In video games, an example would be when water may ripple or appear broken while flowing in a stream, and this alone increases the believability of that water feeling more real in a game environment.

These two modern methods are only a few compared to the other various techniques and development processes used within the creation of video games, and with the increase of this new technology being used, there is no doubt that the majority of video games will use these methods to create more realistic games.

5. Conclusion

To conclude this study, what we have discovered is when following the “*A Process Model of the Formation of Spatial Presence Experiences*” (Wirth et al., 2007), the diagram (Figure 1) within this document is still a very useful piece of knowledge towards creating a realistic game. Breaking this down there are two different inputs towards creating spatial presence, one from the media and the other from the player themselves, the research was mainly focused on how to create a realistic atmosphere within a game as this is one of the most convincing ways to attract a players attention towards a playing a game, following these sub-factors of the media and player’s input, these techniques and methods have been visually and notably identified within video games made within the last decade, using examples such as *God of War* (SIE Santa Monica Studios, 2018) and *Detroit: Become Human* (Quantic Dream, 2018) and breaking them down into three different categories, Narrative, Audio and Music, and Textures and Animation. Following this we then also explored into what video game developers use during the development process to create realistic looking textures, models, animations and visually stunning scenes, looking at methods such as 3D scanning and Ray-Tracing.

6. Further Work

Now that we have a better understanding on how a realistic atmosphere is made within video games, further research can still be done into the subject. For example, how does a person create an engaging story for the player? Some examples could be looking at successful films and TV shows and see what techniques they use to create these, also more research can be done into Joseph Campbell’s the Hero’s Journey (Campbell, 2003), delving more in-depth into

the overall idea of the story template. Having knowledge on how to achieve this will make games stand out and will attract more audiences.

Other further research can be done into different methods that video game companies' use when developing their games, for example, into PBR textures, are PBR textures going to replace traditional hand-painted textures? Could this be due to this method being less time consuming to produce? This does allow more time to be spent on animation and lighting, but are there any disadvantages to this?

As technology advances the next decade will no doubt bring significant changes towards the production of digital worlds and this will surely have an impact on future players and their experience of immersive virtual environments.

References:

Amplifon. (2019). *Psychology of Sound - How sound in video games has evolved*. [online]

Available at: <http://www.amplifon.ie/resources/playing-with-your-mind/> [Accessed 30 Nov. 2019].

Barlog, C. (2018). *First Look: Santa Monica Studio's New God of War on PS4*. [online]

PlayStation.Blog. Available at:

<https://web.archive.org/web/20180413202516/https://blog.us.playstation.com/2016/06/13/first-look-santa-monica-studios-new-god-of-war-on-ps4/> [Accessed 11 Nov. 2019].

Campbell, J. (2003). *The hero's journey: Joseph Campbell on his life and work* (Vol. 7). New World Library. [Accessed 11 Nov. 2019]

Capcom Co. (2019). *Resident Evil 2* [CD] Platform (Playstation) Place of Publication: Capcom Co. [Accessed 15 Nov. 2019]

Capture3d.com. (n.d.). *White Light vs Blue Light Scanning*. [online] Available at:

<https://www.capture3d.com/knowledge-center/blog/white-light-vs-blue-light-scanning> [Accessed 1 Dec. 2019].

Dunsmore, K. (2019). *Review: Call of Duty: Modern Warfare - Hardcore Gamer*. [online]

Hardcore Gamer. Available at: <https://www.hardcoregamer.com/2019/10/24/review-call-of-duty-modern-warfare/360474/> [Accessed 15 Nov. 2019].

Edge. (2010). *Heavy Rain review | Edge Online*. [online] Available at:

<https://archive.ph/20131030093316/http://www.edge-online.com/review/review-heavy-rain/> [Accessed 30 Nov. 2019].

Freksa, C., Habel, C., Wender, K. F. & Hartmanis, J. (Eds.). (1999). *Spatial Cognition, An Interdisciplinary Approach to Representing and Processing Spatial Knowledge*. Lecture Notes in Computer Science. Berlin: Springer.

Gregersen, E. (n.d.). *Refraction / physics*. [online] Encyclopedia Britannica. Available at: <https://www.britannica.com/science/refraction> [Accessed 5 Dec. 2019].

IMDb. (2012). *Kara (2012) - IMDb*. [online] Available at: <https://www.imdb.com/title/tt2296819/> [Accessed 30 Nov. 2019].

IMDb. (2013). *The Walking Dead: Survival Instinct (Video Game 2013) - IMDb*. [online] Available at: <https://www.imdb.com/title/tt2287394/> [Accessed 14 Nov. 2019].

Infinity Ward. (2009) *Call of Duty: Modern Warfare 2* [Online] Platform (Xbox, Playstation, PC) Place of Publication: Activision [Accessed 15 Nov. 2019]

Juba, J. (2010). *Heavy Rain Review*. [online] Game Informer. Available at: https://www.gameinformer.com/games/heavy_rain/b/ps3/archive/2010/02/10/review.aspx [Accessed 30 Nov. 2019].

Lexico Dictionaries | English. (2019). *Suspend Disbelief / Definition of Suspend Disbelief by Lexico*. [online] Available at: https://www.lexico.com/en/definition/suspend_disbelief [Accessed 20 Nov. 2019].

Madigan, J. (2010). *Analysis: The Psychology of Immersion in Video Games*. [online] Gamasutra.com. Available at: https://www.gamasutra.com/view/news/120720/Analysis_The_Psychology_of_Immersion_in_Video_Games.php [Accessed 16 Nov. 2019].

McCarthy, C. (2019). *Call of Duty: Modern Warfare Review: Unlaced Boots on the Ground*.

[online] USgamer.net. Available at: <https://www.usgamer.net/articles/call-of-duty-modern-warfare-review> [Accessed 15 Nov. 2019].

McNamara, T.P. (1986). Mental representations of spatial relations. *Cognitive Psychology*, 18, 87–121.

Mossberg, F (ed.) (2008). *Sound, mind and emotion - research and aspects*.

Ljudmiljöcentrum skriftserie, vol. 8, vol. 8, Sound Environment Center at Lund university.

[Accessed 15 Nov. 2019]

Mou, W., & McNamara, T.P. (2002). Intrinsic frames of reference in spatial memory. *Journal of Experimental Psychology: Learning, Memory and Cognition*, 28, 162–170.

Navarro, A. (2013). *The Walking Dead: Survival Instinct Review*. [online] Giant Bomb.

Available at: <https://www.giantbomb.com/reviews/the-walking-dead-survival-instinct-review/1900-566/> [Accessed 11 Nov. 2019].

Nix, M. (2006). *Heavy Rain Interview - IGN*. [online] IGN. Available at:

<https://uk.ign.com/articles/2006/06/07/heavy-rain-interview?page=2> [Accessed 30 Nov. 2019].

Quantic Dream. (2018). *Detroit: Become Human* [CD] Platform (Playstation) Place of

Publication: Sony Interactive Entertainment [Accessed 30 Nov. 2019]

Radvansky, G.A., Spieler, D.H. & Zacks, R.T. (1993). Mental model organization. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 19, 95–114

Reiner, A. (2013). *The Walking Dead: Survival Instinct Review*. [online] Game Informer.

Available at:

https://www.gameinformer.com/games/the_walking_dead_survival_instinct/b/xbox360/archive/2013/03/21/worse-than-a-zombie-bite.aspx [Accessed 14 Nov. 2019].

Rockstar Games. (2018) *Red Dead Redemption 2* [CD] Platform (Playstation) Place of Publication: Rockstar Games [Accessed 16 Nov. 2019].

Sholl, M. J. (1999). Egocentric frames of reference used for the retrieval of survey knowledge learned by map and navigation. *Spatial Cognition and Computation*, 1(4), 475–494.

SIE Santa Monica Studio. (2018) *God of War* [CD] Platform (Playstation) Place of Publication: Sony Interactive Entertainment [Accessed 11 Nov. 2019]

Wirth, W., Hartmann, T., Böcking, S., Vorderer, P., Klimmt, C., Schramm, H., Saari, T., Laarni, J., Ravaja, N., Gouveia, F.R. and Biocca, F., (2007). A process model of the formation of spatial presence experiences. *Media psychology*, 9(3), pp.493-525. [Accessed 11 Nov. 2019]

Bibliography:

En.wikipedia.org. (2019). *3D scanning*. [online] Available at:

https://en.wikipedia.org/wiki/3D_scanning [Accessed 5 Dec. 2019].

En.wikipedia.org. (2019). *God of War (2018 video game)*. [online] Available at:

[https://en.wikipedia.org/wiki/God_of_War_\(2018_video_game\)](https://en.wikipedia.org/wiki/God_of_War_(2018_video_game)) [Accessed 11 Nov. 2019].

En.wikipedia.org. (2019). *Ray tracing (graphics)*. [online] Available at:

[https://en.wikipedia.org/wiki/Ray_tracing_\(graphics\)](https://en.wikipedia.org/wiki/Ray_tracing_(graphics)) [Accessed 5 Dec. 2019].

En.wikipedia.org. (2019). *Call of Duty: Modern Warfare (2019 video game)*. [online]

Available at:

[https://en.wikipedia.org/wiki/Call_of_Duty:_Modern_Warfare_\(2019_video_game\)](https://en.wikipedia.org/wiki/Call_of_Duty:_Modern_Warfare_(2019_video_game))

[Accessed 15 Nov. 2019].

En.wikipedia.org. (2019). *Hero's journey*. [online] Available at:

https://en.wikipedia.org/wiki/Hero%27s_journey [Accessed 11 Nov. 2019].

En.wikipedia.org. (2019). *Immersion (virtual reality)*. [online] Available at:

[https://en.wikipedia.org/wiki/Immersion_\(virtual_reality\)](https://en.wikipedia.org/wiki/Immersion_(virtual_reality)) [Accessed 11 Nov. 2019].