Linking Realities with Mixed Reality

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Abstract

Gaming has consistently been acknowledged as a storytelling medium for its signature ability to provide user interaction. As Augmented Reality and Mixed Reality become more prominent in the gaming environment, it will be expected to carry on the tradition of storytelling. Currently, augmented and mixed reality are in a state of infancy, where products offer little sophistication and serve as amusements rather than storytellers. As this changeover takes effect, there are certain discrepancies which will hinder a transition from flat screen gaming to reality gaming. To create a successful narrative-driven mixed reality game, these discrepancies must be addressed in a meaningful way. This dissertation will experiment with different realities by developing a Mixed Reality experience using Unity, an experience which will make use of different techniques of AR and MR.

This dissertation investigates strategies for creating immersive experiences for players in video games by utilising reality technology (Mixed and Augmented reality), narrative, and game design as tools. This study's research hypothesis is that game design, reality technologies, and storytelling can be used to provide users with an immersive experience. A prototype / artefact is created, as well as an application, for participants to test and determine whether they feel more involved. The experience was appraised by questionnaire participants, who gave this method a positive response.

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Introduction

Even though the term ‘Augmented Reality’ (AR) has been around since the 1990s, this form of technology has only just started to gain popularity. Mobile devices are now more common than ever thanks to recent technological developments, positioning the medium for broad adoption. Recent progress has even gone so far as to allow cutting-edge devices to run ‘Mixed Reality,’ scenarios which is a step up from "augmented reality" due to the availability of more options. It has historically been associated with computer science but has started to move into the realm of the visual arts; it is still coming into being (Papagiannis, 2014).

Using an AR-enabled device, such as a smartphone or tablet—hereafter referred to as an AR device in general—allows us to see virtual content overlaid on top of a real-time live stream of the world. The AR programme may overlay virtual content on top of a marker, which is typically a detailed image or symbol, and then track the marker to update the position of the virtual content (Papagiannis, 2011). MR is essentially the same as AR with the exception that it takes the user's surroundings into account when projecting the virtual content such as a digital ball will stop when it hits a wall within the real world. "Mixed reality is a blend of physical and digital worlds" (Wen, 2022)

This thesis strives to find methods that can be used in video games to create immersive experiences for players, using reality technologies (Mixed and Augmented reality), storytelling, and game design as tools. The research hypothesis for this study is: Game design, reality technologies and storytelling can be used to create an immersive experience for users.

The main research question is; How can human emotion, game design, and storytelling be utilized to create an immersive experience? The secondary question is: Why is immersion

important in such experiences? The goal of the study is to gather data that can be used to develop an experience that will engross players and provide them with an immersive emotional experience. Along the way, it is hoped to determine whether or not participants will question the experience's content or, more likely, their reality.

During this process an artifact will be created which the user will employ to experience the simulation that utilizes their surroundings and interact with both the physical and digital content. Research and focus groups were conducted to learn more about the target audience's preference to interaction as well as how the content should be delivered to the participants before the artefact or even the simulation is developed. To ensure an immersive experience, research into the type of audience that will be involved was critical when developing the final project, as the audience targeted had to have some knowledge of interactive storytelling, whether it was through video games or virtual reality, in order to know how to approach the simulation. Examples of data gathered include the types of narratives or scenarios that will be presented, and the types of interfaces that will be incorporated within the simulation that will guide users to interact without difficulty and without being a distraction. Participants were also asked about their preferences as to what they look for when it comes to storytelling using any medium.

Contextual Review

2. Research on Mixed/Augmented Reality and their Implementations

2.1. Why this area, why use this tech?

The area of Augmented Reality (AR) / Mixed Reality (MR) is still considered as new technology and thus has many fields to explore. However, many artists and technologists have previously used this technology in related domains. One such example is Tamioko Thiel (1957 -), who employs geolocational technology to place digital information in public spaces. Another example of AR in practise is Yunuene (Yunuen Esparza) (1975 -), a visual artist who primarily concentrates on using image-based targets that, when scanned, are animated. Even though there are studies in fields like education where MR / AR can be used to help students learn through gaming, as it would add another wow factor – as in Pokémon Go (2016) where users can catch Pokemon in their surroundings, and other sectors (Users can learn how to navigate as well as familiarise themselves with their surroundings by using monuments and landmarks displayed within the game) – there is little research to be found when it comes to using MR and AR to enhance storytelling through the use of one's environment.

In the course of this research, I will be delving into other areas of interest such as animation, 3D modelling and printing, virtual reality development, gaming interfaces and other related areas to acquire further knowledge in these fields as tools to aid AR.

2.2. What types of AR/MR are there?

2.2.1. Marker Based/Image Target

Simply said by Ayushi Doegar (2021), this technique produces a result by using the camera on a smartphone. Visual markers such as QR codes (a type of barcode that allows users with any smart device to access information, the information is stored as a series of pixels in a square shapes grid.) and two-dimensional images are examples. When the camera reader detects the marker, the users receive the result and view them on their device

The device first identifies the Target and determines its position and orientation, then overlays the digital content on that Target.

Figure 1: Example of Image based Augmented reality, from google search https://library.vuforia.com/sites/default/files/vuforia-library/articles/Features/Images/Image%20Targets/vuforia-image-targets-feature.jpg

2.2.2. Object Targets/Superimposition AR

Superimposition AR modifies an object in some way to provide a different perspective after detecting it in the actual world. This might be as simple as reproducing a section of the item or as complex as rebuilding the full entity. This technique is similar to Marker Based, except instead of a flat image, it uses a previously scanned three-Dimensional object as a target.

Figure 2: Example of Object based Augmented reality
Google search: https://mbryonic.com/wp-content/uploads/2016/01/arcar.jpg

2.2.3. Area Targets

Area targets are a combination of the previous augmented reality (AR) categories in which the user scans a desired space before inserting digital media into it. This is a relatively new technology that continually detects and monitors elements in one's selected area in order to provide ongoing augmentations of digital content.

Figure 3 : Example of an Area Target / a prescanned environment

2.2.4. Projection Mapping

The name implies mapping of a projection to surface that is frequently more complex than a traditional plain projector screen. The mapped projection is frequently distorted to match the real surface and may be either predetermined to give the impression of interacting with the surface, or in the case of AR can be made to react interactively though the use of a feedback input system.

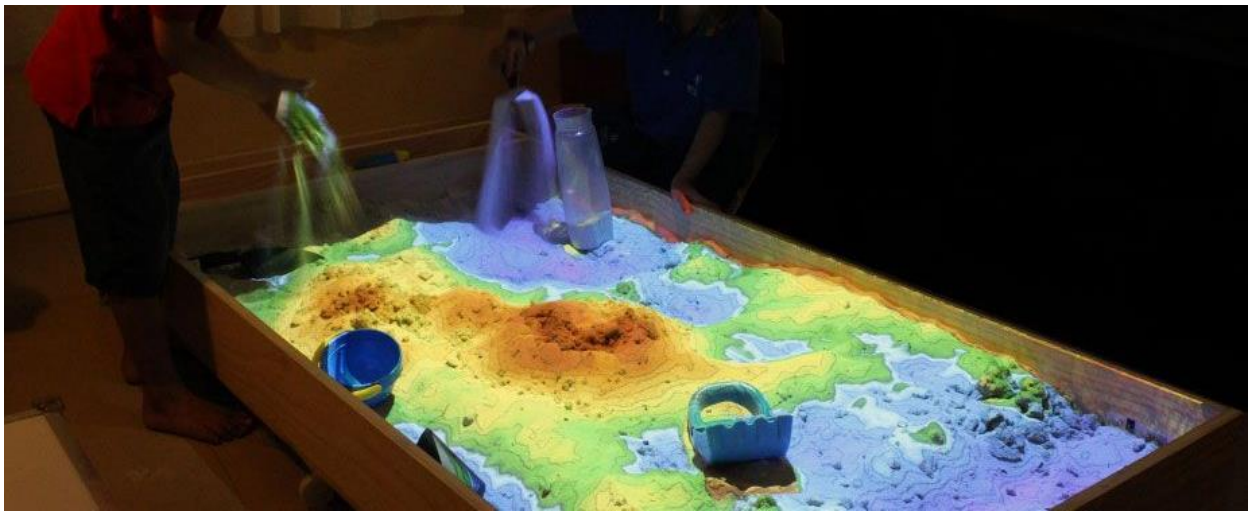


Figure 4: Example of Projection Mapping AR

Google search: https://i.pinimg.com/564x/42/1a/1c/421a1cb13062614d1acf989803d1d0c9.jpg

2.2.5. Plane Targets

Plane targets, or ‘markerless’ targets, which don’t require the user to link the content to any prescanned object. They are more adaptable than marker-based AR since they let the user place the virtual object wherever they want. ‘Markerless’ augmented reality utilises the device's hardware, such as the camera, GPS (Global Positioning System), digital compass, and accelerometer, to collect the necessary data for the AR application to operate.

Figure 5: Example of Plane Targets
Google search: https://mbryonic.com/wp-content/uploads/2016/01/maxresdefault-1.jpg

2.2.6. Location-Based Targets

AR that is location-based links digital material to a specific location. The items are laid out in such a way that when a user's location matches a specified area on the screen, the digital content is shown. Pokémon Go (Wingfield & Isaac, 2016), the game that popularised augmented reality, is an example of location-based AR. The program uses your smartphone to overlay virtual Pokémon characters over the camera feed and keep them positioned in 3D space based on real world surfaces, and players are urged to find as many of the characters as they can.

Figure 6 : Example of Location-Based AR
Pokemon-Go(Google search;
https://www.digitalartsonline.co.uk/cmsdata/features/3671619/ar_pokemon_go_istock_georgeclerk-niantic.jpg)

2.3. Which of the above listed MR/AR should be utilised in the artefact and why?

'Area Targets' would work well because players would only be allowed to go to a few sites. Since Marker Based targets are simple for the camera to identify and will not cause any delay, they will not interfere with the user experience when used as the controller to interact with their surroundings (the pre-scanned ‘area target’). These AR types (Area Targets and Image Based Targets) are chosen with the goal of creating a simulation with the least amount of lag or interruption possible to prevent breaking the player's immersion and allowing him to focus only on the experience.

Figure 7 : A 3D Environment scan (Testing)

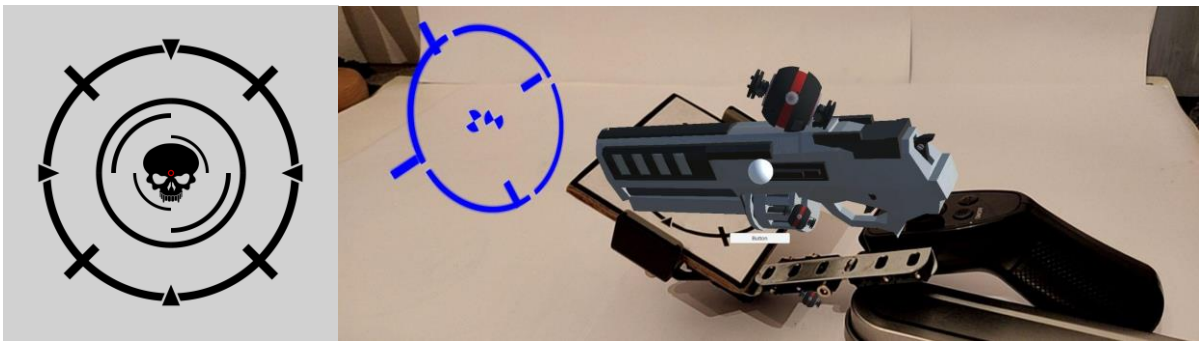


Figure 8 : Early prototype of Artifact / Controller

3. Narratives and Flow.

3.1. Linear vs Non-Linear

According to Mike Shepard (2014) in the simplest sense, games may be divided into two forms of storytelling, or styles: linear and nonlinear. Linear narratives move in an incremental pattern, thus players must complete Objective A before moving on to Objective B. There may be a few instances, as in The Hobbit (2003) (Figure 9), where the player is briefly placed in the middle of the game or action before being transported back to the beginning of the plot. Non-linear games continue in the way the player desires or rather the player is given a number of options which can change the flow of the narrative. Objectives B-Z become available once a player completes Objective A, which is generally the introduction part. Linear games have a distinct beginning, middle, and end, all of which follow a logical path.

Figure 9 : The Hobbit 2003 (game reference)

Mike Shepard explains that regardless of the narrative style, all players are put in the identical situation or scene, but the experience (Linear narratives) varies according to the choices made by them right there and then (Should I take refuge here, pick up this weapon, utilise this spell or weapon, look for hidden items, and so on?). This storytelling technique may be seen in the Halo

games, namely in Halo Reach (2010). The Final Fantasy series (1988-2014), Dishonored (2012), Star Wars: Fallen Order (2019), and Alan Wake (2010) all depend on linear storytelling: all users experience the same story, plot, and architecture, with the only variance being strategy during gameplay.

As shown in the graphic below (figure 10), Halo players may customise their character's armour and looks to their liking just like in 'Star Wars: Fallen Order' functions in a similar manner. The characters chosen, the weapons and armour the player is equipped with, the frequency of combat vs. speed, and so on, vary depending on the game being played. Even though character customisation isn't a main part in narrative flow it still gives the user the impression of having more control over the narrative. In Alan Wake (2010), players employ a variety of strategies: do they utilise the more powerful but less efficient flashlight; the slower but more powerful weapon; eliminate the minor adversaries before confronting the large one, or vice versa?

Figure 10 : Character Customisation menu found in Halo: Reach (2010)

The beginning, the middle, and the end are all the same in most of the mentioned examples like Halo (2010) and The Hobbit (2003) having to do with linear narratives. This is beneficial in narration since it ensures that players have identical experiences, condensed themes, morals, and expected emotions in-game as they would from a tale delivered through text or film. A linear game immerses the player in a linear tale. Everyone who read the Harry Potter series (Rowling, 1997-2007) had comparable experiences, motifs, and paths to take. The same concept applies in linear-narrative games.

Non-linear games, on the other hand, have a fixed (sometimes changeable) beginning and then an open area for players to explore as they like, as Tom Bissell, video game writer of Gears 5 and Battlefield Hardline, describes in interviews (Bustillos, 2013) and publications (Bissell, 2010). He refers to them as open-world, free-roaming, or sandbox games instead of non-linear games, highlighting the significance of narrative flexibility and user exploration.

> "The genre is superintended by a few general conventions, which include the sensation of being inside a large and disinterestedly functioning world, a main storyline that can be abandoned for subordinate story lines (or for no purpose at all), large numbers of supporting characters with whom meaningful interaction is possible, and the ability to customize…the game's player-controlled central character." (Bissell, 2008,1)

Hybrid games contain a linear storyline but provide the player greater choice, enabling them to complete available missions in whatever order they like and keeping the options open as the story progresses. Certain games work well with both linear or non-linear mechanics, but titles

like Mass Effect (2007) and Dragon Age (2009) show that the narrative can be both and still tell a fantastic tale.

3.2. Leaning towards Non-Linear Narrative experiences.

Game narratives have been around since the 1980s, with Donkey Kong Arcade (1981) being the first game to feature a true narrative (Jarkko, 2016). The structural differences between the two narratives may be seen in the figure 11 below. The story is about more than just a beginning, middle, and end in nonlinear narratives. Events are commonly portrayed in such a way that the narrative does not adhere to a strict structure. As a result, nonlinear storytelling has become popular in television shows such as Arrow (2012-2020) and Attack on Titan (2013-) and video games such as Hollow Knight (2017) and Far Cry (2004).

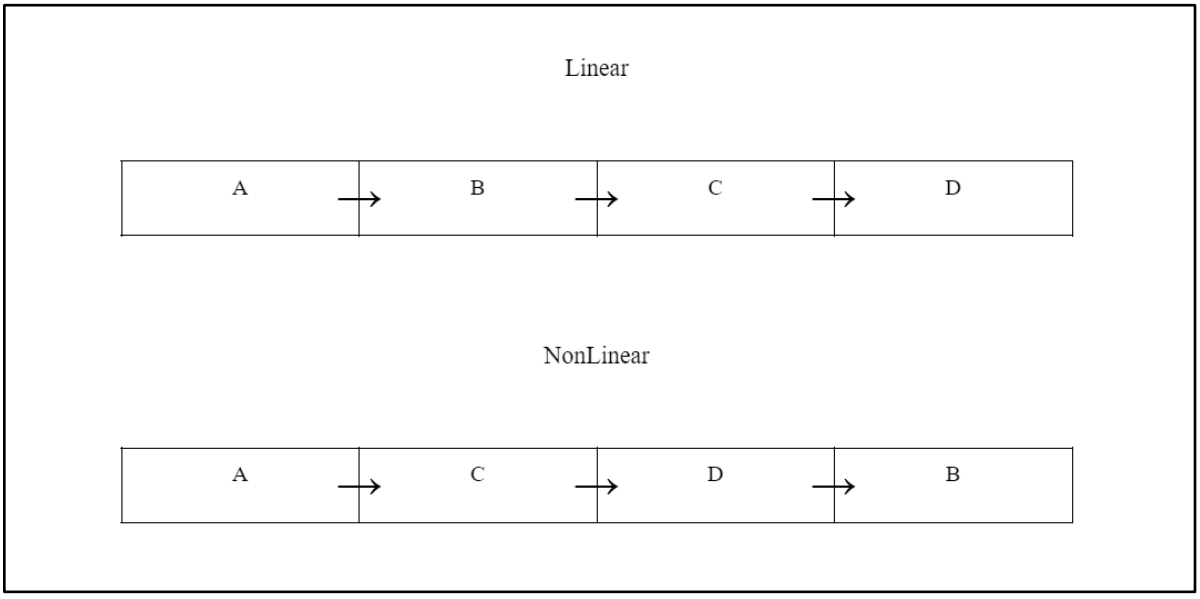


Figure11 : Difference between Linear and Non-Linear

Nonlinear can also refer to games with many stories and endings in video games. This is a common approach in many role-playing games, where players can choose how their avatar acts in various scenarios. In some video games, the narrative can be skewed chronologically, similar to how this effect is utilised in movies to depict the main character's ability to process information. The movie Pulp Fiction (1994) is an example of non-linear storytelling. "Quentin Tarantino utilizes non-linear narrative in *Pulp Fiction* primarily as a tool to introduce the characters multiple times, through different character's perspectives," (Hill, 2019)

As a result, when creating the artifact for users to test, users will be able to go at their own pace and complete tasks in whichever sequence they see suitable. This would help them to go further into the experience. After analysing the focus group responses, it was apparent that the majority of people preferred the idea of proceeding at their own pace with nonlinear narratives (Appendix D), while the rest did not care whether the scenario/narrative was linear or nonlinear, as long as the options were clear and did not add any confusion.

3.3. Types of narratives

3.3.1. Embedded narratives

Embedded narratives in games are stories that have already been written. The story is decided by the game's developers, and the player follows their lead. Every time the game is played, the story is the same. Cutscenes and backstory are unaffected by the player. According to Elle McFadezean (2021) games with incorporated stories are usually evocative and have plots that are

the closest to linear plots. They are also commonly single-player games that focus on immersing the player in the suspense of the story instead of allowing them to interact with other gamers.

3.3.2. World narratives

In a world narrative, immersion in games can be achieved by both spatial and narrative involvement. Both of these aspects of involvement can be achieved through the game's virtual environment. Worldbuilding is where the player has control over the environment and can create as they see fit, this can be seen in games like ‘Fallout Shelter’ (2015) and ‘Sim City BuildIt’ (2014) where world building was utilised to enable the player to get fully immersed in both the story and the environment.

Although even the tiniest glimpse of the current game world can improve the player's interest, not every game requires a big accessible setting. Even when the game does not feature a navigable location, games like Hearthstone (Blizzard, 2014) or Raid: Shadow Legends (Plarium Global Ltd, 2019) make use of world story where the user navigates through the interface where he / she can see hints of what aesthetic of the environment should be.

The world narrative is made up of both visual and audio story data from the virtual gaming world. Architecture, writing, clothing, and furniture, among other things, all tell a story about the world. In a virtual world, almost any object, or the absence thereof, may convey a tale. Audio may also be used to tell a tale. BioShock (2K Games, 2007) employs audio recordings hidden around the environment to reveal the history of its inhabitants.

Spatial engagement examines the game's virtual space, and hence is linked to the world story. Ryan describes spatial immersion as the experience of a player in virtual space through movement and the formation of an emotional bond with a virtual world (Ryan, 2009). She acknowledges that these phenomena are not technically narrative, but she emphasizes the significance of place as a narrative element (Ryan, 2009). When the player is comfortable in the

virtual environment, he / she may concentrate on other areas of the game, resulting in a greater sense of immersion (Calleja, 2011).

With careful level and game design, an atmosphere conducive to spatial participation may be created. A colourful setting aids immersion by attracting the player into the experience (Skolnick, 2014). It is critical to build the game environment in such a way that the player can recognise distinct regions and locales. This helps the user create a spatial map of the area, which makes them feel more engaged and connected to the game environment (Calleja, 2011).

The existence, or lack of characteristics in the game environment, according to Sylvester Arnab (2014) is the finest approach for building world story. Even inconspicuous evidence might be enough to launch a tale. The absence of a resident might be indicated by dying houseplants or ignored mail. Bloody footprints on the ground may indicate a close wounded adversary. Mise-en-scène is a term used in cinematography and theatre to describe the process of arranging elements in a scene to create a visual theme. Lighting, space and composition are all important characteristics of the mise-en-scène. The techniques used to create a mise-en-scène may also be applied to worldbuilding in video games. Changing the lighting, for example, may drastically alter the vibe of a place.

The usage of an environment mood boards and concept art that provides extensive descriptions of the area and ensures that the gaming environment is unified, is advocated. The influence of the global story is strengthened by world coherence and the expression of internal relationships within it (Sylvester, 2013). Inconsistency in the world might hinder the player from developing a strong bond with the game, resulting in a lack of immersion.

3.3.3. Emergent narratives

Emergent narratives are influenced by player engagement. The game retains its rules and structure, but the player's actions can alter the story's trajectory.

These games frequently contain 'authoring elements,' which are game components that allow the player to create or affect their environment (and consequently their narrative). Emergent narrative games are frequently replayed by players to attain alternative outcomes.

Emergent narratives evolve from the gameplay and interactions inside the game system should be unique to each player. Sylvester (2013) defines emergence in games as the result of basic mechanisms interacting to create complex scenarios. "Rather than excluding story, interaction produces it" (Calleja 2007, p.115). By including game features that allow or promote emergent story, game designers may help players tell more tales.

Emergent narrative is not required to advance the game or aid in the achievement of the game's aim. Example, cars are offered for the player to utilize in Lego games. Driving these cars has no bearing on the game's overall progress and provides no benefit to the player. They are, however, a fantastic tool to help player tales evolve. Many games that don't have a clear winner employ emergent storytelling to tell stories. The Sims (Electronic Arts, 2000) is an example of a game that depends on emergent narrative rather than a planned tale.

Unintentional emergent narrative is also possible. The 2005 Corrupted Blood event in World of Warcraft (Blizzard, 2004) is a good illustration of how an unanticipated problem may lead to large-scale player tales. A fault in the gaming system triggered the Corrupted Blood occurrence, which may be defined as a virtual pandemic. The occurrence took place during a raid, when the

end boss, Hakkar, applied the Corrupted Blood debuff to players (Felon, 2020). This resulted in the affected character's health deteriorating. The Corrupted Blood was only supposed to have an effect on that part of the virtual world. Non-player characters, such as pets or minions, were able to spread the sickness outside of the region where it was intended to be limited due to a glitch. Following the discovery of the issue, some players unleashed sick pets or minions into towns and cities with the intent of spreading the Corrupted Blood to other players.

Many fascinating incidents occurred as a result of the disease's epidemic, which were researched by experts, particularly epidemiologists. Some occurrences during the Corrupted Blood Incident were beneficial to some players while being detrimental to others. Despite the fact that this occurrence resulted in several player stories, Blizzard finally elected to reset the game servers to a period prior to the incident. A gaming system that does not retain the same rules and options for all players is not fun and can lead to serious immersion concerns.

As the Corrupted Blood Incident demonstrates, gameplay elements have the capacity to improve the plot and the level of narrative immersion. The aspect of emotive participation in the parts of emergent storytelling in building immersion may be added to player stories, making them incredibly distinctive and personal. When the player controls the game character and explores the surroundings, spatial and kinaesthetic participation are present. Ludic participation arises from the player's interaction and decisions. Social interaction is not always an element of emergent storytelling, but it may help to make player tales even more immersive. Emergent narrative may engage the user on numerous levels of engagement, providing a solid foundation for video game immersion.

3.3.4. Evocative narratives

Stories that rely on connotations – the player's experiences, imagination, and knowledge – are known as evocative tales. This style of story leverages visuals we are already familiar with to convey story material without having to explain it. When one sees a waterfall, blood trail, or red barrel, one would have preconceived notions about what to expect.

These stories can also reference a series, particularly if the game is a sequel or adaptation of a film. Because of their knowledge from other sources, players may recognise objects in the game.

Both the player and the game producers influence the evocative story, but ultimately the player has the last say. The game's producers can strive to include evocative features, but whether or not the player recognises them is up to them. Players may also apply their own experiences and expertise to their gaming, forming narrative via their own interpretation of the game. As a result, every game has an engaging narrative, and the players can uncover new ones each time they play.

3.3.5. Enacted narratives

In Enacted narratives players must build their characters through enacted storylines. Enacted narratives are used in story aspects like power upgrades and levelling up. These stories are frequently found in single-player games that focus on character development.

3.4. Which of the narratives should be used?

I have discovered that games do not only employ one of these story styles. They employ a variety of styles such as seen in Star Wars: Fallen Order' (2019) where an embedded narrative is put in front of players to follow however, we can find other styles such as world narrative where the environments are used to give hints of what has happened before the player has reached a location or the environment in which the player is in can change entirely for a few moments to showcase important information such as a flashback. Another style found in the game 'Star Wars: Fallen Order' (2019) is Enacted narrative, in which the player's character can be given upgrades as the game progresses, but the player can choose what to upgrade, affecting how the player interacts with the enemy as well as the environment.

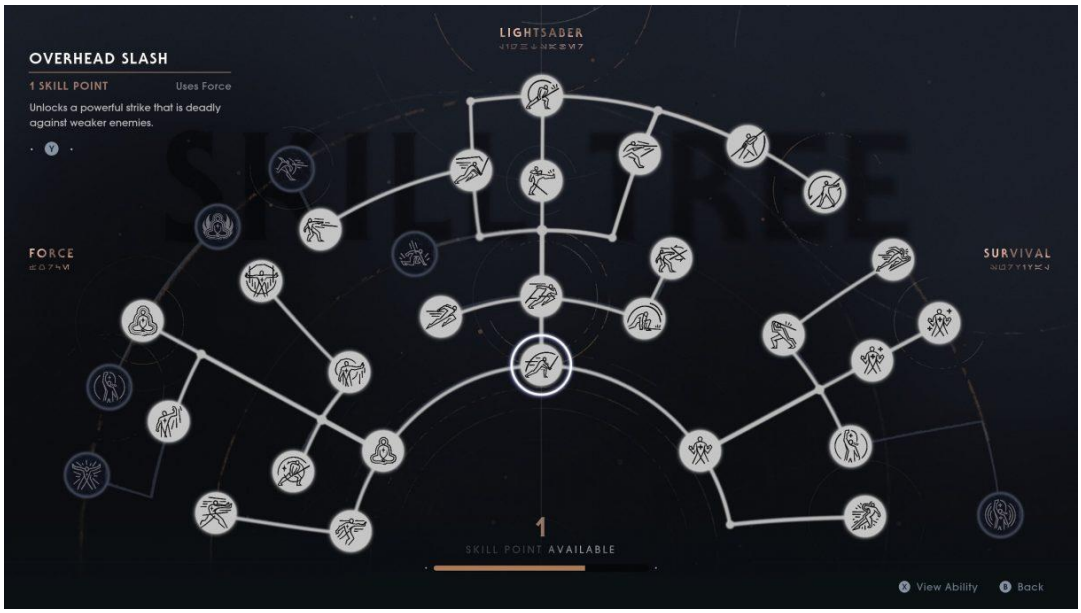


Figure 12: Upgrading system in "Star Wars: Fallen Order "

With this discovery I used two of the said styles, the first being an Embedded Narrative where the narrative scenario will not vary as the player progresses, where the only outcomes are that the

participants succeeds or fails which only happens if the character / player kicks the bucket. The second style is World Narrative where elements of the environments are used to aid the participants not only to progress but also understand the scenario being presented.

4. Fundamentals of Immersion

4.1. Definition of Immersion

To grasp the principles of immersion in video games, one must first grasp the definition of the term. Immersion is not a new field of study and it is not limited to video games. Immersion has been studied in domains other than video games, such as literature, filmmaking and even journalism. Despite the fact that these fields have many similarities to games, it is still vital to research immersion in the context of games. This is not to say that theories regarding immersion in other media are irrelevant in ludology.

The word Immersion is derived from the Latin word, ‘immergere’, which implies "to dip into" (Oxford University Press, 2018). The word has since come to represent everything from describing a celestial occurrence to expressing a method of studying a foreign language. The word ‘immersion’ is used in this thesis to describe player involvement in a game. Immersion is defined by the Oxford University Press (2018) dictionary as "deep mental interest in anything," while the Cambridge University Press (2018) dictionary defines immersion as "full absorption in something."

Immersion in video games is defined in a variety of ways by ludologists, although none of them are universally agreed upon. Despite the lack of an academic definition, players and game

creators usually understand what immersion means in video games. Some gaming forums have threads where users discuss what they found most engaging about specific video games. One user on the GameSpot forum explains immersion as follows: "Games that almost made me forget that I'm playing a video game" - "I became a part of another world that was difficult to leave" (GameSpot Forums, 2015). This explanation emphasises the player's intense mental commitment. Similar game participation is simply one of many examples used to characterise player involvement.

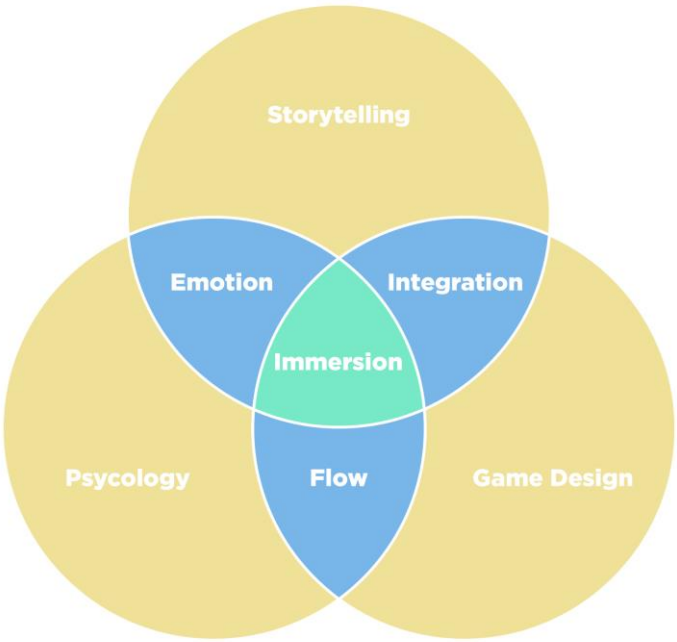


Figure 13: Fundamentals of Immersion Diagram (Player Immersion in Video game 2018)

Possible interpretations include a thinning of the mental barrier between the player and the avatar (Sylvester 2013, p. 40), a sense of participation (Bryant & Giglio 2015, p. 58), spatial presence (Madigan 2015, p. 128), deep engagement (Qin et al. 2009, p. 112), and a metaphor for the

player being ‘in’ the action (Qin et al. 2009, p. 112), (Atkins 2013, p. 158). These few examples exhibit a range of perspectives on video game immersion.

Immersion, according to some authors, is made up of several components. Ryan (2009) discusses two types, that of narrative immersion and epistemic immersion. Three types of immersion are described by Ermi and Mäyrä: sensory immersion, challenge-based immersion, and imaginative immersion (2005). Calleja goes on to define six types of immersion; kinesthetic, spatial, shared, narrative, affective, and ludic experiences (2011).

When defining immersion, it is important to remember that it is made up of many different elements. Immersion is not a single event, but rather a collection of distinct factors. The definition should not be overly limited, but it must include enough information to minimise misunderstandings. The concept utilised in this thesis takes into account the various aspects of immersion. Immersion is described as "intensification of internalized participation that blends a number of elements" according to Calleja (2011, p. 38).

4.2. Interactivity being the key element in immersive experiences

The essential feature that distinguishes video games from other forms of media is interactivity. Immersion can happen without any interaction between the medium and the consumer in books or movies. Video games have a unique opportunity to involve the user and provide a foundation for generating significant experiences and emotions thanks to interactivity. In his article, Christou (2013) explains that immersion is an emergent quality that results from the player's involvement with the game.

In many aspects, interactivity relates to player involvement. In video games, there are two types of interactivity: player-to-game system interactions and player-to-player interactions. Both are extremely effective strategies for increasing immersion. Interaction between players is not required for immersive experiences to be created, but it can surely help. Almost all of the examples in this thesis are based on interaction and the decisions made by the players.

4.3. Immersion through storytelling

Arguably, every video game has a plot. Scripted and emergent storytelling are the two basic genres in which games convey stories. Whatever the case may be, gaming may be employed as a storytelling medium that increases player engagement and adds complexity to the experience. Storytelling is a strong tool for improving the overall gaming experience (Skolnick, 2014). It is worth mentioning that storytelling does not always imply games with pre-written plots. Storytelling can also refer to the story that emerges as a result of gameplay.

A ‘player story’ is another name for this type of story. Emergent storytelling is included into every immersive game experience. Scripted plot does not appear in all games, but it is a crucial factor in creating player immersion in story-driven games.

Game storylines, according to Bryant and Giglio (2015), lead players to create a deep emotional relationship with the game world, which keeps them coming back. Good storytelling can help players justify their actions, define their objectives, and make the game look more organised and methodical (Bryant & Giglio, 2015). Immersion in video games can be achieved through a variety of storytelling techniques.

According to Qin et al. (2009), gaming narratives have three distinct qualities that distinguish them from other forms of storytelling namely, interactivity, nonlinear structure, and connection between gameplay and plot (2009, 107). Ryan defined four different types of story immersion: geographical, temporal, emotional, and epistemic immersion (2009). Calleja (2011) focuses on one aspect: narrative engagement.

Scripted stories are created through narrative participation, while emergent stories are created through spatial involvement. The world narrative is created by combining spatial and narrative participation. Games that allow the user to navigate in a virtual environment contain world narrative.

4.4. Immersion through Psychology

Immersive games can benefit from theories and practices that use a cognitive perspective to direct or influence the player's behaviour (Brugada-Ramentol Bozorgzadeh and Jalali, 2022). Guide the player around the game world, use a reinforcement schedule to award the player, or create a specific atmosphere within a scene are all examples of player manipulation. Subtle player modification can help one have a more natural and consistent playing experience.

We can see that psychological methods can boost the impact of narrative on the player by using emotions, anticipation, and stakes in games and stories. The social play combines elements of storytelling and game elements, with techniques based on cognitive research having a critical role in the experience.

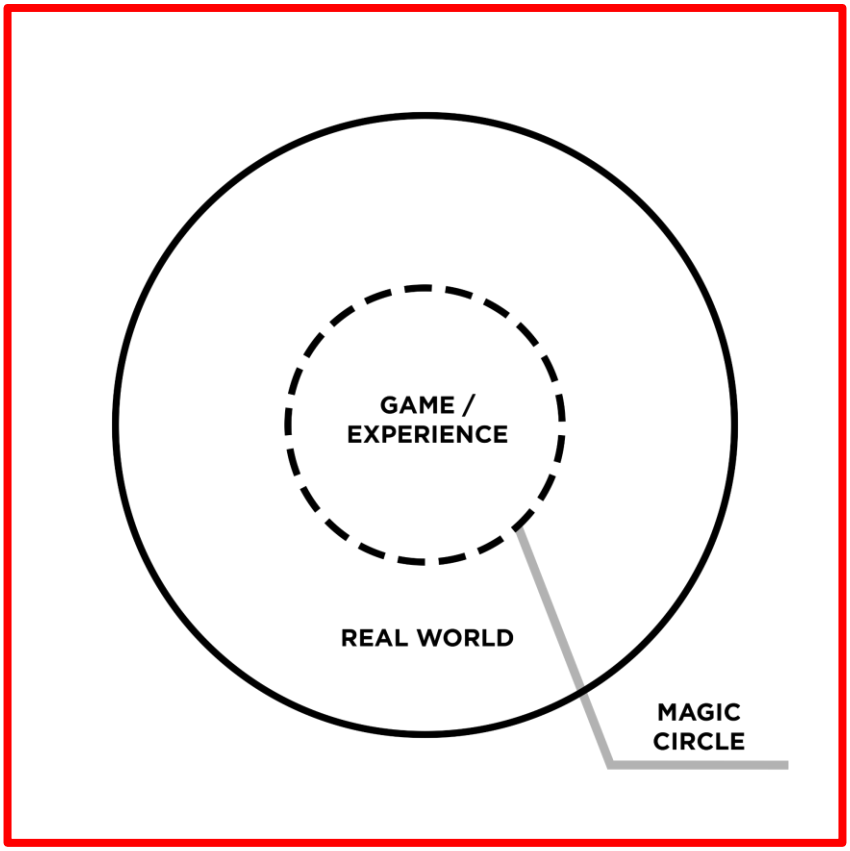


Figure 14: Juul's (2005) conception of the magic circle (pp. 165-166)
Game Studies literature (2005)

4.5. Motivation

Immersion cannot occur if the player loses interest; therefore, a game must keep the player motivated. Intrinsic and extrinsic motivation are two different types of motivation theories (Shodhan, 2017). The term ‘immersion’ is defined as "a psychological state in which intrinsic motivation is the major motivator of engagement." This condition is prolonged when the player's attention is solely focused on stimuli, and awareness of other stimuli in the surroundings is lost" (Burns and Fairclough, 2015, p.107). Intrinsic motivation is considered an important factor in

keeping a player engaged and involved in the game (Shodhan, 2017). A game's design should examine its target audience in order to provide the right ingredients for fostering intrinsic drive.

Billieux et al., (2015) investigated problematic online gaming participation and, based on their findings, showed various psychological profiles of players and their motivations to play. More than one psychological profile can be used to identify players. A game might also appeal to individuals with different psychological profiles. Nonetheless, a game's design should take into account the major target audience's incentives.

Calleja (2011) posits two temporal phases of motivation, in addition to intrinsic and extrinsic motivation: micro and macro. These phases describe the two types of motivation that keep players interested in the game. Micro-involvement refers to the drive to keep playing, whereas macro-involvement refers to the player's motivation to interact with the game while they are not playing. Playing games is not usually motivated solely by a desire to win.

4.6. Player Immersion through game design

The principles, rules and mechanics of a game are determined by its design. A well-crafted game design is an excellent method to establish a solid foundation on which to build an immersive gaming experience. The rules and mechanics of a game should ideally be incorporated into the player's consciousness, allowing them to enjoy the moment of gameplay without having to share their attention. "Rather, the rule system is experienced through decision-making and the pursuit of personal and game-defined objectives" (Calleja 2011, p. 150). Goals are crucial in ludic engagement because they motivate people to take part in the game, but they will not be required

for an immersive experience. A more important aspect is maintaining a consistent flow that keeps the player involved in the game.

Some games involve tiresome tasks that the player may not appreciate if there is no external reward in sight. In games, compulsion sequences and reinforcement schedules can motivate players to finish boring and repetitive tasks. When the player is rewarded for their activities, grinding becomes more appealing (Boller, 2017).

Extrinsic rewards can keep a player interested in the game and increase gameplay engagement. Compulsion loops and reinforcement schedules have their own problems, as much as they can motivate the player. According to King and Delfabbro, clinical obsession is linked to game rewards perceptions (2014). A game's design should consider how to avoid the development of possible addiction.

5. Players-Bartle's Taxonomy

5.1. Player categories

When it comes to gamification in the industry, it is critical to understand how your users desire to play games. The Bartle Test of Psychology was developed by Richard Bartle to categorise how individuals play games into 4 categories. These four categories are: The Achiever, the Explorer, the Socializer, and the Killer.

Prior to using Bartle's taxonomy and categorising the participants, it is worth noting that these categories are not rigid, as most candidates would showcase traits in more than one category. Regardless of this, most people would still have a more dominant personality which would

determine the overall preference. If you utilise this tool to establish where the majority of your players fall, you can then use that knowledge to select the majority of features you will employ, while only include a few elements that appeal to each of the other categories.

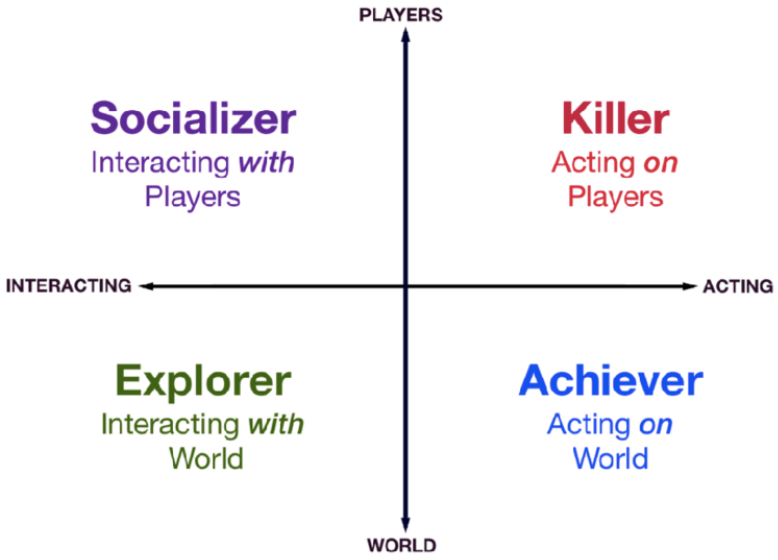


Figure 15: Bartle Taxonomy Diagram (google search)
https://www.researchgate.net/figure/Bartle-Taxonomy-Strubledesign-2019_fig2_338775073

5.1.1. The Achiever

Achievers are mostly after gaining points and ranking. These players want to be able to show their competitors how far they have progressed. They enjoy collecting and showing off their badges earned from games like Halo, where even easy tasks win them medals. Approximately 10% of persons, according to Bartle, are Achiever type gamers. One is likely to know several people like this, as an example, someone who boasts about taking a faster way to a location than his / her friend is an Achiever. As a result, introducing a scoring system into the artifact by

offering badges for milestones, is a wonderful incentive to keep this type of player's attention fixed.

Figure 16 : Badge reward system in Halo: Reach (2010)

5.1.2. The Explorer

Explorers like to go to new places and discover new things. They are less concerned about points and rewards. For them, the goal is discovery. Explorers are alright with mundane tasks as long as they open a new section of the game or deliver some sort of Easter Egg.

Explorers enjoy the element of surprise that a game may give, and around 10% of players fit this description (Kumar, Herger and Dam, 2020). These are the gamers that will feel at barriers in a game to obtain access to a concealed passage; their excitement at doing so, not gloating to their peers about their discovery, is what motivates them. You will be speaking their language if you add a feature like this in your gamification design. Since in this project's artifact the user has a

greater range of motion due to the fact that it would be incorporated in their environment, incorporating an easter egg into the artifact is not difficult. It could be as simple as adding text or implementing a hidden feature within the controller they are using, such as implementing a button combination that allows them to view the game or experience it in a different way from that which they would normally be accustomed to.

5.1.3. The Socialiser

The vast majority of players are socialisers. That equates to approximately 80% of all video game players. Interacting with other players gives socialisers enjoyment in their games. Socialisers are prepared to collaborate in order to accomplish more and greater things than they could alone. Farmville (2009), Facebook's most popular game, and Minecraft (2011), a more modern game that allows up to eight players to gather online to explore and build together, appeal to the Socialiser.

For instance, socialisers are prepared to water someone else's crop in return for new crops for their own property. Another example would be workplace colleagues who depart at the end of the day and remind one other to water each other's crops. These people may be friends or just acquaintances. Whatever the circumstance may be, Socialisers believe that joining forces makes sense. It is worth emphasising that this is the final sector where strong rivalry exists, but this does not suggest that Socialisers are slackers with no desire.

5.1.4. The Killer

The Killer suggests a sinister-sounding kind, yet one that is ultimately true. Killers are comparable to Achievers in that amassing points and gaining status gives them a thrill (Kumar, Herger and Dam, 2020). Killers are different from Achievers in that they want to see others fail. They are incredibly competitive, and nothing inspires them more than winning. They want to be the greatest at the game, and it should go without saying that the only way to do so is to defeat everyone else. One would think that this personality type is common, but study shows otherwise. (Kumar, Herger and Dam, 2020), only a small proportion of players are Killers. — less than 1%, to be precise. Some gamers, particularly those with the Killer player personality trait, are only truly content when they are winning and everyone else is losing.

5.2. Which of the mentioned players is the artifact mainly aimed for?

Following the results of the focus groups (Appendix D) and seeing players from all categories, it is clear that all players from all categories can participate in the experience. However, players in the Explorers and Socialisers categories appear to immerse themselves more than the other two, as the artifact / experience requires players to explore and simply survive, with no scores or badges or awards.

6. Characters and their Identity

According to P. M. Staff (2013), there are two types of video games available today: those with dolls, sometimes known as Avatars, and those with fully developed characters. The first category gives the player a blank canvas with limited characterisation to work with, while the second puts

them in the shoes of the presented character, who already has established elements and a backstory.

Games that condition which character to play are frequently dissociated from the user's knowledge of the character; on the other side, games that lack characterisation are perceived as sandboxes with no underlying significance, reducing the game to nothing more than a tool. To believe in the art of video games, one must believe in and recognise player participation as a kind of creative expression (Staff, 2013).

When looking at restricted characterisation, one can notice that it typically seeks to communicate a clear story or even story sensing, or, as Tadhg Kelly (Raw Game Design, 2015) puts it, the importance of interaction with the gaming world is reinforced. We come across a doll that serves as an extension of oneself rather than as a character or protagonist. When a user adds a character to the doll, the player assumes the position of an actor and begins acting in the game's tale.

When a user / player is presented with a predefined game, such as that of Tomb Raider (2013), he or she is presented with a protagonist that the game has already developed, with all of the gaps filled in, including the name and all of the traits. Lara Croft is the player, and the character supports all of the player's (directed) decisions. It is simple to conclude that fixed characterization is appropriate for movies.

Replayability or the word reincarnation are two words that come to mind when describing the effect of player-character. When approached correctly, the player-character concept allows

players to walk into the shoes of the character while simultaneously adding additional context from their own life. The absence of voice acting and facelessness can help with this since they allow the player to fill in the blanks with their imagination while simultaneously narrowing the gap between the avatar / characterand the player. The player, on the other hand, would be equally developing and taking from the character at the same time. For these reasons, the character Lara Croft (Tomb Raider, 1996) was successfully steered in this direction and also for these reasons reference was made for this thesis.

When attempting to put oneself in the shoes of a fictitious character, what ideas does the player have? Before delving into the player-character interaction, it's important to understand the various aspects that come into play when the player is playing along, such as Spatial, Share, and Narrative, as mentioned by Gordon Calleja in his book 'In Game from Immersion to Incorporation' (2011). The term 'spatial involvement' relates to the character's interaction with the environment, as well as whether or not the player can predict what will happen when certain instructions are provided, such as predicting how far the character will hop while jumping between two locations. 'Share Participation' refers to the player's capacity to empathise with the character in whatever situation he or she is in, whereas 'Story Involvement' relates to the narrative being played and how engaged the player may get in witnessing and affecting the outcome.

Although the aforementioned varieties of 'Involvement' may not immediately reveal the character-player relationship, they are important forms that the player must go through and understand before considering a relationship with the character. As a result, if the spatial

environment (controls) or storyline do not pique the audience's attention, there is a low likelihood that the user will want to continue building involvement inside the game / experience.

Following a study of the forms that the player looks for while seeking to connect to the game, we may ask the player, "Who am 'I' in the Game?" As researcher Daniel Vella put it, "understanding of the ways in which games determine their players' subjective existence towards the Gameworld" (Vella, 2016). (p.13) In his research, Daniel writes. We may go back and forth between character kinds using the connection, especially in terms of how the player might sympathise with or relate to them. Whether the user is playing a character with a well-developed past or a blank slate, the user will always find a way to put himself or herself in the shoes of the character.

6.1. From creating a complete character to creating a character without an identity

6.1.1. A Complete Character design process

When creating a character, one would take the following steps to help the player create a character that the player can relate to (Masterclass, 2020): -

6.1.1.1. General Idea

The designer’s role in this step is to look at the plot that will be executed and determine what kind of character is required to get a sense of the character's personality type, without going into

too much detail. Further details and tweaking are added after the designer has a broad notion of the character.

6.1.1.2. Establish a backstory

A solid backstory for the character is vital when creating a well-designed character. This might be disclosed during the game or simulation, or at the start, to define all of the character's relationships with other characters and to have a deeper understanding of the character; the better the history, the more the audience would sympathise or identify with him / her.

6.1.1.3. Scenario

This step's purpose is to establish the scene in which the protagonist will be located. It will be easier to discern how the character will fit in after the scenario is set. The scene will be the focus as the aesthetics of the scene will be the backbone of the game. For example, if one creates a war scene, one will naturally equip the character with the necessary equipment aesthetic to match that given scenario.

6.1.1.4. Figure out the character arc

One must next determine what changes the character will go through from start to end as they progress in the game. Once you establish this, you can then finalise the aesthetic. An examination of the emotional and physical changes the character will through, as well as how the character will reflect these changes is essential to gain a better understanding of their actions.

6.1.1.5. Add character traits

When viewing any type of movie or series, adding features to a character is just as vital as their looks because it lets the audience form a bond with them, whether by sympathising with them or discovering oddities with which they may identify. This is crucial because, if done correctly, the audience will perceive the games protagonist as more than simply a character; they will see them as a person who has come to life.

6.1.1.6. Define the relations

Another technique to figure out who your character is, is to write down the interactions he or she has with other characters and examine how these relationships evolve as the story progresses, giving you a clear picture of the character's behaviour and actions. The relationship between the character in development and the player will be influenced by how he or she interacts with other characters.

6.1.1.7. Provide an aesthetic that fits the story

In this final stage, it is time to give the characters appearances that match both the narrative and the setting. Character qualities that complement the preceding stages are frequently inspired by the earlier stages. If the character is given a pre-determined wardrobe, the designer must make the gear as iconic as possible; nevertheless, it is also standard practise to offer various designs for

the player to choose from as long as all of the designs match the settings provided as well as the character's qualities.

6.1.2. Faceless unidentified character design process

Given that the type of character being created for this study is one without an identity, changes to the above list are required, in this case the list should be shortened rather than altered. The objective is to put the player in a game with as little data as possible, comparable to a blank canvas for the player / user to fill in. As a result, the player would be expected to fill in and get more immersed in the scenario / story.Having followed the processes for developing a character with fixed characterisation, the steps for developing a character with non-fixed characterisation, or a character without an identity, are examined. As previously indicated, removing phases from the 'Character Design process' will allow users to fill in the gaps. The phases that will be omitted for this project are 'Background Story,' 'Character Arc,' 'Character Traits,' and 'Relationships.' As previously stated, the main factor for this is that one would want the participants to fill in the gaps and input components from their own lives to make it feel authentic and develop their own journey forming their own connections with the rest of the characters, rather than trying to follow a storyline that will not change regardless of the user ’s actions.

Which of the remaining steps, now that the aforementioned procedures have been eliminated, is a must for developing such a character, and why?

6.1.1.1. General Idea

This stage is required since all designers need a point of reference. As previously indicated, there is no need for details; hence, knowing that our character is a soldier is enough to start drawing a basic figure and decide how best to provide him or her amour. The key question was whether the character should be fully clothed, including his face. If we obscure the face completely, we create a sense of mystery and intrigue, pulling the audience in with their want to learn more while also making it easier for them to put themselves in the shoes of the protagonist. Because the character has no identity or other means of identification, anyone, including the player, could be hiding behind the mask.

On the other hand, one might give the player the option to choose to reveal particular face characteristics (in the case where the character is wearing a mask or any manner to hide his identity) but only to a certain extent, and whatever is seen can be altered. This will keep the mystery alive while also enabling users to add unique features to break down the barrier between both the player and the protagonist. Following much analysis and drawing (Appendix B character sketching), it was determined that the character in development's face would not be fully covered, enabling the player to adjust facial characteristics such as the eyes and skin colour. As a result, it was decided to reveal some face characteristics, not enough to create a full image of the individual, but enough to characterise parts that the player may find significant.

6.1.1.2. Scenario

The Scenario must be included since it is critical to establish our character within the framework of a plot / screenplay. This allows us to further constrain the aesthetics. The current character's goal is to be placed in a battleground which is a combination between the video game titles Halo: Reach (2010) and Call of Duty (2003). Both of the mentioned games are action-packed and need the heroes to be well-prepared for any eventuality thrown at them. When placed in a high-intensity setting, a player is more likely to engage with the surroundings, otherwise the game will be lost. Because the setting / situation in which the figure will appear is set in the distant future, it is not feasible to just look at current army gear and see how it may be included, but rather to come up with more futuristic notions that are 'upgrades' to what already exists. To achieve this aim, layers were added to what already exists, such as adding effects like holograms which will not only look futuristic but would also have a function to guide the character. Other elements such as adding interfaces with a more futuristic look, as the case of interfaces like weapons used in Halo: Reach (2010) are good indications that the scenario or story takes place in the future.

6.1.1.3. Provide aesthetic

After one has achieved a broad notion of the character and the situation in which he or she will be put, it is time to start thinking about the aesthetics and finalising possible themes. This was accomplished by creating a final character design that can be seen in appendix A or on page 69 in the Project section along with the final artifact.

Looking at the final version, we notice that the figure is wearing a face mask that conceals most of his or her face but leaving the head and region around the eyes visible to the user. Along with the rest of the armour, the character received a chest plate, shoulder pads, and wrist guards. The armour was made to appear light in order to offer the character optimum mobility,
as can be seen in the project section on Page 69 or in appendix A.

Final Project

7. Types of User interfaces and which to apply to the application / artifact

7.1. Types of User Interface

7.1.1. Non-Diegetic

Non-diegetic user interface features exist outside of the game's plot and setting. The elements are unknown to any of the characters in the game, including the player's avatar. Non-diegetic components must be properly developed, positioned, and contextualised (Bowers, 2019). In fast-paced games, non-diegetic components might disrupt a player's immersion experience. In strategy games, however, they can provide gamers with a more complex assessment of resources and actions.

Stat meters are a frequent non-diegetic component in video games. They maintain track of points, time, damage, and various resources amassed and expended by players during gameplay.

Figure 17: Example from Titanfall 2(2016) of Non-Diegetic interface with info such as health ammo count and map displayed on screen.

7.1.1.2. Diegetic

Diegetic UI components exist in both the story and the environment of a game, and characters within the game are aware of them. Poorly planned diegetic components can nonetheless distract or frustrate players even if they exist within the game story and space.

Diegetic components are complicated by scale. A speedometer on a vehicle's dashboard, for example, will most likely be too small for players to see clearly. In certain games, handheld diegetic elements (such as maps) can be switched to a 2-D, full-screen view, rendering them non-diegetic. Dead Space (2008), for example, has a hologram map, while Halo:Reach (2010) has an ammo counter on the rifle.

Figure 18: Example of Diegetic interface with the ammo count displayed on the gun. (Halo: Reach, 2010)

7.1.3. Meta

Meta user interface elements can be found in a game's plot but not in its environment. A player's avatar may or may not be aware of meta aspects. Traditionally, meta components have been used to signify damage to a player's character.

Meta components might be minimal, such as a coat of dirt gradually accumulating on the game's two - dimensional surface, or they can be important in the gaming experience. In combat and adventure games, the field of vision may be shattered, blurred, or discoloured to signal that a player has suffered damage.

Figure 19: Gaming Interfaces Meta Interface Example. (Halo: Reach, 2010)

7.1.4. Spatial

Even though they are incorporated in the game's space, characters in a game cannot see spatial UI components. Spatial components can be used as visual aids to help players pick items or point out important locations.

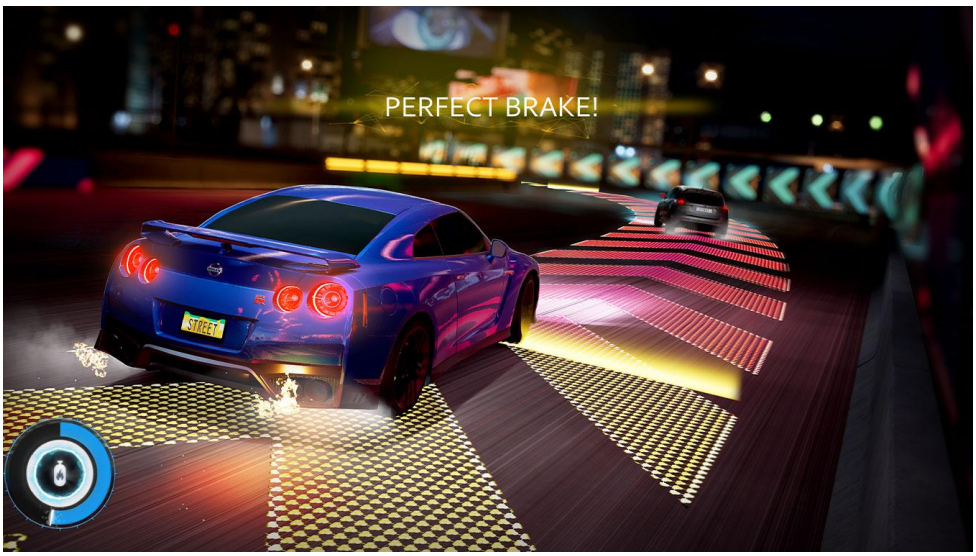


Figure 20 : Gaming Interfaces (Example of Spatial Interface). (Forza Horizon, 2012)

Written tags or pointers to follow are typical examples of spatial UI components, as shown in the picture above. Players in fiction and adventure games may come upon crucial artefacts that appear weird. Text labels quickly eliminate uncertainty and keep players involved in the game.

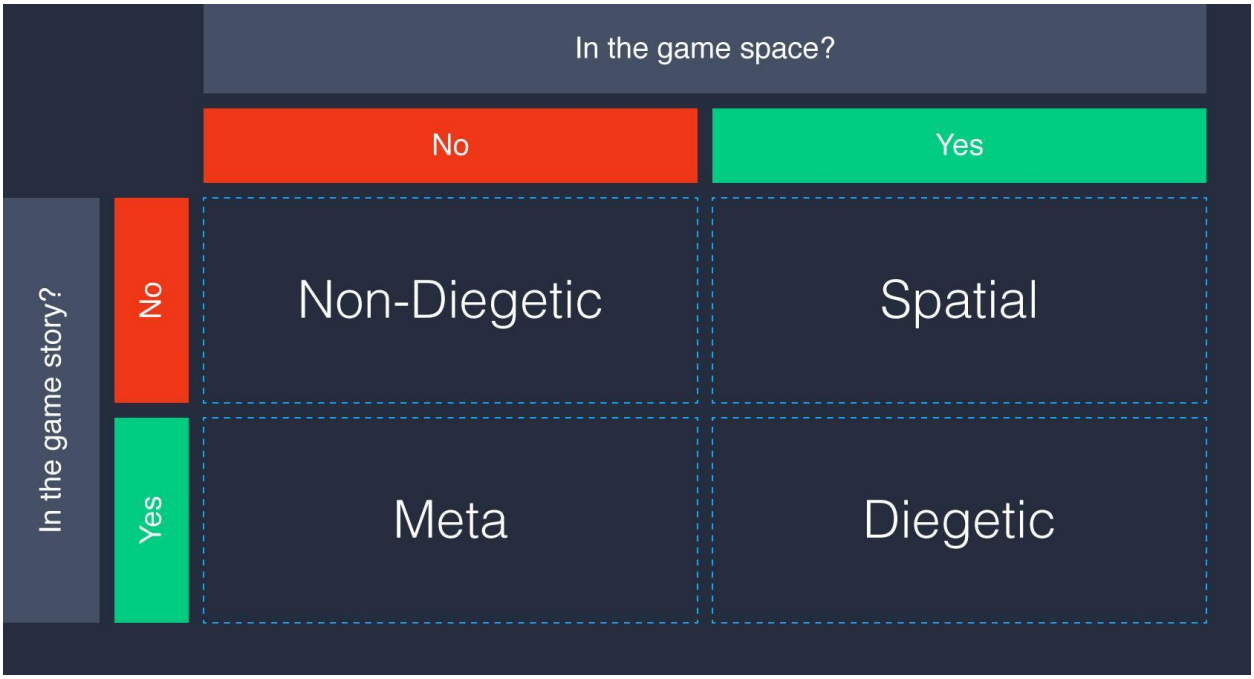


Figure 21: Gaming Interfaces and how to distinguish them.
Level Up: A Guide to Game UI (with Infographic)
https://www.toptal.com/designers/gui/game-ui

7.2. Which Interfaces to incorporate in the Application / Artifact.

Given that the main goal of this thesis is to merge two realities and bring digital media into the user's reality, it is critical to treat anything digital as if it were a part of the environment, rendering obvious guides like those found in 'spatial UI' useless because they would break the user's immersion. The same may be stated of 'non-diegetic UI' as it would not be part of the user's surroundings unless futuristic features were included, in which case it would be considered 'diegetic.' As a result, only 'diegetic' and 'meta' user interfaces remain, as they can both be integrated into the user's surroundings.

As previously mentioned, Halo: Reach (2010) provided inspiration for the main character's gun, which allows the player to see the ammo count deplete while he is shooting. Aside from the ammo count, the user can see a health bar in the upper right corner, thanks to the character's future helmet with a built-in screen.

8. Artifact

8.1. Purpose of Artifact

The goal of this thesis is to employ Mixed Reality to create an interactive experience and determine if it is possible to leverage components of one's environment to enhance any given experience. This is a step beyond AR. In AR one is simply given a layer of digital media that does not interact with his or her environment, but still tries to give the impression that the media is part of the environment by adding perspective (item can shrink and grow depending on how close the user is) and adding fake shadows to blend in even more.

Users will need a means to interact with the media that is being presented in their environment, which is why a custom controller is utilized. Of course, users may still interact with their surroundings by pointing the camera straight at the object they wish to interact with to activate a feature. Another option is to build collisions in the space that will be activated when users approach a certain distance from the trigger. Even if all of these eventualities are feasible, a controller will give users more control over the experience because it will be easier to manage than stepping back and forth in the hopes of activating a trigger.

Figure 22: Artifact: Second Attempt (Viewed through the application for the simulation)

8.2. First Approach

Considering that the objective was to create an experience for users to interact with digital information in their environment while simultaneously allowing the surroundings to influence the content, it seemed reasonable to give users a baseline against which to measure the experience. As a result, it seemed logical to develop a second experience / simulation in which the area to be used was digitized and replicated as an on-screen simulation. Users can compare the two versions, one 'on-site' and the other 'on-screen,' to see which had a greater impact or, in other words, had them more engrossed in the experience.

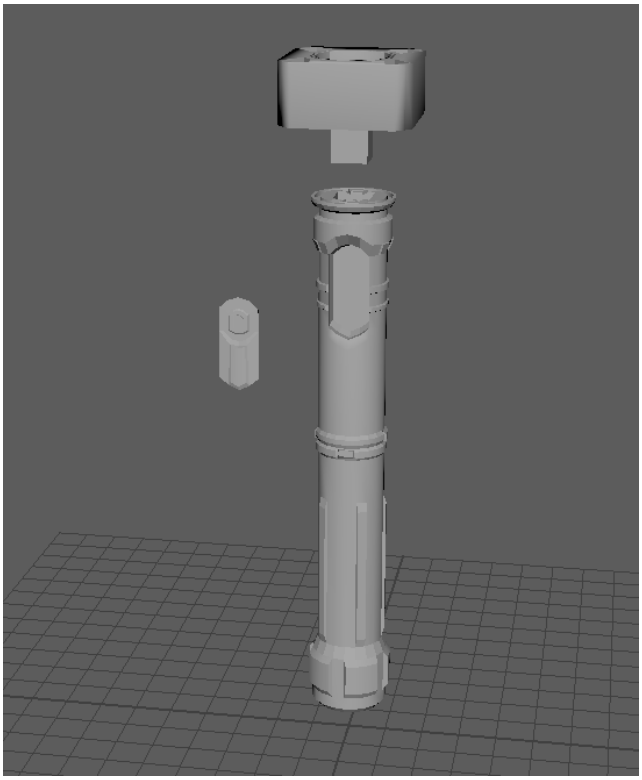


Figure 23: First joystick attempt (3D model)

Figure 24: Attempt in creating an onscreen simulation.

8.2.1. Application

As previously stated, the original process adopted to develop the application was to create two versions of the same simulation, one of which would be played on a screen such as a smartphone or a computer. In the second version, the user would see the simulation through the use of a Google Virtual Reality cardboard box that included a smartphone. When the smartphone is in use, the camera is turned on so that the user may view his or her surroundings through the phone. Digital content can be added in between thanks to the camera/display.

A combination of technologies was utilized to construct these simulations, including 'Maya' for 3D content, 'Vuforia' for creating and scanning the environment that was used to make mixed reality viable, 'Dream weaver' for coding, and finally 'Unity' to merge all of the previously stated technology. The main program, 'Unity,' was utilized for both testing and exporting the application to any intended device, in this example a smartphone and a PC.

8.2.2. The creation of a Joystick

Even though the majority of the work was done on the application, the user will require a tool to assist him or her in interacting with the MR experience. Since the smartphone will be sealed in the VR Google box, there will be no physical input or access to the screen except for tasks such as proximity monitoring and distance measurement. Apart from these inputs, the user will require a means to interact with the material, which hence necessitated the creation of a bespoke joystick to link to the smartphone through Bluetooth.

8.2.3. First Attempt in creating a joystick.

A joystick in the shape of a handle or a sword hilt was used in the first attempt in creating a joystick. The chosen design was inspired by the 'Star Wars' franchise where a familiar tool for the intended audience, and even if it was not, further it would be simple to use. A small chamber was incorporated in the design of the joystick, to accommodate a mini-Bluetooth controller, allowing the user to enter commands as needed. In addition to the button inputs, the controller also had 'image targets' at the top of the hilt for the smartphone camera to pick up and interact with the scanned environment.

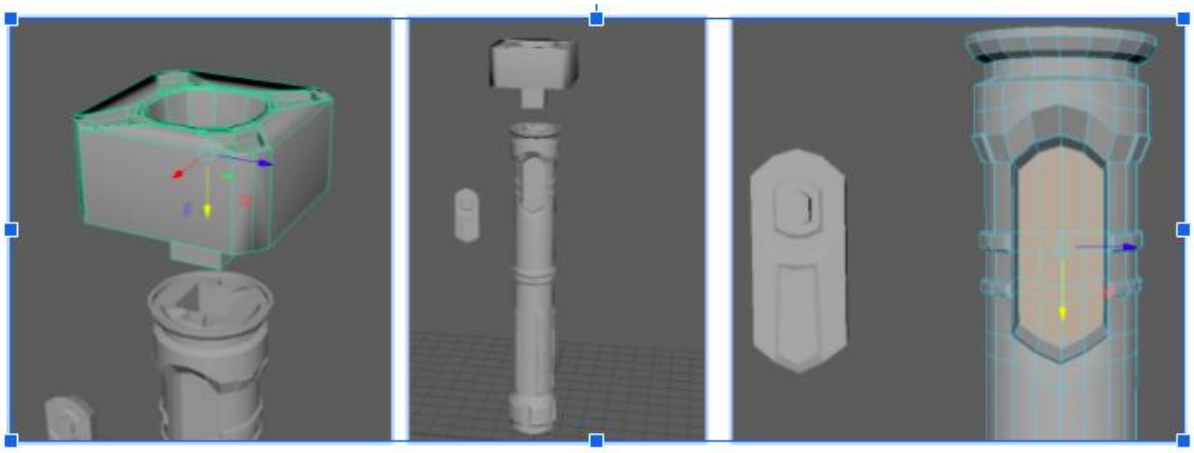


Figure 25: Joystick (First Attempt)

8.3. Second Approach

The first concept was scrapped due to concerns with accuracy failure when detecting the image target with the smartphone especially since the user was required to move controller quickly. Due to this problem, the second controller concept had to be one that didn't force the player to move the controller too quickly. The ideal design option chosen was to model it after a gun. This

meant that the user would not need to move it too quickly because it provided a clear view of the aiming site at all times and this is essential to use it efficiently.

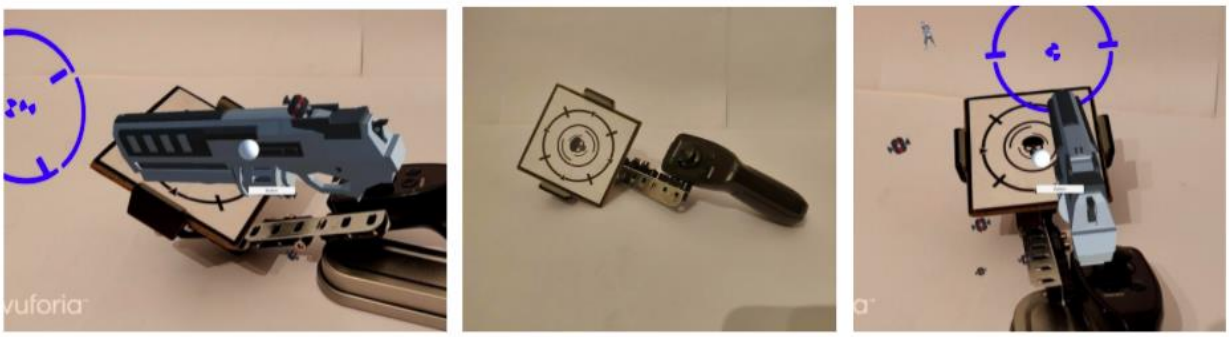


Figure 26: Second attempt in artifact / joystick

Consequently the second and final artefact created is a Bluetooth joystick in the shape of a pistol with a grip on which multiple visual targets may be attached. Even if the main goal is to use the controller as a handgun for RPG (role playing game) experiences, to aim at leaving the options available rather than offer only one type of experience. Because of this, alterations were made for the final design.

In order to finalise the final artifact a 3D model was created using ‘Maya’ which was subsequently 3D printed. The artifact (reference to the image below) consists of two main parts.

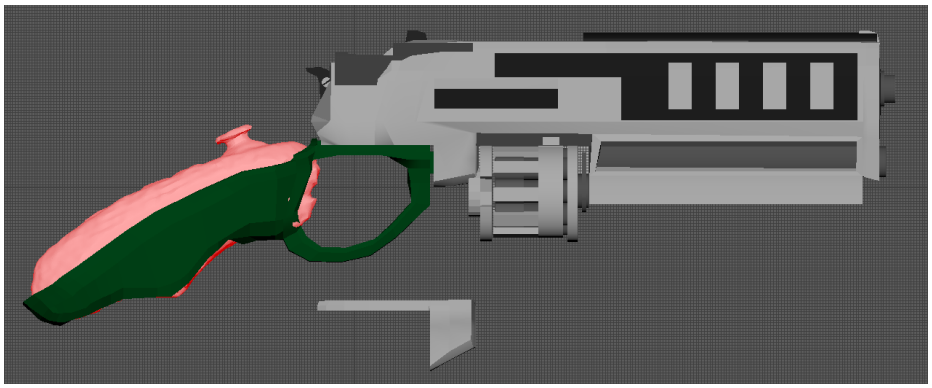
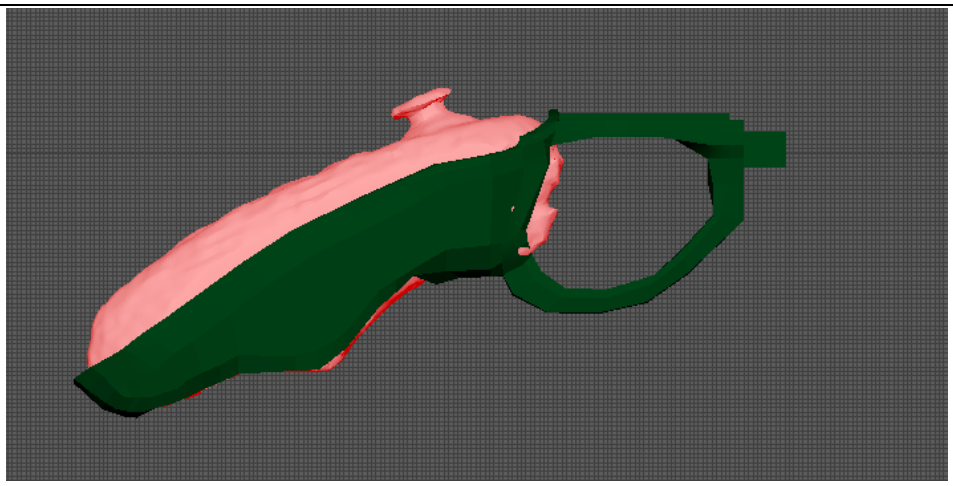


Figure 27: Third and final attempt 3D model (Main components before 3D printing)

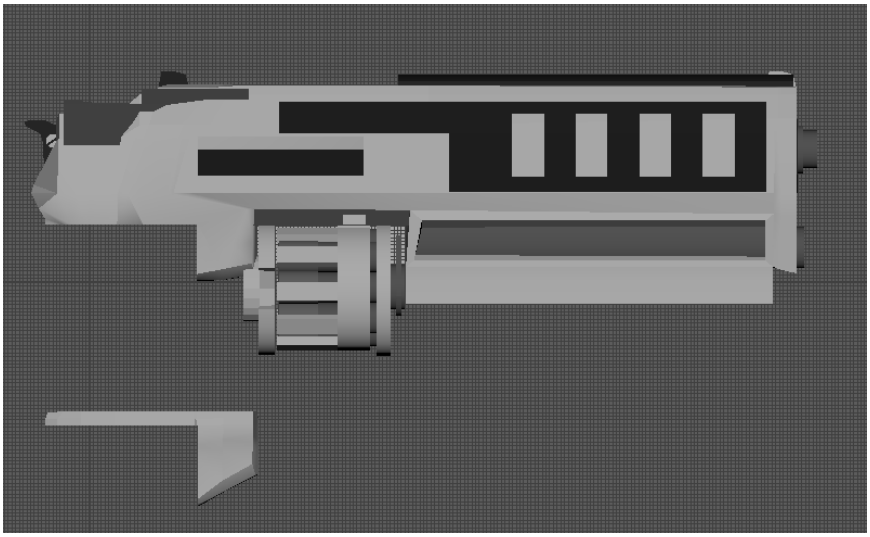
Part A being the grip which holds the Bluetooth joystick, would be used throughout all the experiences as it is the controller hub and the main grip that users will use to input controls for any given activity.

Part B consists of multiple attachments to which the player can pin image targets; depending on the activity that the user will pursue, hence this part would be interchangeable. In order to showcase the concept of 'Part B' being interchangeable, two models were 3D printed, one in the shape of a fire arm and the second as a simple attachment which will simply hold an image target. The firearm will be used for RPG experiences whereas the second attachment will be used for simply interacting with your environment. These two attachments are sufficient to convey the concept of the users being able to switch the attachments dispensing on the task or activity chosen.

Figure 28: Bluetooth joystick attached to the 3D printed artefact (Manual)
Google search: https://cdn-0.fccid.io/png.php?id=3564749&page=0



Part A of the artifact (Joystick)



Part B of the artifact (Joystick)

Figure 29 : Part A and Part B (Joystick)

The gun attachment was inspired by a number of video games and movies however, the main inspiration came from the ‘Halo (2001)’ game series and ‘Titanfall 2’ (2016). In these games as the main protagonists are at some point handed a futuristic gun/sidearm that displays the ammo count. This concept was utilised not only to aid users but also to utilise the space and place an image target for the camera to recognise and use.

Figure 30: Halo:Reach(2010) and Titanfall (2016)

Figure 31: Final artefact/joystick (3D Printed)

8.3.1. Simulation / Application

With the artifact (Joystick) complete, the next step was to create a simulation in which the user would make use of them. As stated in the beginning, the main aim was to create a game scenario in an existing environment where the application will take into account to ones surroundings. Once the setup of the environment was complete, it was all about selecting a narrative or rather a scenario which the player would find easy to grasp and adjust themselves to and understand what their objective is. Originally, the initial simulation was intended to be held at the university grounds, the initial concept was to place the user in an apocalyptic scenario where s/he would need to defend himself / herself against Zombies and in the process collect a number of items

around their location in order to complete their mission. The scenario drastically changed from this first initial intended approach to the final one. Along with the on-site version of the simulation it was originally also intended for the user to an ‘on-screen’ version with the same scenario as well as objectives as so that they would be able to compare the technologies as well as the immersive aspect.

8.3.2. Why change the approach?

Due to the fact that the original version of the project involved the scanning of a good portion of the University grounds (specifically near the library and Quadrangle / Atriju Vassalli) and the location was chosen as to make it easier to gather participants for testing however this was not a feasible option since elements of the environment would change constantly thus making the application glitch as the camera of the devices being used would struggle to recognise the prescanned environment. Apart from the scannable environment, the fact that players would be running around with a VR box potentially colliding with other students and hazardous obstacles would be too risky. In order to make this experience possible, a smaller area had to be utilised in order to have more control on any changes that would occur to the environment, guaranteeing that the application would not have any difficulties to scan and project content onto the environment.

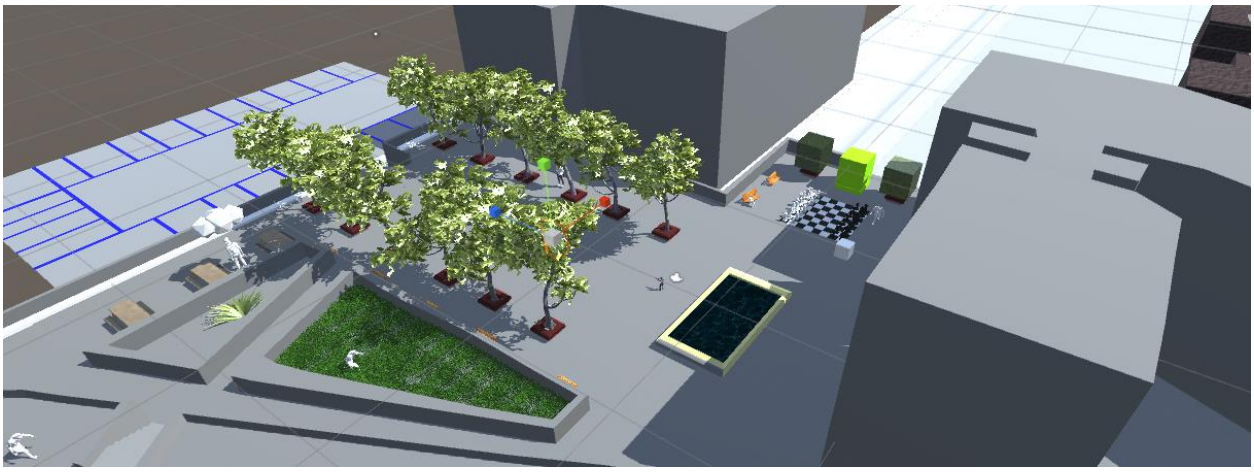


Figure 32: A 3D recreation of the university of Malta using 3D software using Maya

With regards to the on-screen simulation, that was finally scrapped completely as I believed that users will most likely focus on the comparison of technical features rather than the actual experience and the immersion aspect.

Figure 33: A 3D Environment On-screen (Testing)

8.4. Final Approach / Final Project

Once the environment was chosen, certain game elements could be added to the scene in order to begin the testing phase to ensure that a playable prototype could be presented to the participants. The initial elements added where solely function based such as that of the controller and the interaction with the environment. Certain elements would be added depending on the feedback given by the participants that would give their opinion / preference during focus groups such as the type of user interface as well as whether or not the player will be playing a fully developed character or not.

8.4.1. Focus Groups' Findings and Final Decisions

Focus groups were organised in order to gather information on the participants' preferences to assist me in making the final decisions before completing the simulation. During the focus groups, the participants were educated on the subject and an open discussion were held on what elements would impact their experience.

During the focus groups, the participants were presented with a set of questions that were split into three sections. The first section dealt with their experience with reality technology and their preferences regarding the kind of games or experiences they look for with such technologies. From the results gathered from this section it was apparent that they were all familiar with the technology, of course some more than others but the involvement of mixed reality was new to some of them. This was very encouraging as it meant that once we came to the testing phase,

participants would be able to focus on getting immersed in the experience rather than trying to figure out how to use the technology, which after all is not the main goal of the experience.

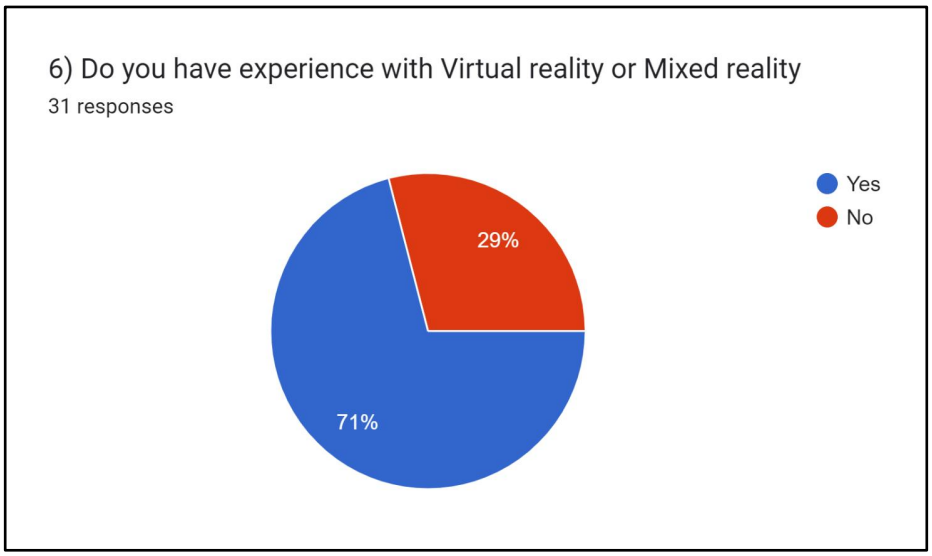


Figure 34: Question 6 - Focus group questions (Focus group question)

In the second section, participants were asked questions about their preference regarding their relationship with games as well as to identify the category of player they see themselves under (as seen in chapter 5 of this dissertation where Bartle's Taxonomy is explained). This information assisted me in creating the content given during the simulation as it guided me in choosing whether to add more detail or whether to add elements such as a high score. The majority of participants identified themselves as 'Socialisers' and 'Explorers' and because of this, it was essential to add detail to the simulation and isolating them during the experience was not a must, as most felt comfortable experiencing any event even when others were present.

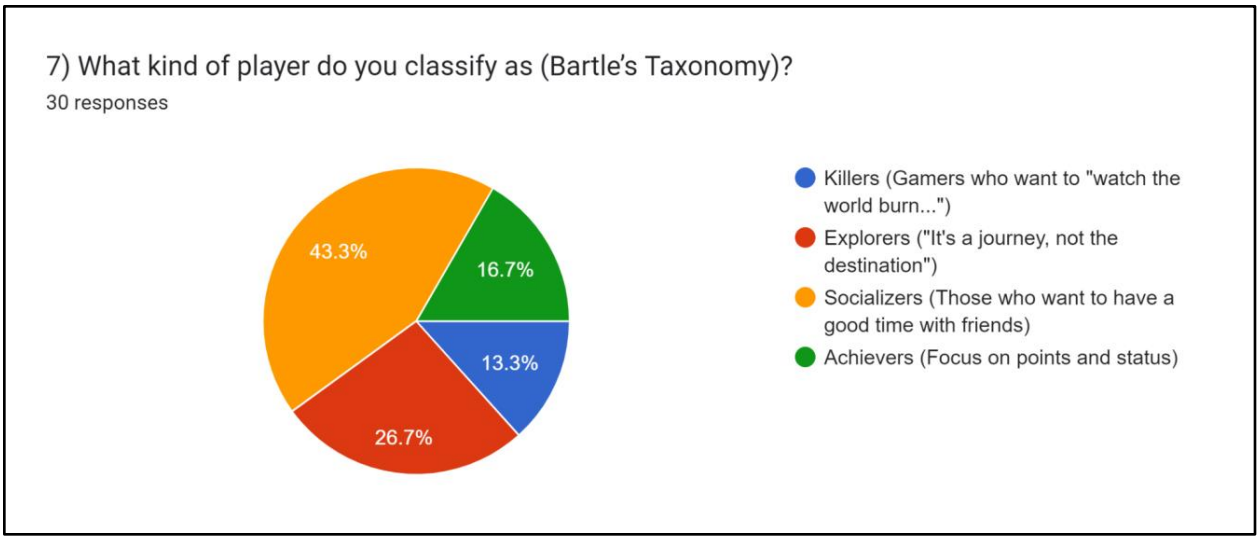


Figure 35: Question 7 on player classification (Bartle's Taxonomy) (Focus group question)

When it came to the type of games, the majority did not have a specific preference but the top selected types of games where 'Social', 'Adventure' and 'Action'. These preferences would suite the simulation perfectly since the experience would include a scenario that has to do with fighting off a type of an enemy and interacting with the environment for the sake of exploring. After establishing the type of game the participants enjoyed playing, the next step was to dive deeper and see the type of characters they like to play as and the kind of narrative they like to follow. The findings of the focus groups on this topic highlighted their preferences to a character they can empathise with a full background story or a basic outline of a character with gaps for the participants to fill in to make it more personal, and the scenario. Hence, users preferred having a fully developed character with a face however having certain undisclosed characteristics such as the gender, as seen in the game series Halo: Reach (2010)

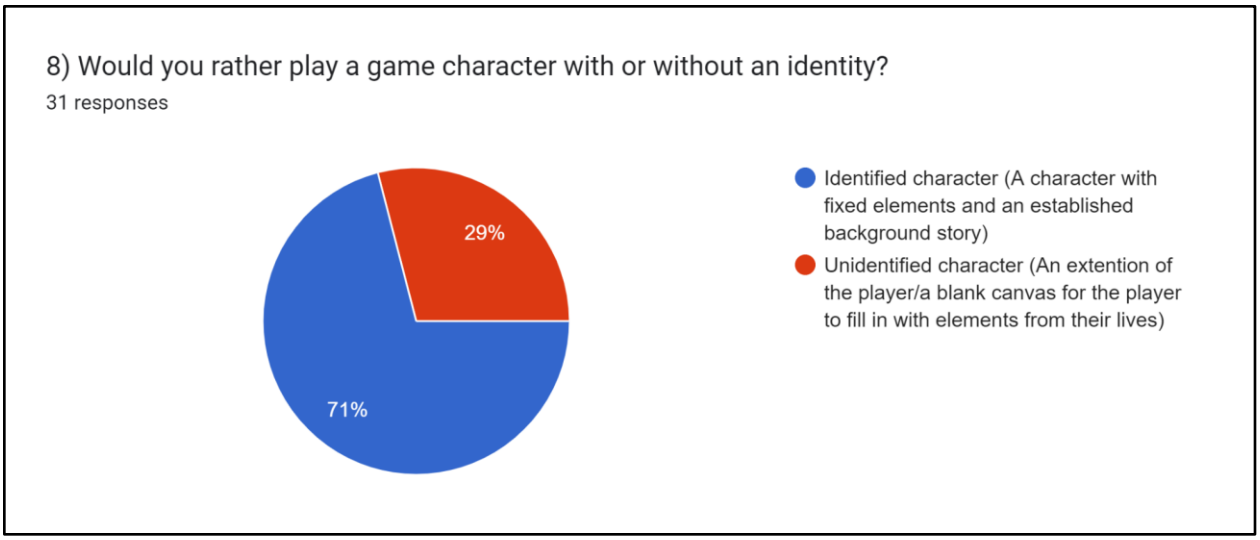


Figure 36 : Question 8 on Identified or Unidentified characters (Focus group question)

When it came to questioning them about the narratives, the participants were simply asked if they like Linear Narratives (from point A to point B) or non-Linear Narratives which might give users too much freedom and might confuse them if the instructions are not clear. As expected, the majority preferred Linear Narratives for the simple reason that they would rather opt for an experience that is straight forward and that allowed freedom in other areas such as the exploring of the environment and taking their time when going from one task to the next, as long as their next task is clear.

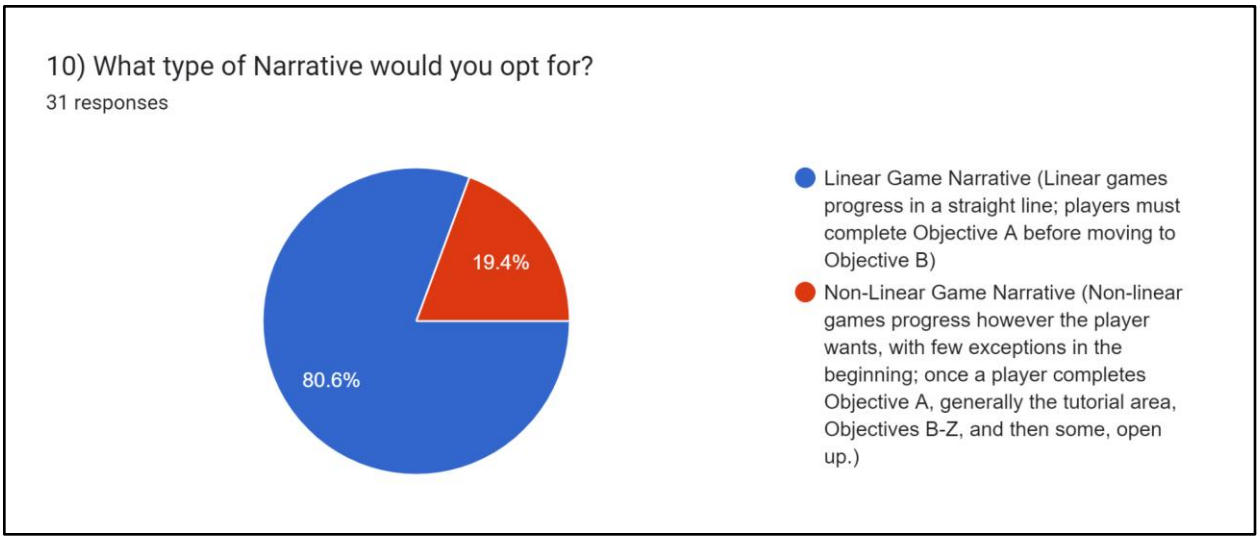


Figure 37: Question 10 on Linear and Non-Linear narratives (Focus group question)

Looking at the last section of questions, participants were asked about their preference in user interfaces as well as which interface they believe would go well with the experience. It was important to obtain this information as it would make the difference between placing information and instructions either on screen making it straight forward for users to see, or placing the interface as part of the environment, which I believed to be the best option for the participants to be fully immersed in the scenario. By the end of the focus groups, the majority of participants were indifferent to what type of interfaces they prefer as it was not something they took into consideration. It was only important to them that the information was easily accessible and the manner in which it is delivered made little to no difference to their experience. However, when it came to deciding the best game interface to be used, it was clear that having a diegetic user interface would assist with this type of experience, as it helped them get fully immersed in the given scenario.

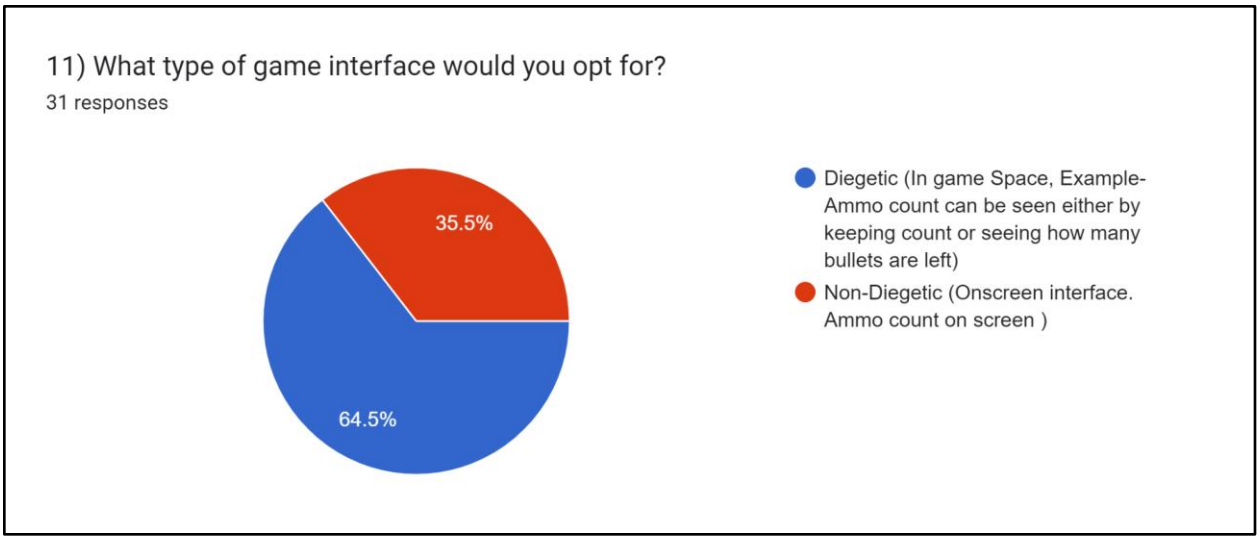


Figure 38: Question 11 on Diegetic or Non-Diegetic interfaces (Focus group question)

8.4.2. Scenario presented to the Participants.

After the focus group data was analysed, emphasis could be placed on the artifact's scenario. After a bit of contemplation and planning, the participants were be presented with a scenario that takes place in the near future, where the participants play a soldier sent on a mission which if not successful would lead to the extinction of the human race due to the invasion by extra-terrestrial drones that seek world domination, similar to that seen in 'Halo:Reach'. In order for the protagonist to complete his mission in this scenario, s/he will be sent back in time in order to warn allies about the incoming invasion before it's too late. The protagonist arrives just when the invasion commences. Unfortunately, he / she is not sent earlier in time as there is not enough power available and all resources have been depleted to send the participant on his / her mission.

Inspiration for the time travel element came from the film 'The Tomorrow War (2021)' in which the protagonist is also sent to another time in order to save his future. Once the protagonist

arrives at his destination, a file would begin to upload sharing all the necessary information with his / her comrades but until the data transfer is complete, the mission is to simply stand his/her ground and protect the area until the transfer is complete.

8.4.4. Run-through of the simulation and Game mechanics.

The final application was produced and tested by me several times after all assets and development were finalised. At that point, it was time to pass it on to the tester / participants. As the participants familiarised themselves with the controllers and adjusted to the new perspective (since they needed to wear the virtual reality boxset) a brief explanation of the scenario was given to them, to mentally prepare themselves before commencing the experience.

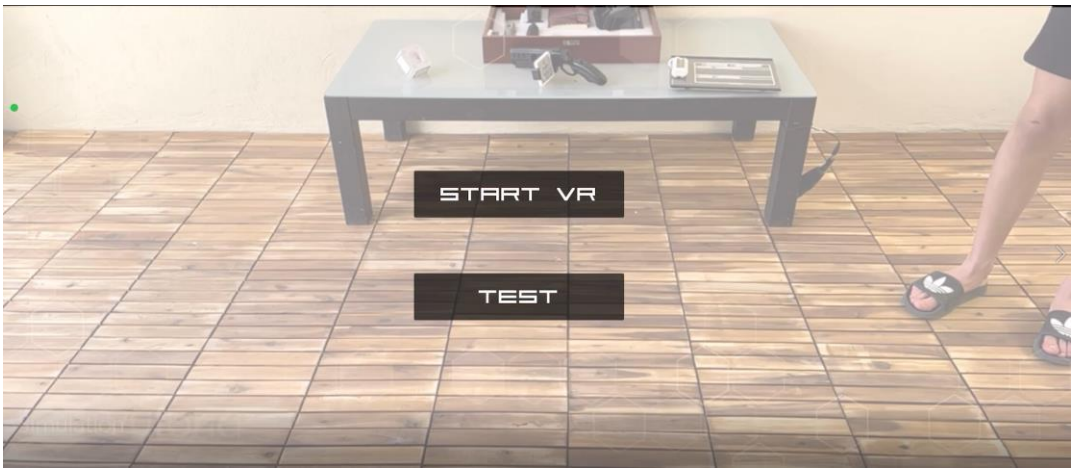


Figure 39: Screenshot of mixed reality simulation menu.

Once participants were ready and well oriented, the simulation could start and the first thing they encountered was a table with a few items on it. Hovering over the table was some incorporated text which indicates what to read first this is the ‘Mission Brief’, which gives the participant a mission description and information about what tasks to complete in a sequential order with the

first task being to take the ‘DataCube’ found on the table together with the Controller / Artifact to activate the time machine.

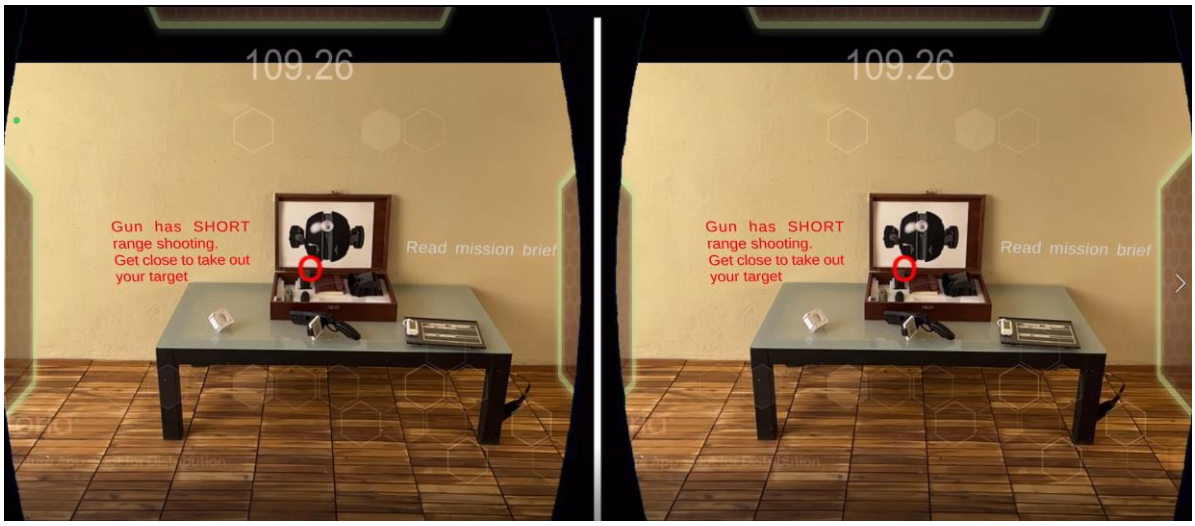


Figure 40: Screenshot of mixed reality simulation starting point with text indications.

Figure 41: Screenshot of mixed reality simulation showing ‘Mission Brief’.

When the participants were done reading over the mission brief they could then collect the Data Cabe and Artifact and make their way to the open area where they will saw a hologram of a soldier indicating where to go and where to stand. After going on to the designated location, the

participant was then able to see another hologram of the same Data Cube they collected indicating where to place it.

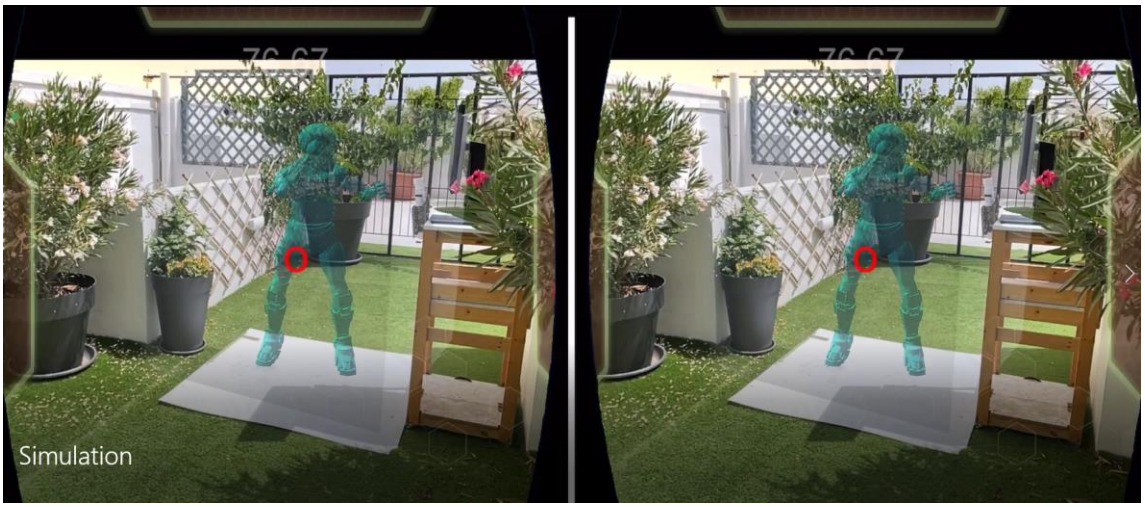


Figure 42: Screenshot of mixed reality simulation with participant approaching time machine.

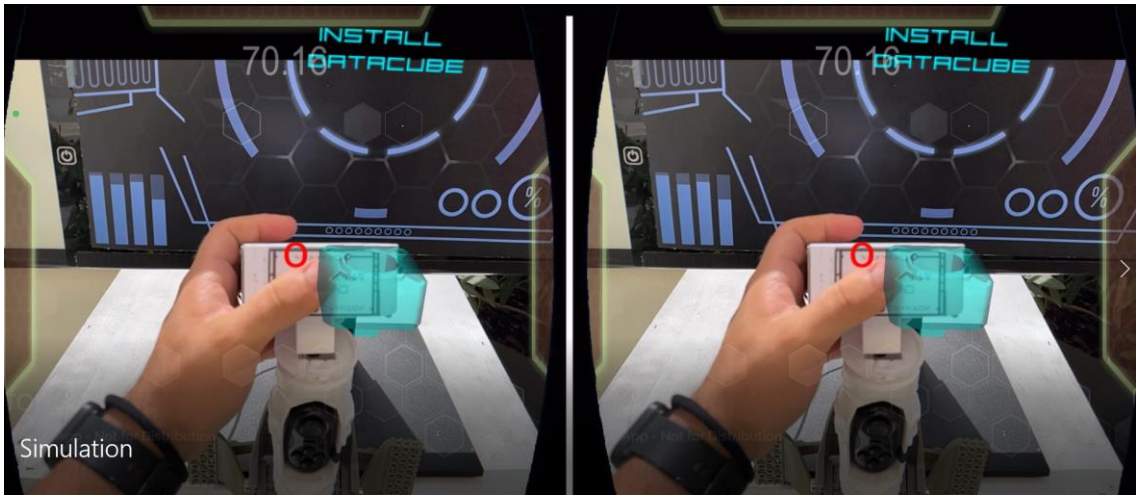


Figure 43: Screenshot of mixed reality simulation showcasing 'Data Cube' being used to activate time machine.

Once the user placed the DataCube in place, a trigger was set off which activated the time machine where a 360 degree video of the same environment they were in started to play, but with the difference that time was moving much faster, giving participants the illusion that they are

travelling through time. While the video was playing, the participants was not able to move around, but they were still be able to look around and turn allowing them to see the effect.

Figure 44: Screenshot of mixed reality simulation showcasing time machine animation (360 Video).

At the end of the 360 degree video, the participant was then able to move around the environment again and he was be able to see that in front of him / her on the display screen an upload had started, indicating that a data transfer had started. This meant that participant had completed the first task and must now start the next. During the Second Task, the participant has to move around the environment locating enemy drones and attempting to shoot them down. If the participant came into contact with one of the drones, then all the digital assets would freeze, a cracked screen would appear along with test indicating that the participant had failed the mission. If the participant managed to shoot down all drones, or at least avoid contact with the drones until the upload reaches 100%, then user would have completed the mission.

Figure 45: Screenshot of mixed reality simulation showcasing 'Game Over'.

Figure 46: Screenshot of mixed reality simulation showcasing the upload/timer for the upload until mission is complete.

Figure 47: Screenshot of mixed reality simulation showcasing enemy drones.

Once the upload had reached 100% the user got an indication on the display monitor stating that upload is complete. Other indications showing that this level is complete include all drones disappearing and the updated text of the mission brief stating that all tasks have been completed. At this stage, participants were then be able to do as they pleased and simply roam about experimenting with any remaining digital content.

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8.4.5. Inspiration of assets within the simulation.

Inspiration for both the scenario and game mechanics came from a number of sources. In the case of the artefact/Gun, inspiration came from a combination of ‘Halo: Reach’ (2010) and ‘Titanfall 2’ (2016) as the protagonists in both games have the option to choose a weapon that can indicate the ammo count along with a feature to point the direction of either where the participant has to go or simply point North aiding the user to head in the right direction thanks to the map provided.

Figure 48: 3D Printed Artefact viewed from application showcasing the joystick interface.

When it came to the drones, inspiration came from the film ‘Oblivion’ (2013) and they were used as the main antagonist as it was easy to incorporate them within the simulation due to the

fact that they can hover around without the need to make physical contact with the environment when engaging the participants. This aided in creating the illusion that they are part of the environment and could leave users unsure about their reality.

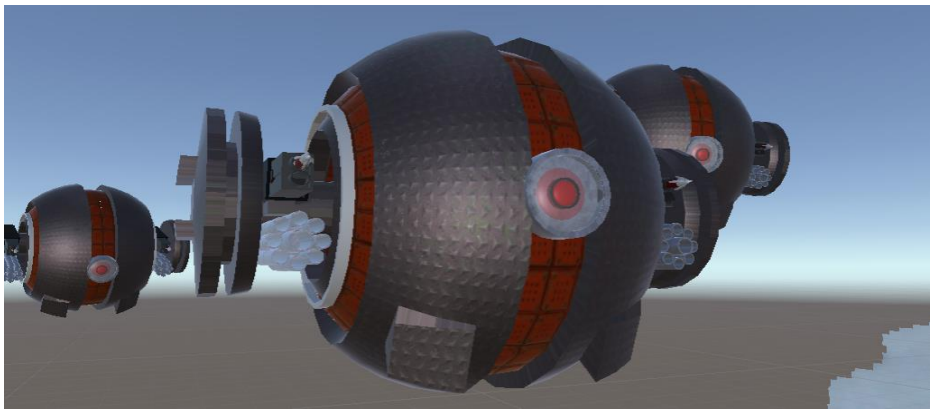

Figure 49: Enemy drones for participants to take down during the simulation.

One of the main points of inspiration for the user interfaces that aid users complete their tasks, specifically Diegetic interfaces (as it was the preferred choice among all participants) was yet again ‘Titanfall 2’ (2016). Holograms were used to give clear indications to users as to what to go as well as what to do and where to go, or even where to place items, as seem in the simulation with a hologram of the character indicating where to stand and a hologram of the ‘DataCube’ indicating where to place it.

Figure 50: Hologram within simulation used as a guide for participants as an indication of where to go or where to place items.

Two more examples of Diegetic interfaces that were implemented into the scenario are the mission brief, where the user can pick up and read what his / her next task is and see what tasks were complete and lastly, the user's visor, which served as an indicator whenever the user got hit or when he/she lost the game which was indicated with the screen cracking and turning red.

8.4.6. Feedback from Participants

Finally, after all the participants had a chance to experience the simulation, they were given a set of questions for evaluation. Participants were asked how they rated the experience and why, to which the majority gave a high rating, stating it was a new experience and in view of the fact that interacting with the digital content was very seamless as can be seen in appendix E (E1 and E3 / Question 1 and 3). They were also asked if it was easy for them to accept the digital content as part of their environment or if they questioned what was real or not. There were mixed views about these questions. Some points they forgot or got confused, such as when they were viewing the 360-degree footage and some confusion regarding user interfaces as they thought it was part of the actual environment, this was evident with those who don't have as much experience with virtual realities or gaming. However, those who were able to distinguish between what was digital and real still found it straight forward to accept as they still made sense due to the scenario put forward. Their acceptance might also be owing to previous experience with gaming or virtual simulations, in which they have been accustomed to specific aesthetics as well as adopting a role that has been assigned to them. Lastly, the participants were asked what could be improved in the experience. Since it was a very new experience to them most simply stated that

the interactions between the users and content could be more accurate as at times it took the participants redoing a particular action more than once such as when they shot the drones or when it took a while for the camera to load some interfaces. Other than that, they were keen to see how far this technology could go.

9. Conclusion

The results of this study highlight that my vision of Mixed Reality in interactive storytelling was positively received by the research participants. It is evident that most of the participants who answered the questionnaire and tested the application found MR to be beneficial in more ways than one. Very few participants showed a lack of interest in seeing MR applied in this area as they believe that it would only be a short-term hype due to the fact that people would stick to traditional methods of entertainment. Of course, this is only the opinion of a few participants, but it still did not stop them from enjoying the experience and seeing potential within the entertainment industry.

One of the main objectives of this research was to determine whether users would doubt their reality when attempting the simulation, and from the outcome of the simulation it was highly evident that at times, unfortunately, confusion was experienced by the participants. Both in the manner intended where they would question what was real or not and in a manner that they had difficulty orienting themselves in the experience however it was temporary as they quickly got their bearings, of course given more time adjustments can be made this fix this error to make the transition to accepting a new perspective with digital content within one's reality. Due to time constraints, some opportunities for research were not pursued such as the option to create both on-site and on-screen versions of the same environment, and the possibility of creating a complete narrative rather than having given participants a scenario and run a few tests within that limited scenario only.

MR is predicted to be the way forward in both the Media and Entertainment Industry as well as the gaming industry, due to its potential in interactive storytelling. It is advisable to investigate

other software that is currently under development that may increase the possibilities in application because they have fewer restrictions than the existing ones (namely ‘Unity’ and ‘Vuforia’). This is being recommended particularly for those who may wish to further investigate the use of MR in Entertainment and Storytelling. Further beneficial research in this area would be that of collecting data from wider audience from all age groups, as the use of a larger sample of data would provide more accurate results.

During the research carried out for this study, I encountered software and techniques which exposed me to a wealth of knowledge not only in MR but also in coding and 3D design, fuelling my desire to peruse further studies and a career in the digital arts.

After all the research and testing in this dissertation, I believe that Augmented Reality / Mixed Reality might be the next step in interactive storytelling. However, for this to be possible and to gain traction MR needs to stop being a secondary option offered within experiences and instead be offered as the main attraction. I believe that this dissertation can be used a as steppingstone since it is more than possible to use this technology in big scale projects and deliver a complete narrative along with all game functions rather than just a demo with one scene. In doing so I believe that the next step is not only to create a fully developed gaming experience within an existing environment that takes not only fixed elements like walls and statues but also elements that are temporary to the environment.

Of course, the technology is still very young but throughout this research it was seen that there is already so much we can do with it and by focusing on this media / entertainment section one can demonstrate endless possibilities that can be utilised in other sections, and so the next stage would not only be to create a complete gaming experience with a narrative but also see what

other sector this technology can be applied in such as that of education, tourism and even navigation.

WORD COUNT: 14,400

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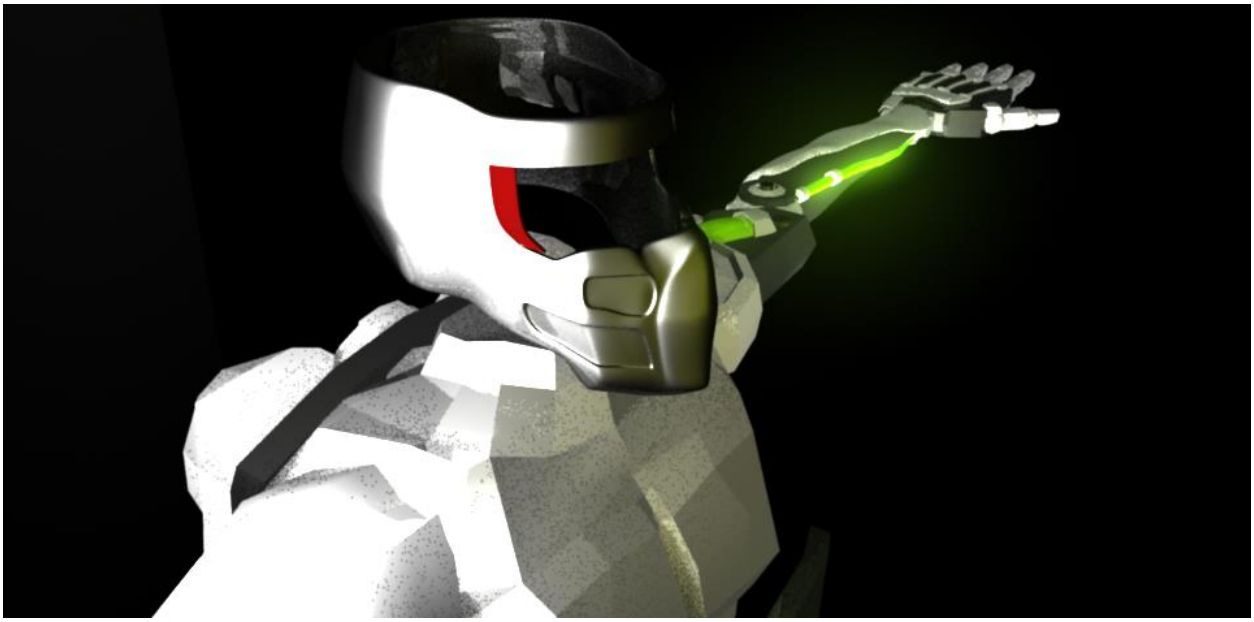
APPENDICES

Appendix A- Character Development

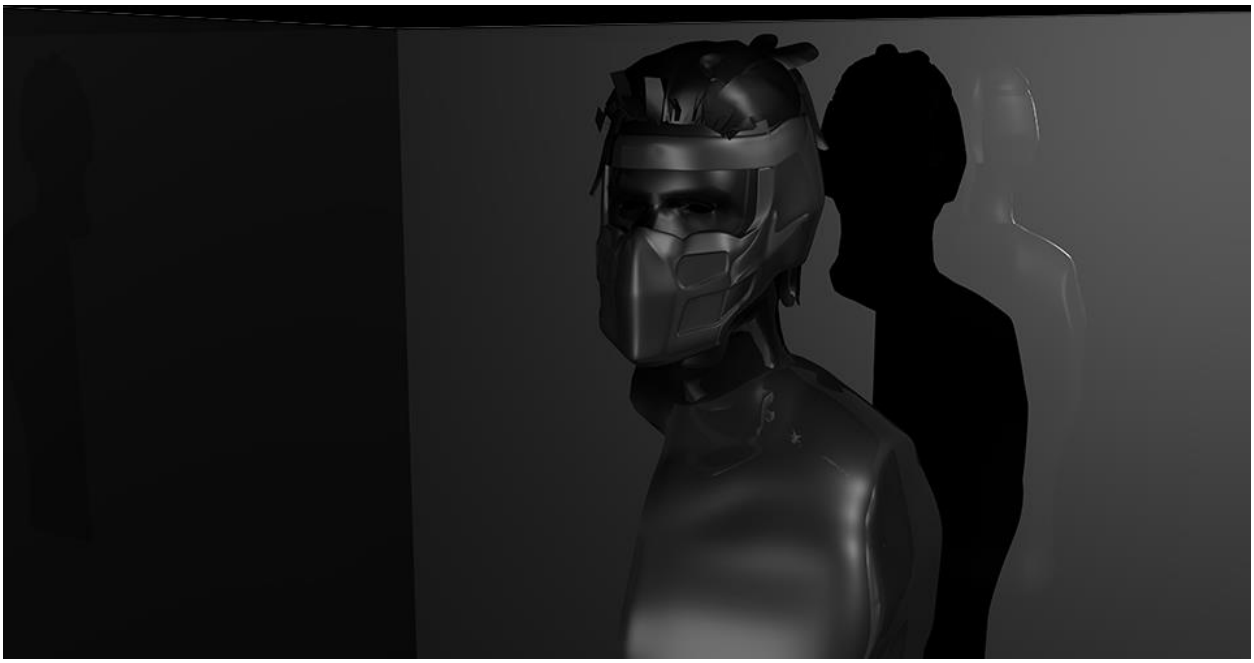
A1: Character Design Sketch

A2: Character Design Sketch

A3: Character Design Digital Illustration

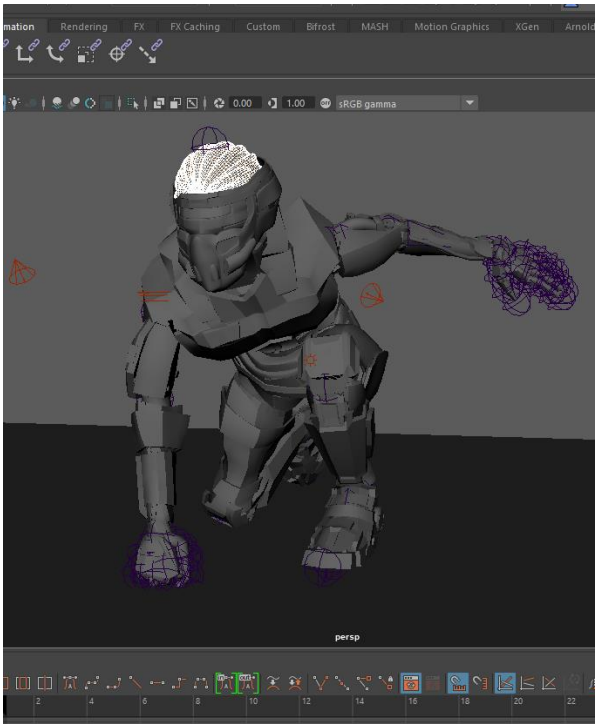


A4: Character Design 3D Modelling in progress



A5: Character Design 3D Modelling in progress

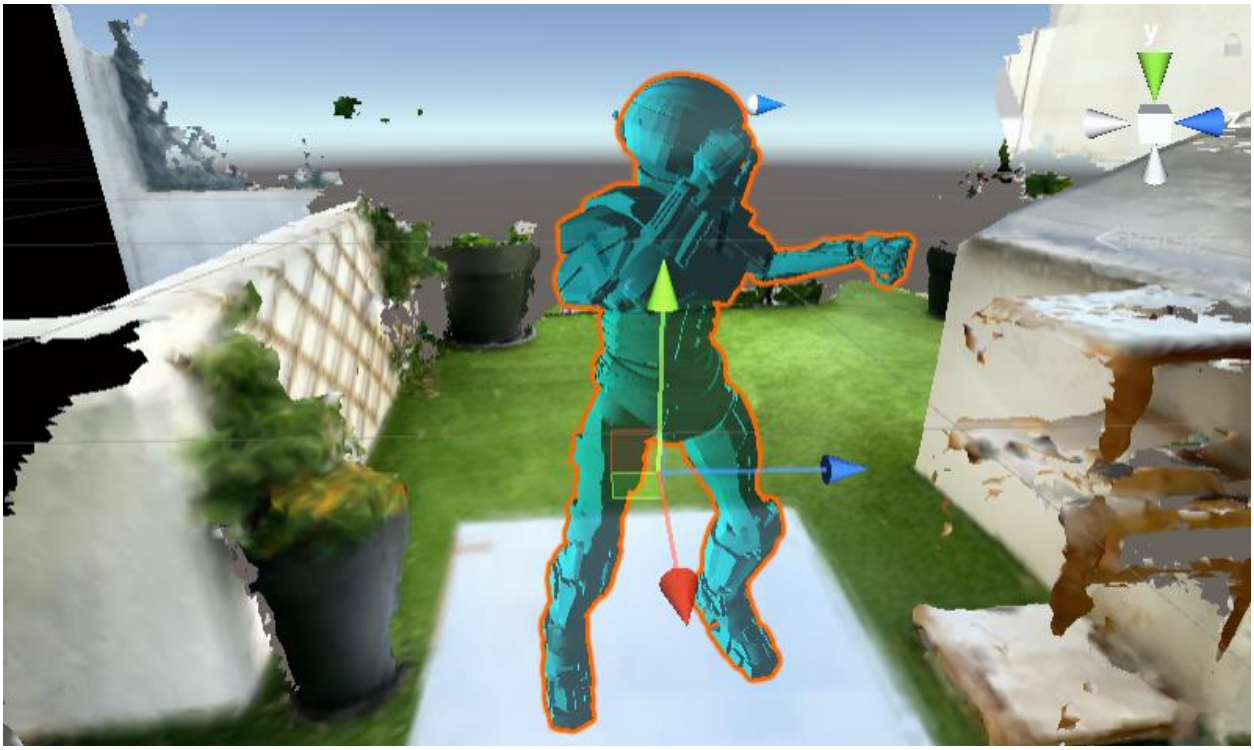
A6: Character Design 3D Render Test



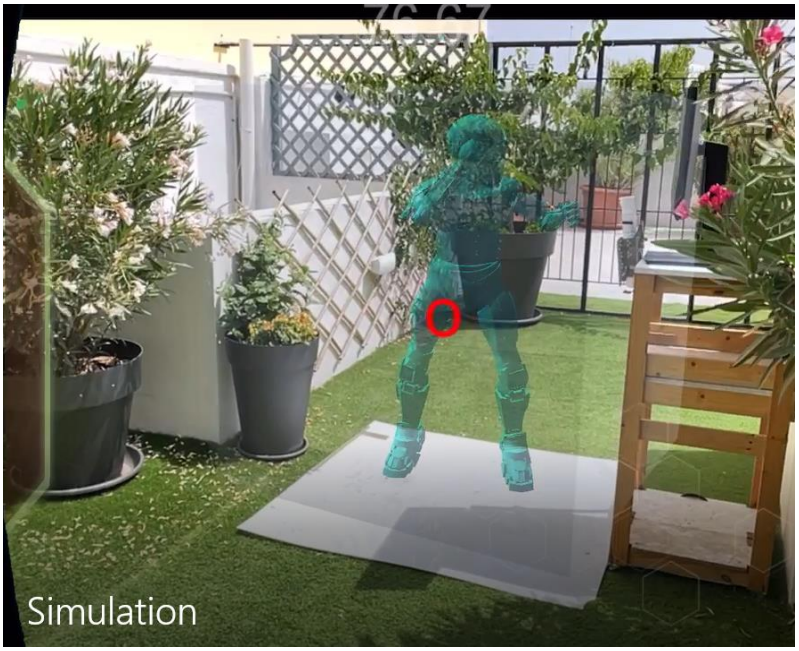
A7: Character Design 3D Render Test

A8: Character Design 3D Render Test

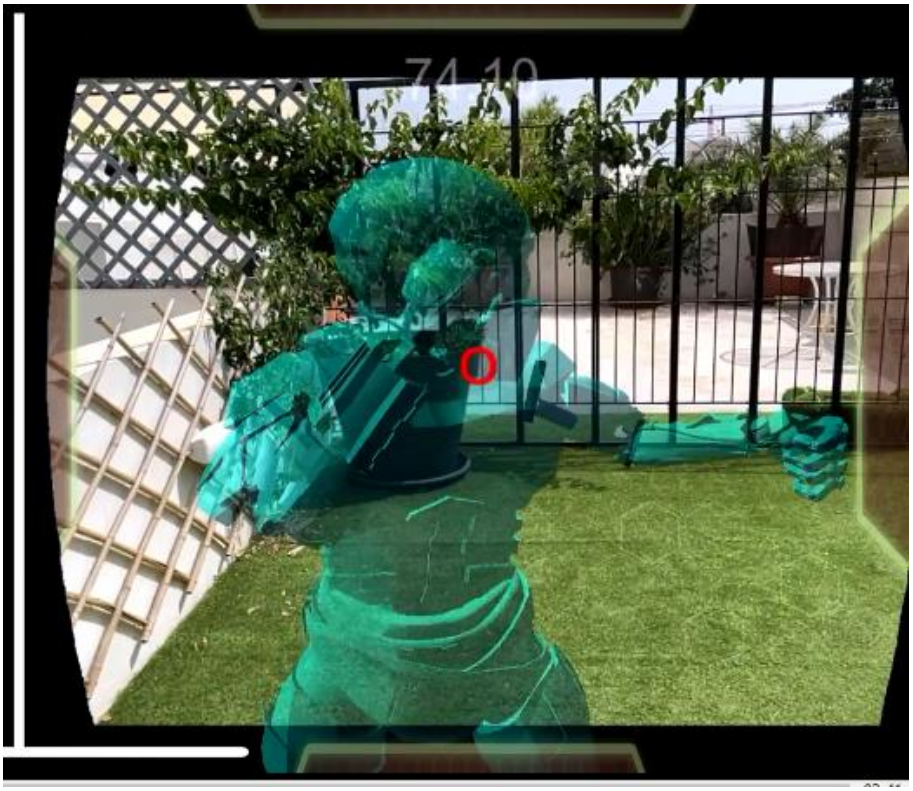
A9: Character Design 3D Render Test



A10: Character showcased within the Simulation (Back-end)

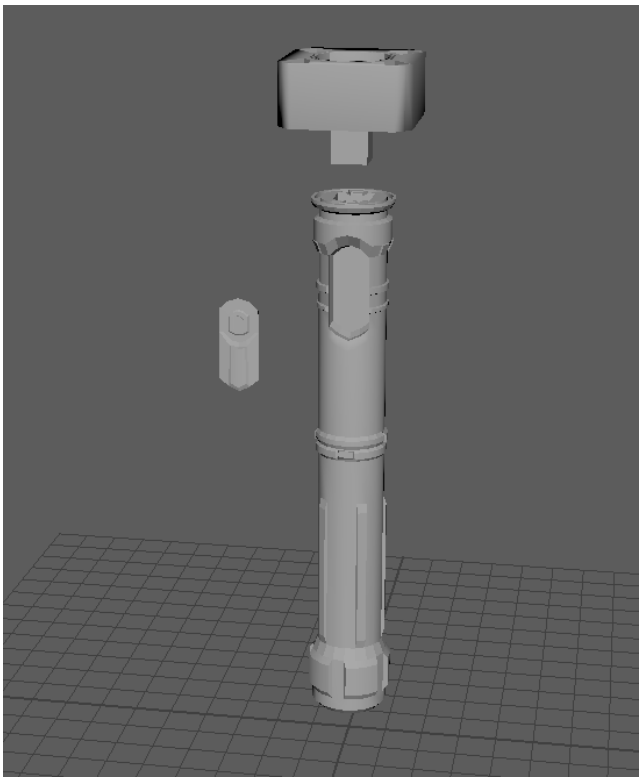


A11: Character showcased within the Simulation

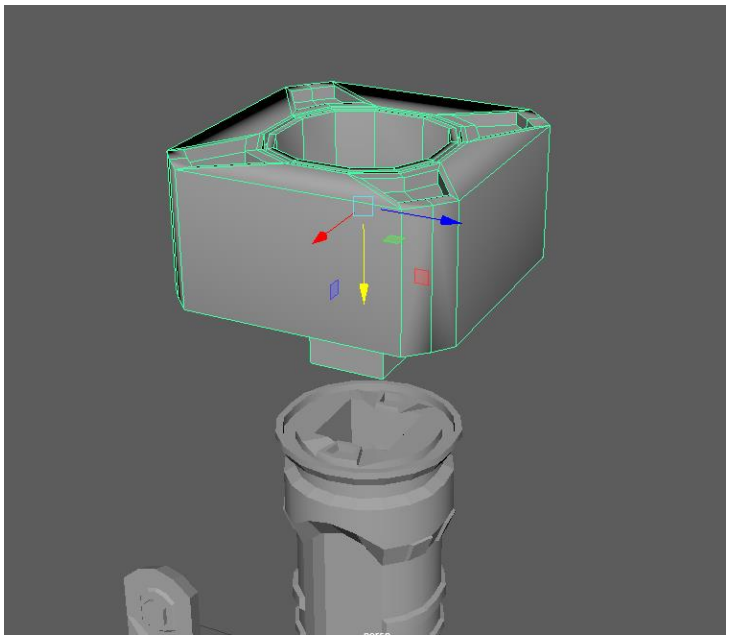


A12: Character showcased within the Simulation

Appendix B- Artifact (Joystick)

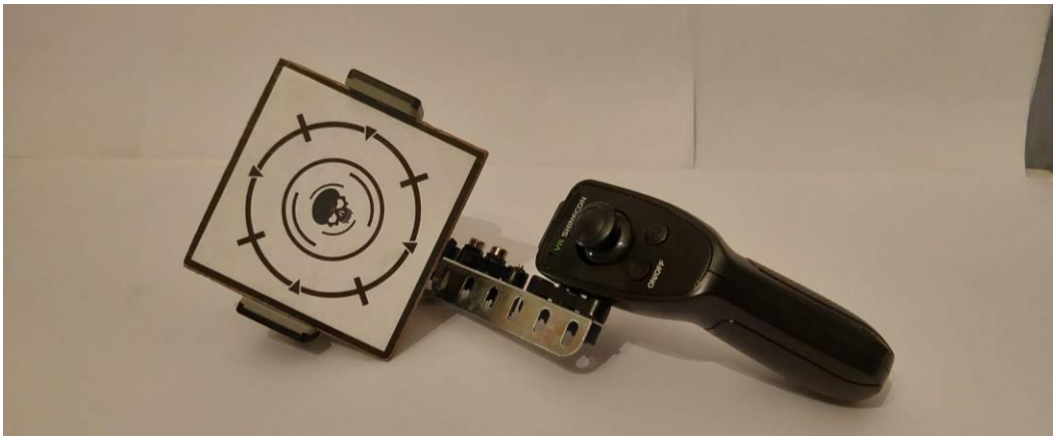


***B1**: Artifact: First attempt (3D model)*

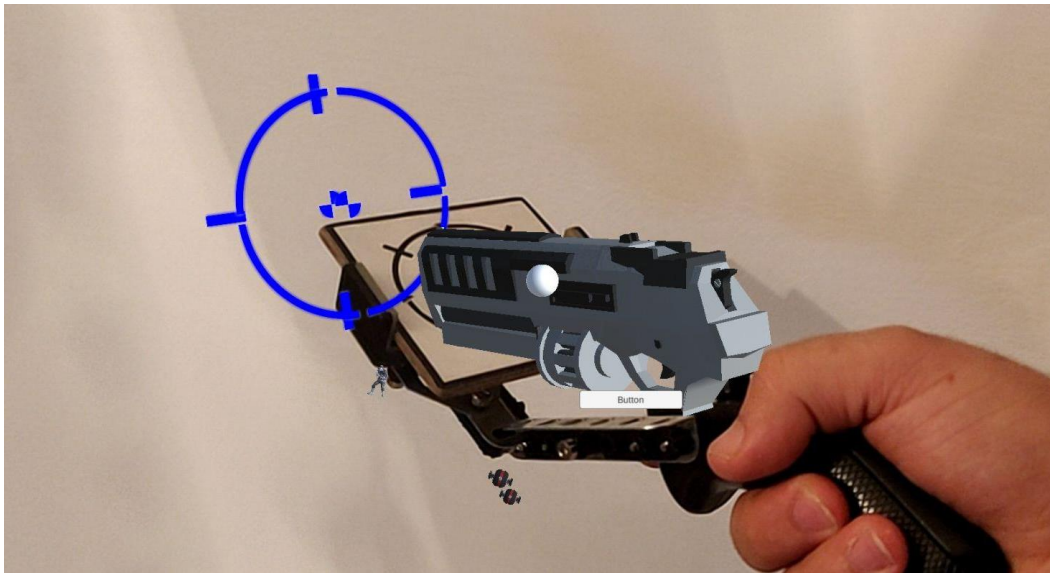


***B2**: Artifact: First attempt (3D Model)*

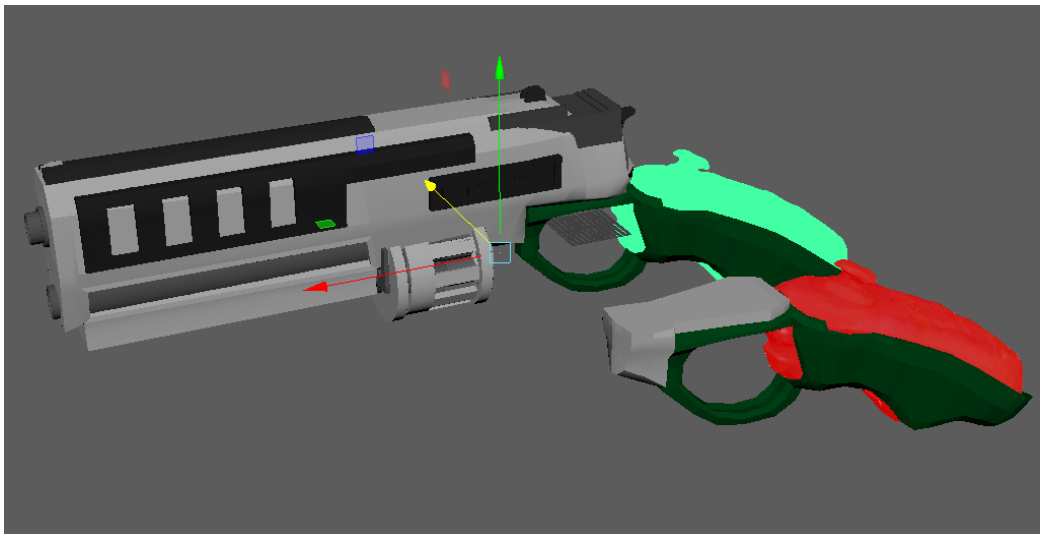
***B3**: Artifact: First attempt (3D Printed)*



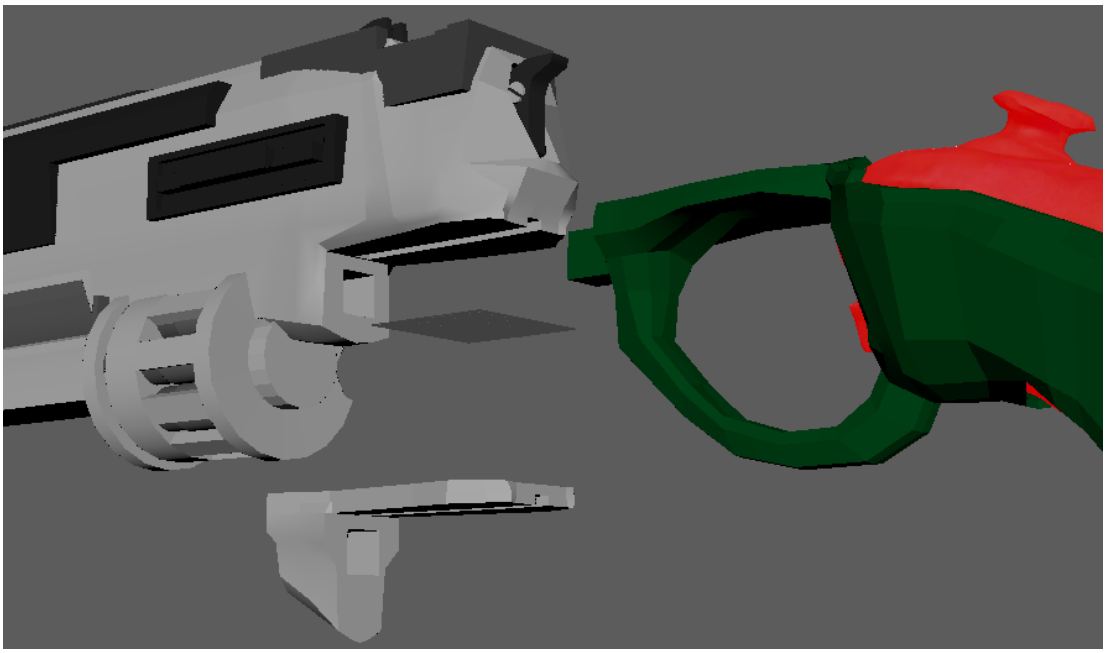
***B4**: Artifact: Second attempt*



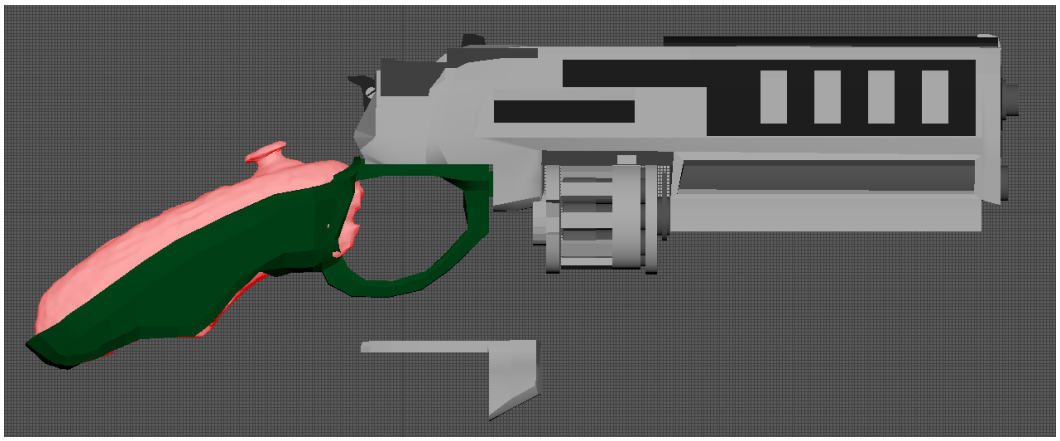
***B5**: Artifact: Second attempt (Working Demo)*



***B6**: Artifact: Third Attempt 3D model*



***B7**: Artifact: Third Attempt 3D model*



***B8**: Artifact: Third Attempt 3D model (Main components before 3D printing)*

***B9**: Artifact: Second Attempt (3D Printed Pre-assembled)*

***B10**: Artifact: Second Attempt (3D Printed Assembled)*

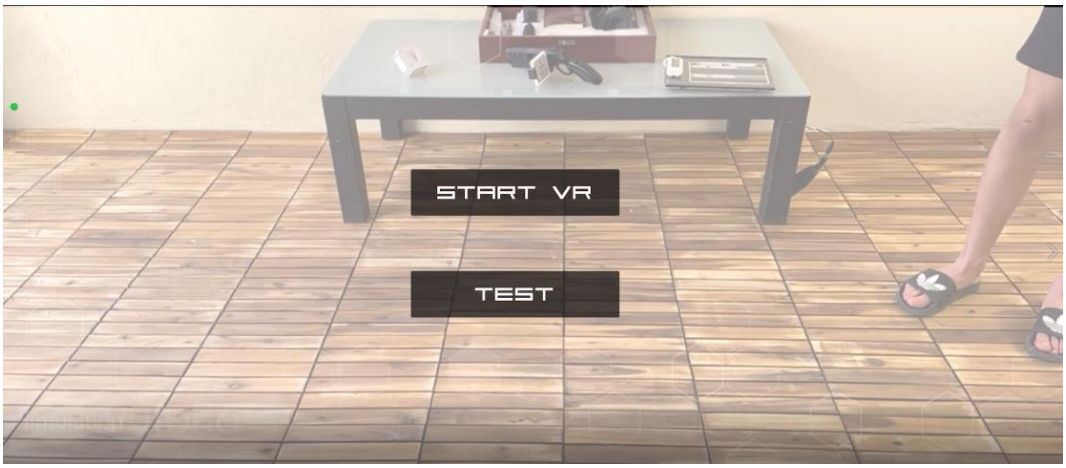
***B11**: Artifact: Second Attempt (Viewed through the application for the simulation)*

Appendix C - A Mixed Reality Experience / Application

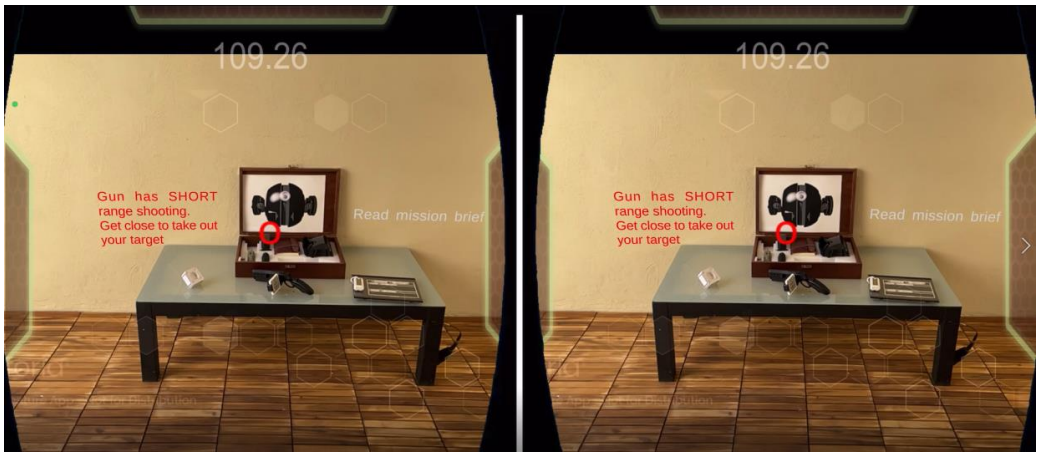
***C1**: Artifact- First Attempt in creating an onscreen simulation*

***C2**: Artifact- Second Attempt in creating an onscreen simulation*

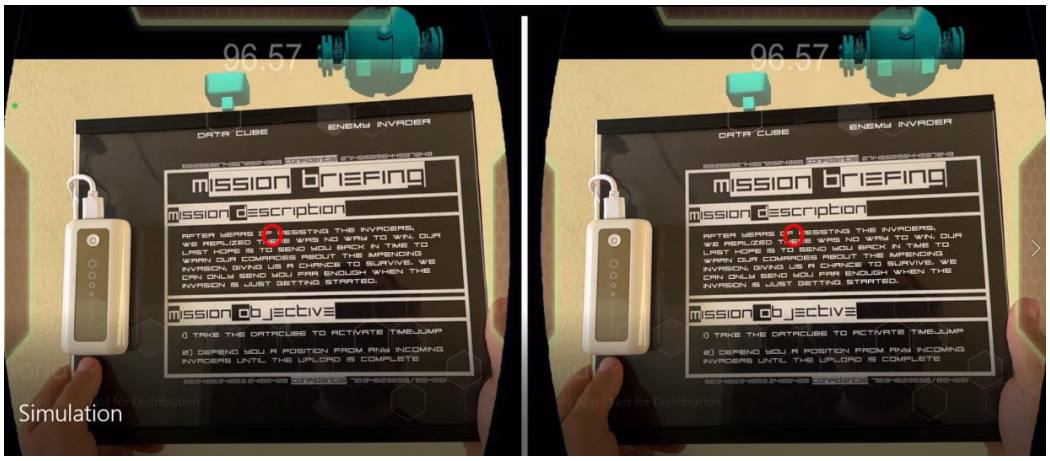
***C3**: Artifact- Second Attempt Mixed Reality Testing*



***C4**: Artifact-Final Simulation showcasing 'Main Menu'*

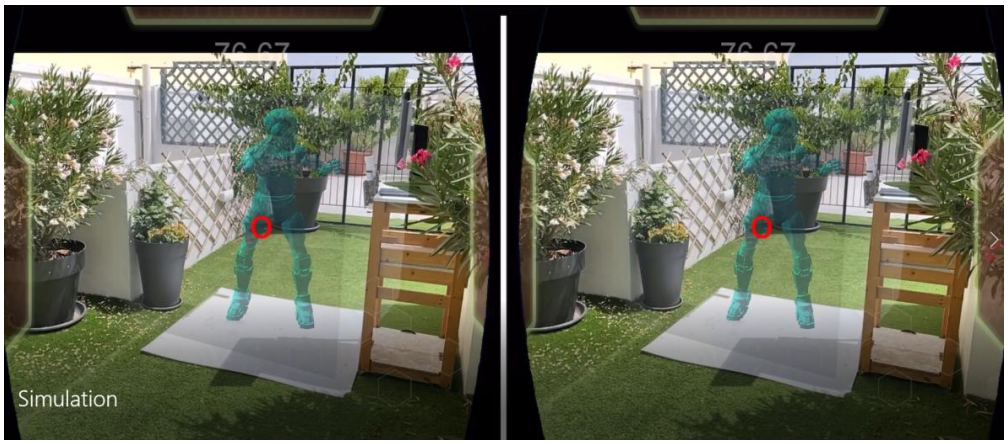


***C5**: Artifact: Third and Final Simulation showcasing starting with text indicating the participant's next step*

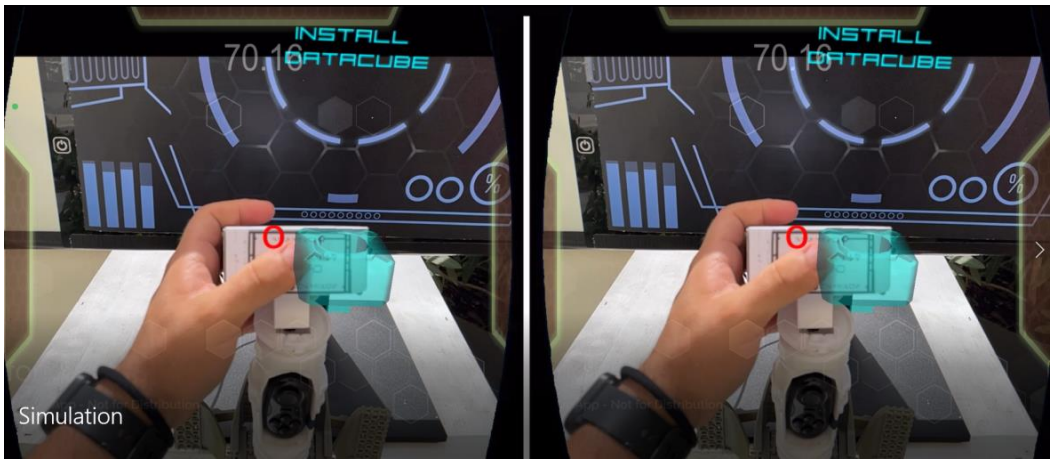


***C6**: Artifact- Final Simulation showcasing 'Mission Brief'*

***C7**: Artifact-Final Simulation showcasing artifact participants use to interact with digital content.*



***C8**: Artifact-Final Simulation showcasing hologram instructing the participants where to go as well as what to do.*



***C9**: Artifact- Final Simulation showcasing a hologram indicating where the participants need to place the 'Data Cube'*

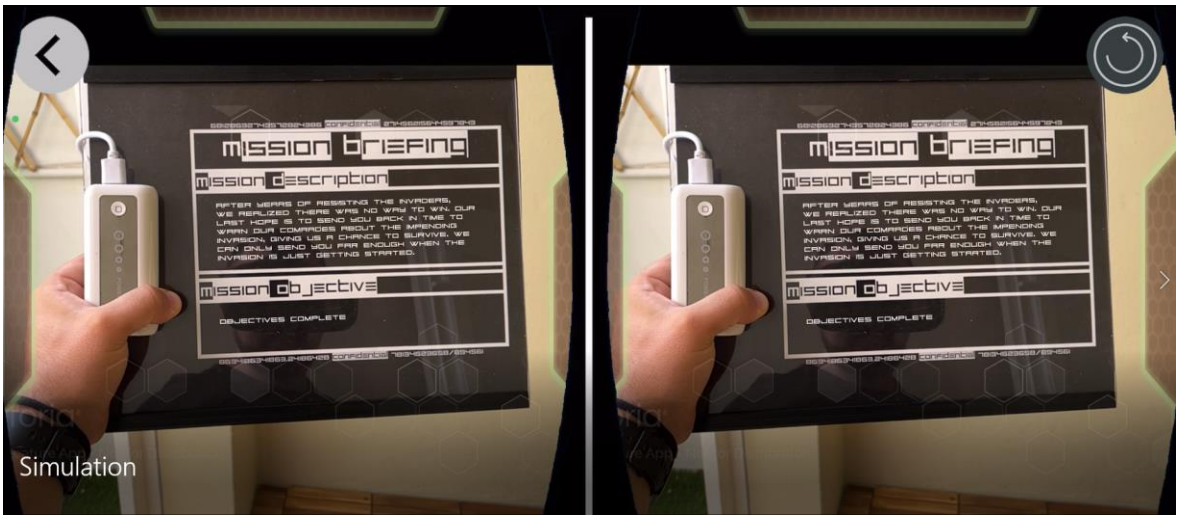
***C10**: Artifact- Final Simulation showcasing 360 video / time machine animation*

***C11**: Artifact- Final Simulation showcasing drones within the environment which participants need to both avoid and take out.*

***C12**: Artifact- Final Simulation showcasing a timer / upload which once complete will mean that the mission is complete.*

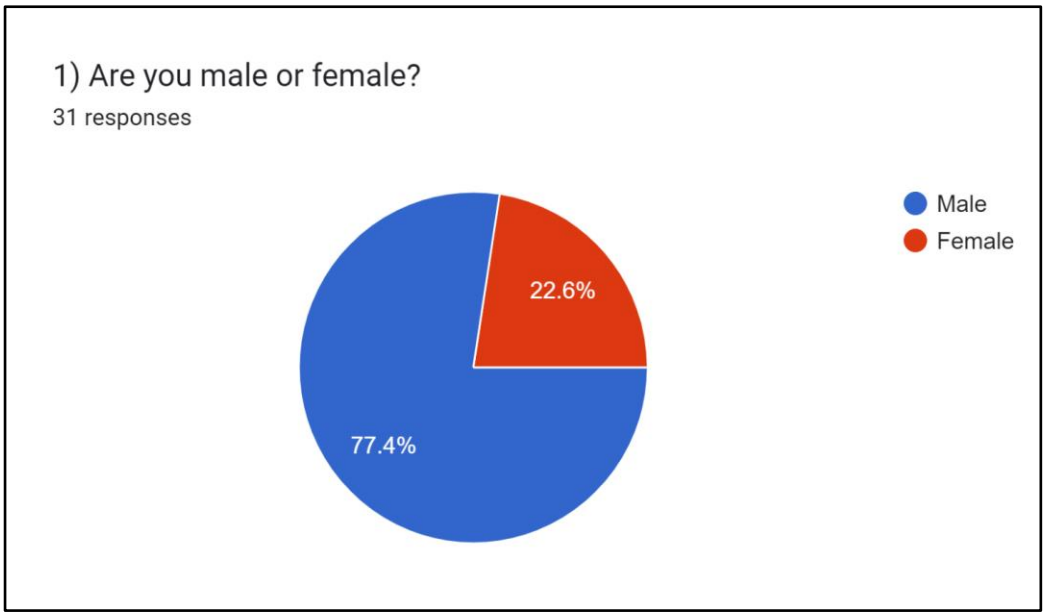
***C13**: Artifact- Final Simulation showcasing 'Mission Brief' with updated objectives.*

***C14**: Artifact- Final Simulation showcasing the display screen indicating that the upload of data is complete.*

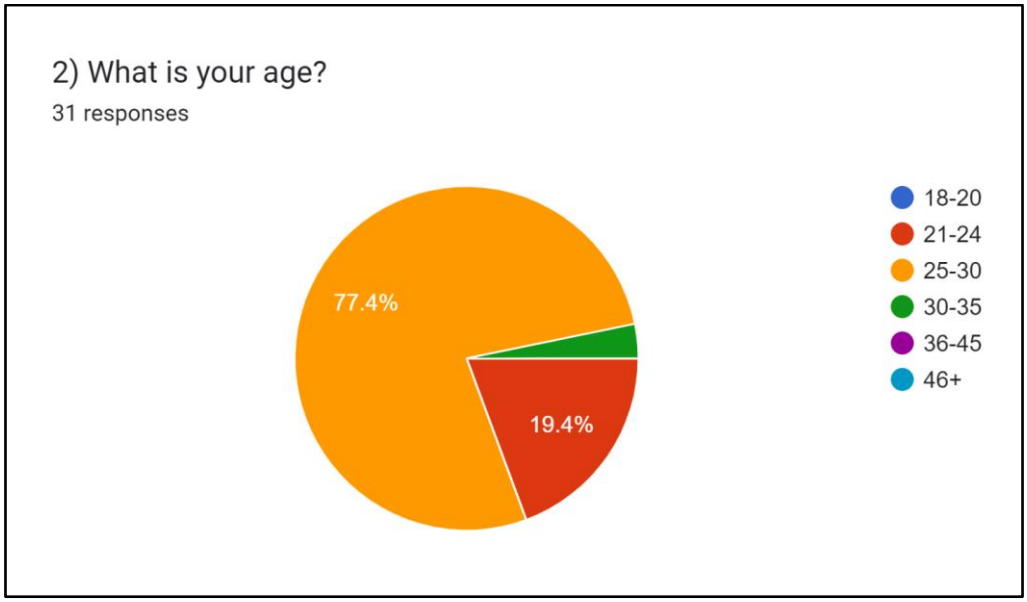


***C15**: Artifact- Final Simulation showcasing the 'Mission Brief' with all objectives complete*

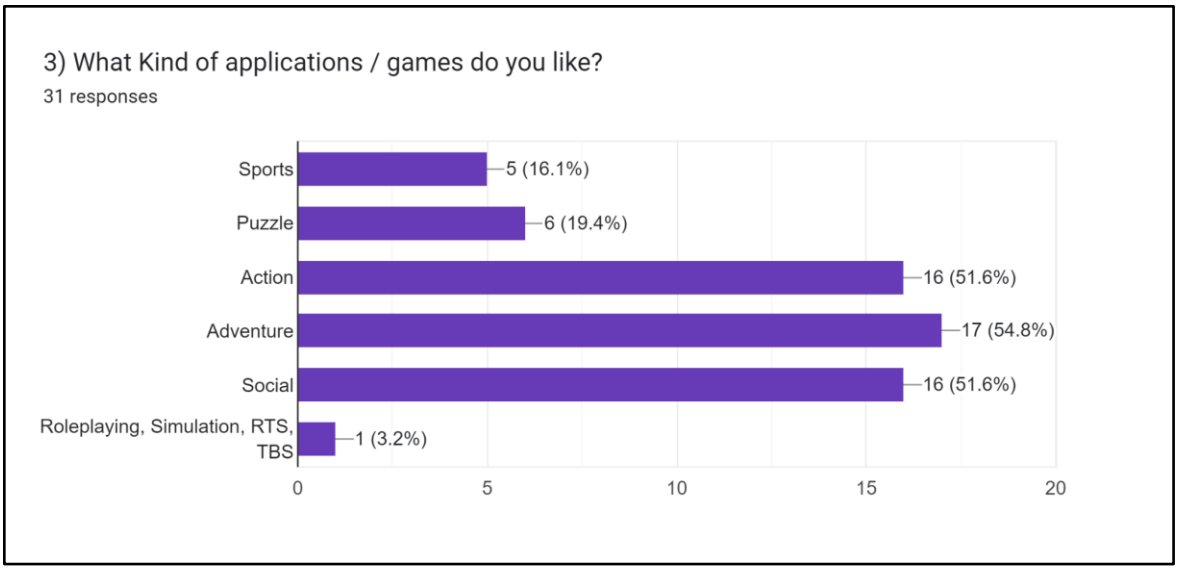
Appendix D - Questionnaire results (Focus groups- 20 Participants and 31 responses)



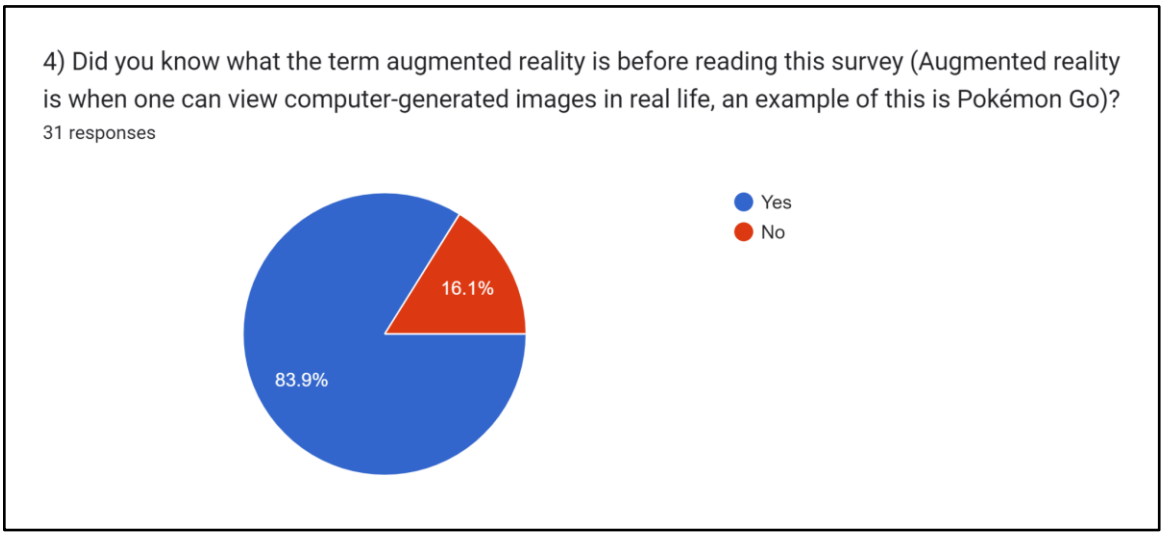
***D1**: Question 1*



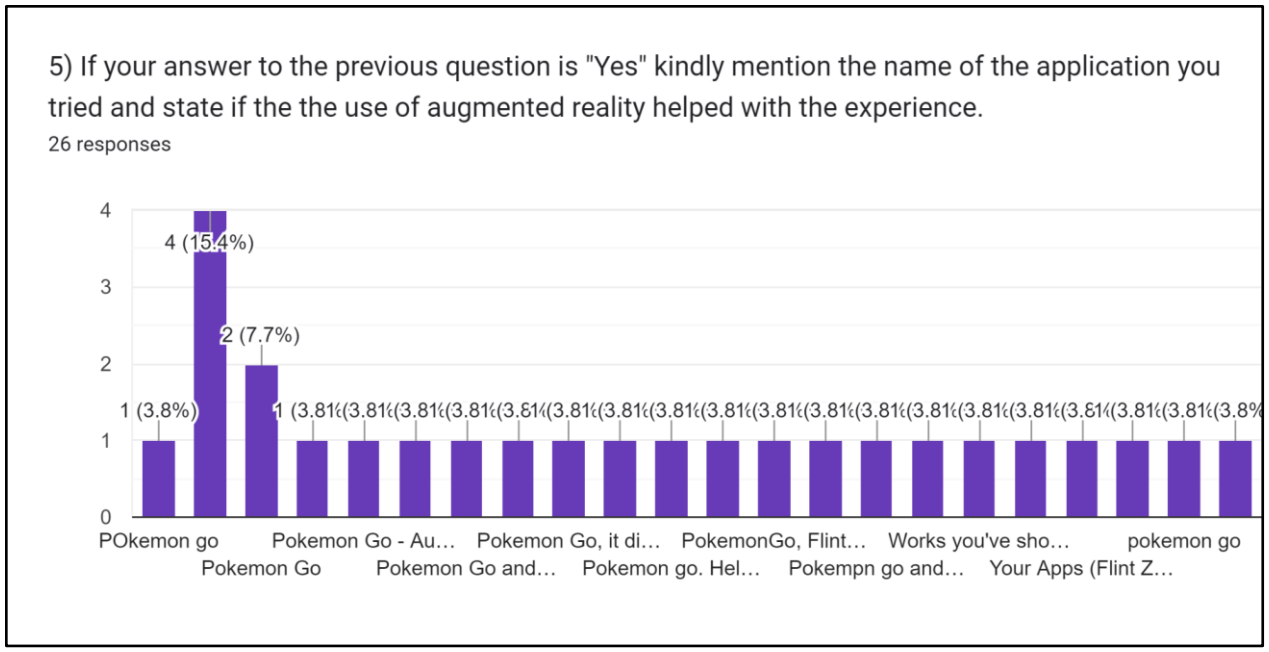
***D2**: Question 2*



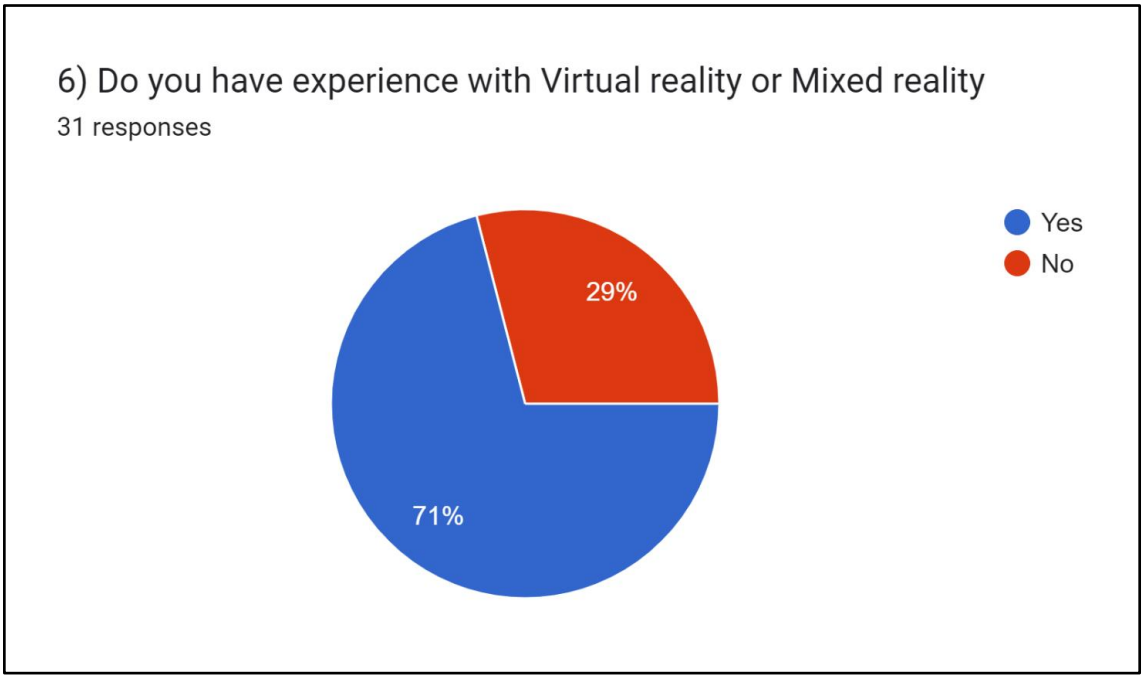
***D3**: Question 3*



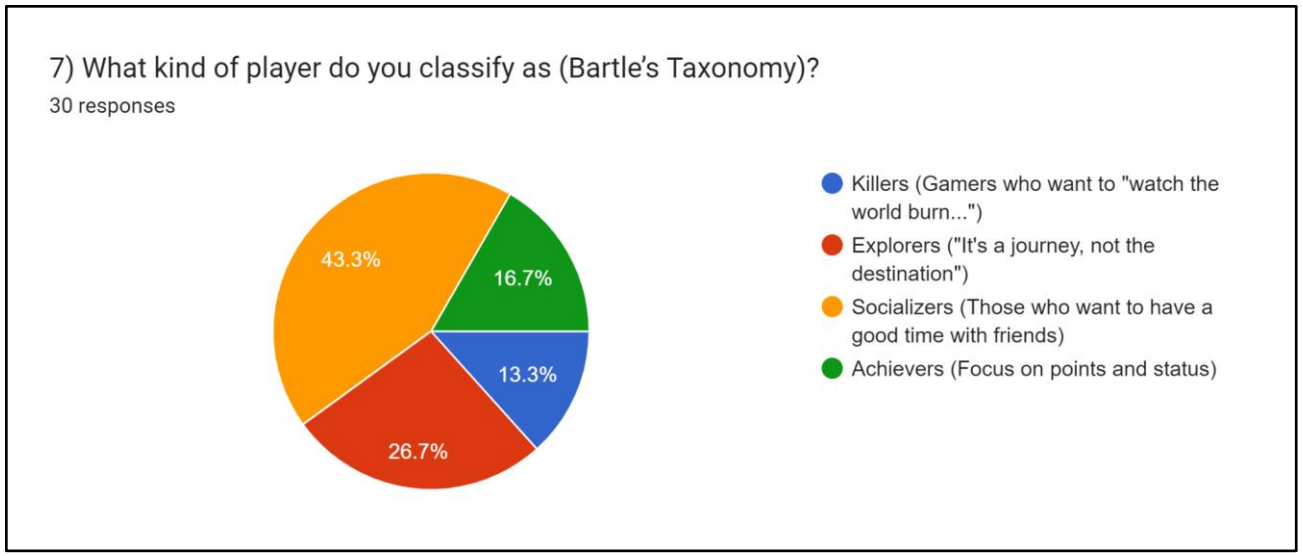
***D4**: Question 4*



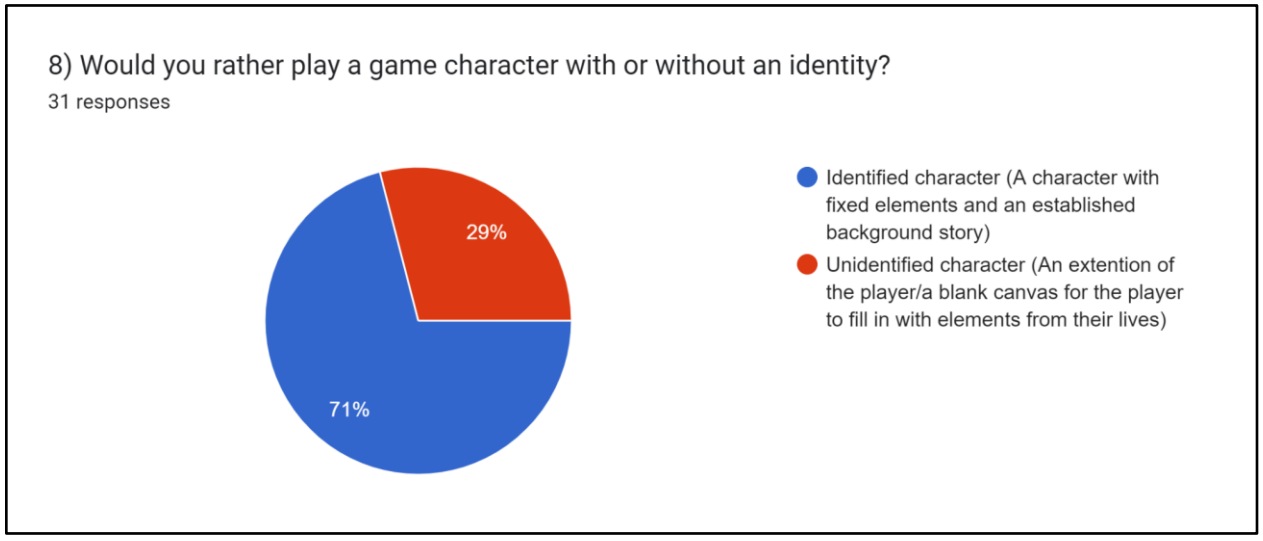
***D5**: Question 5*



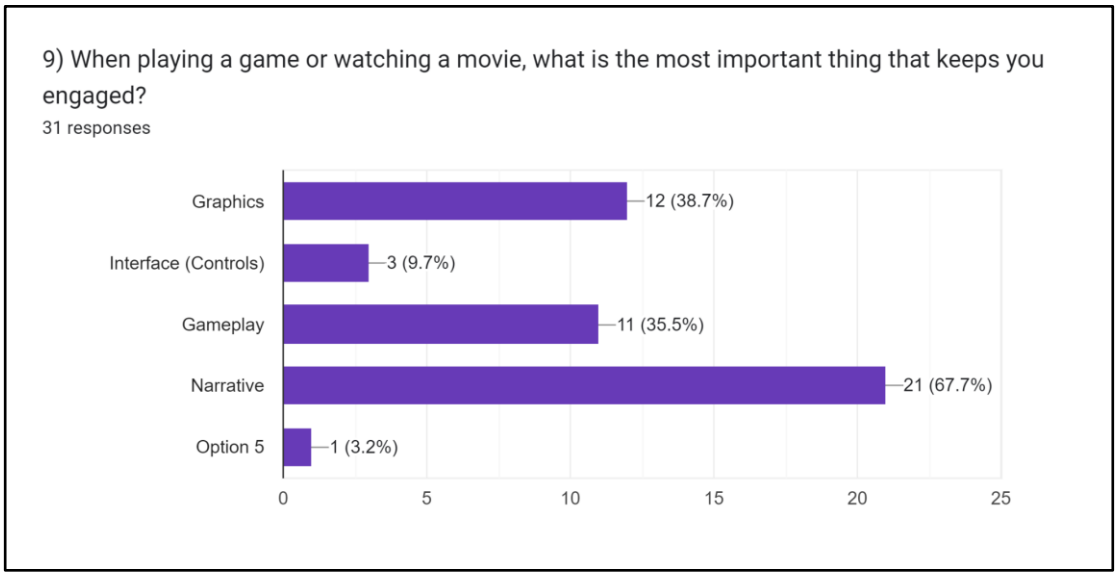
***D6**: Question 6*



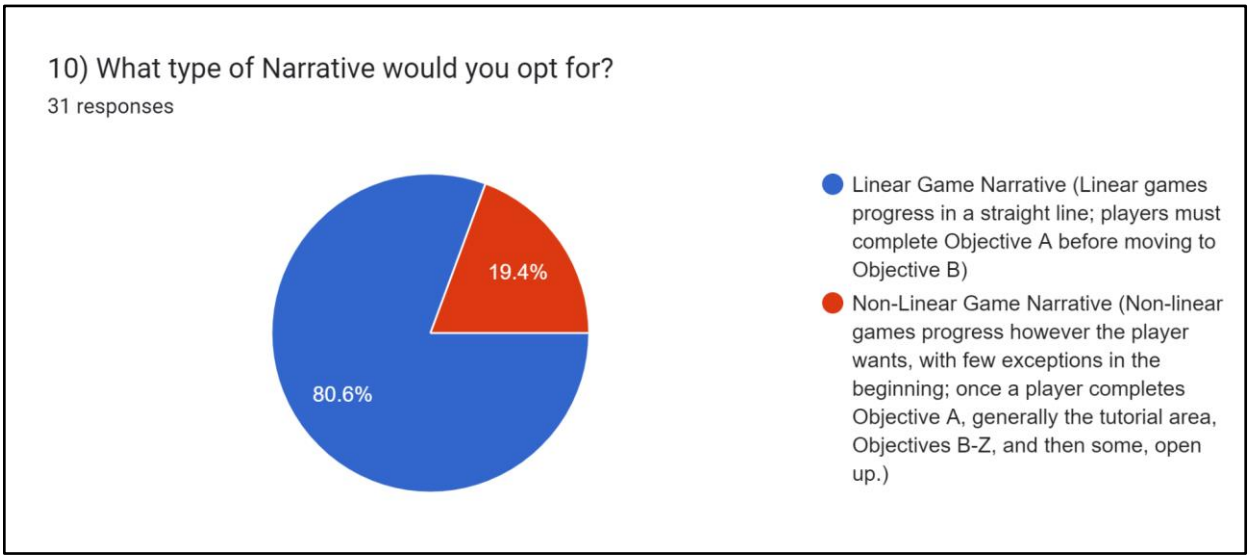
***D7**: Question 7*



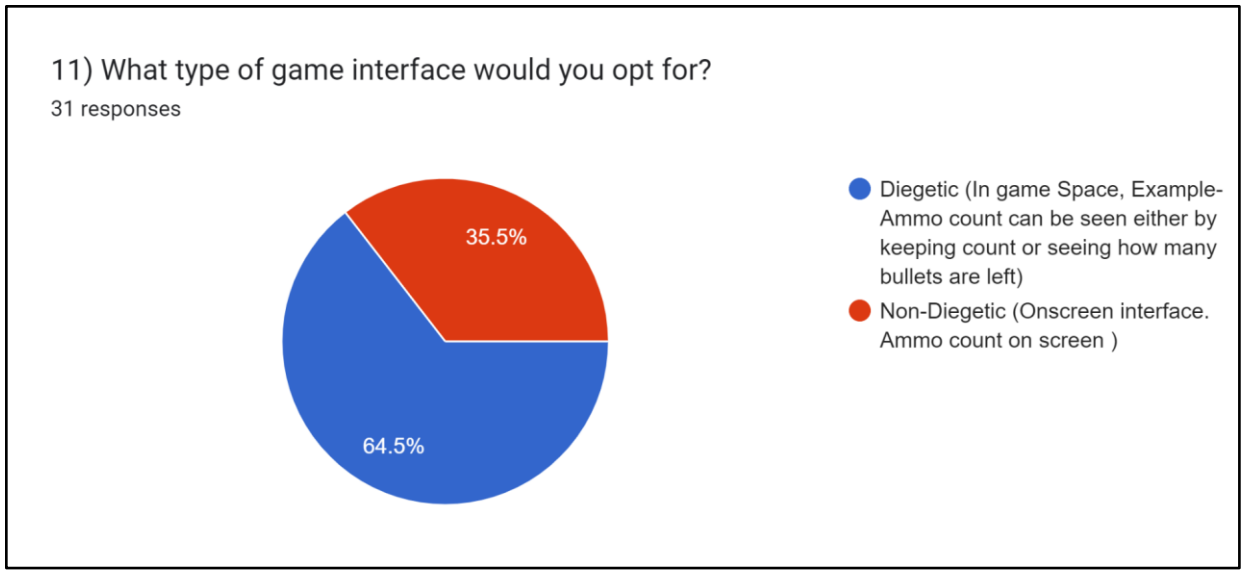
***D8**: Question 8*



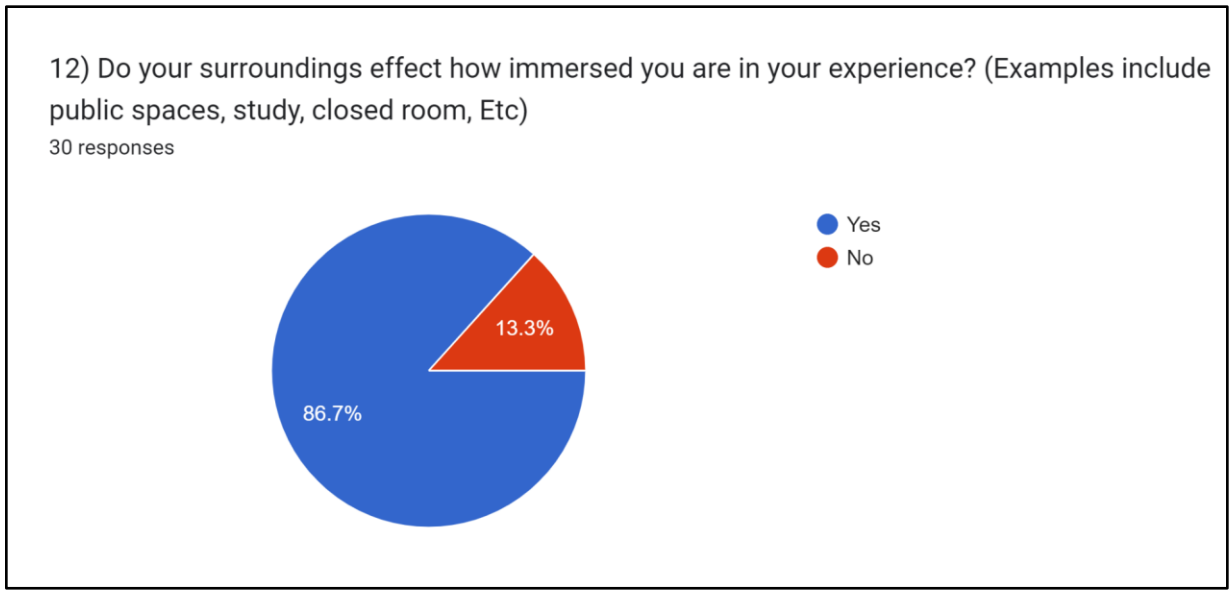
***D9**: Question 9*



***D10**: Question 10*



***D11**: Question 11*



***D12**: Question 12*

13) What would be your ideal environment to engage / immerse 100% in any media experience(Movie, game, book, music, etc)?

30 responses

Always find it easier when i'm alone

In my room without interuptions

Being secluded in a room

Id like to play alone but it doesn't really make a difference.

Prefer to be Isolated

In my room or in a safe space

I don't mind people watching but i'd give it my full focus if i'm alone

Quiet room for a movie. Anywhere for a book but most likely in a quiet room is better

I don't mind, I like wath#ching movies alone but i like the idea of playing or watching movies with others to share my experience

Ideally in a room alone but it wouldn't take mch to get into whatever i'm doing as aslong as it's a good story

Where i am Does't really affect me as long as nothing comes between me and whatever i'm doing

Game

Always find ot better in an isolated space

In my room or any space i'm familiar with

Depends on the activity but in general i like to experience alone if i want to fully immerse myself

Gaming Capsule

Music

I don't Mind being arround people i'm confortable with but other wise alone at home

***D13**: Question 13(Part 1)*

Quiet and secluded place with very few/ no people around.

Better alone in my space

as long as i'm alone

Alone in a room wihtout distractions

Ideally Alone but I like to interact with others for a more enjoyable experience

Alone otherwise its Akward and can't concentrate.

Quiet room with surround sound system

Anywhere would do, public or alone in a room

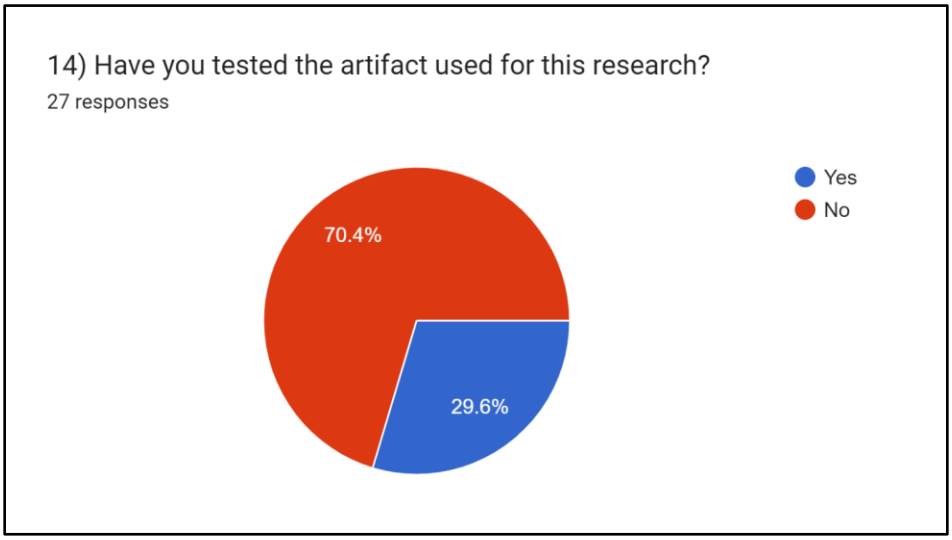
Mhux ha taghmel differenza imma wahdi ahjar

Quiet area with comfortable seating

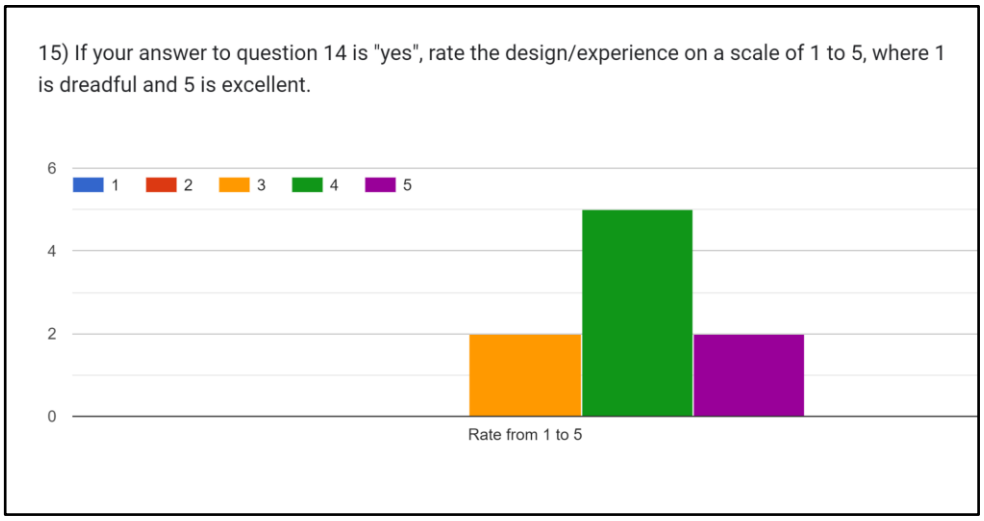
I'm social so i like to socialize when i play

Either onmy own or with people i am familiar with

***D14**: Question 13(Part 2)*



***D15**: Question 14: Asking if Users have tested the demo versions of the artifact*



***D16**: Question 15*

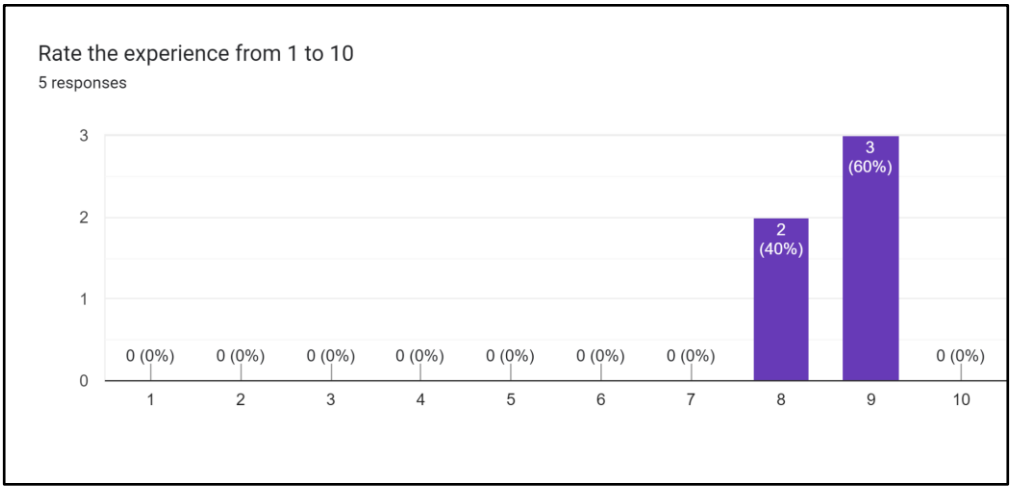
16) Concerning your answer to question 15 what alterations would you recommend if any? (Recommendations can be made both to the design and function of the artifact)

7 responses

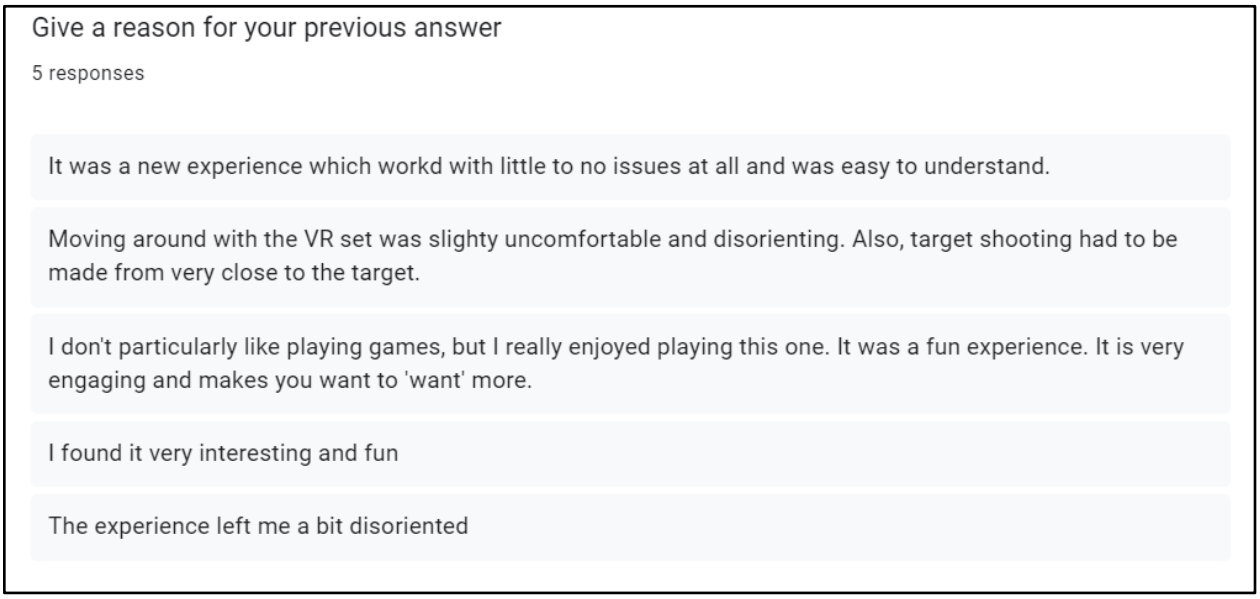
- It's cool, make the joystickmore stirdy
- Button controlls
- The joystick needs to be heavier but everything else is cool
- NOt used to this tech so maybe more instructions
- Nothing at all, great work!!
- Waiting to see the full project
- Waiting for the full version but very little to adjust, max the interface as it glitches slightly

***D17:** Question 16*

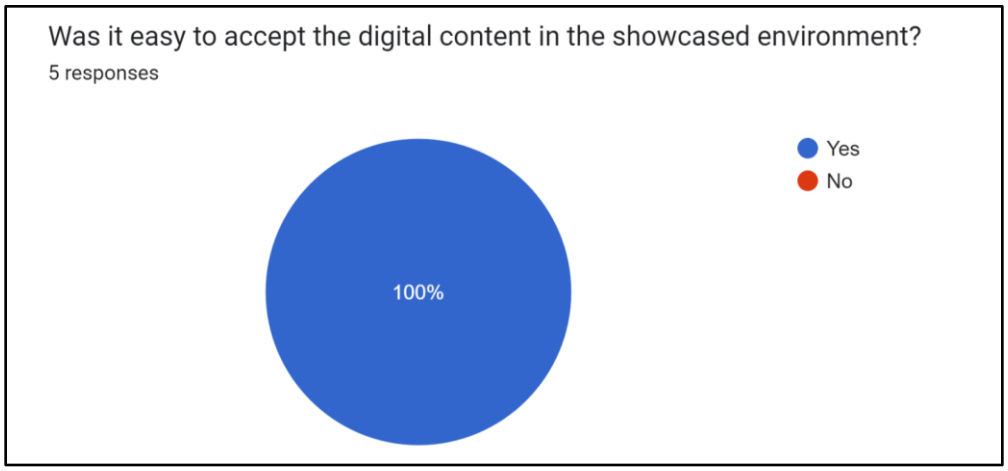
Appendix E - Feedback Forms for Mixed Reality Experience



E1: Question 1



E2: Question 2



E3: Question 3

Explain why if your prevous answer was "No"

0 responses

No responses yet for this question.

E4: Question 4

What adjustments would you make, both functionally and aesthetically?

5 responses

Ajust distance when shooting drones or make a visual effect to indicate that they've been hit.

I would add a target to make it easier to aim at the targets. I would also add the steps or instructions on the corner of the VR output.

I felt a little disorientated at points, it was a bit strange to move around. Maybe if the targets moved a little, it might make it a bit more challenging to shoot at them.

Aesthetically: as a challenge, I would do one moving target (a boss) from side to side and have a health bar. No other aspects need to change in my opinion.

Functionally: maybe the gun, to make sure that you are aiming at the target put a red dot to show you are actually pointing at the target

Add more game features. Such as a health bar so that there is some risk. This can be placed top left corner or even on the gun.

E5: Question 5

Appendix F – Artifacts Showcase

F1: Artifacts for showcase

F2: Artifacts for showcase with image target for demonstration

Appendix G – Artifact / Application Testing Footage

Refer to Digital File

Appendix H – Focus Group Audio Recordings (20 Participants)

Refer to Digital File

Appendix I – Signed Canescent Forms

Refer to Digital File