

Exploring the Aesthetics and Functionality of Casual Game Environment Assets

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This report presented in partial fulfillment of the requirement for the degree of bachelor of science in Multimedia and Creative Technology

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Approval

This Project titled “Exploring the Aesthetics and Functionality of Casual Game Environment Assets” submitted by Fakhrul Alam (193-40-631) to the Department of **Multimedia and Creative Technology, Daffodil International University**, has been accepted as satisfactory for the partial fulfillment of the requirements for the degree of **B.Sc. in Multimedia and Creative Technology** and approved as to its style and contents. The presentation has been held on **19/08/2023**.

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Abstract

Low-poly assets are a great way to create 3D mobile casual strategy games. They have many advantages over high-poly models, such as improved game performance, fluid gameplay, and cost-effectiveness. That can be done quickly and easily, enabling developers to streamline their production cycle and reduce expenses. Additionally, low-poly models have versatility in aesthetics, allowing game designers to produce games with distinct and eye-catching aesthetics. Low-poly 3D game assets are used in mobile casual strategy games to create visually stunning and highly functional games.

This paper analyzes making these assets, focusing on balancing aesthetic quality and performance efficiency. It also includes case studies of popular mobile casual strategy games that use low-poly 3D graphics. Successful development of low-poly 3D game assets within a group project setting depends on effective team communication, proper work allocation, adherence to project schedules, and quality standards.

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CHAPTER 1

1.1 Introduction

The mobile gaming industry has undergone significant developments, with players wanting immersive and graphically captivating experiences on their devices. To fulfill these needs, game developers have investigated different approaches to optimizing game performance without compromising graphic quality. Low-poly 3D gaming assets have gained substantial interest due to their advantages, particularly in mobile casual strategy games. Low-poly game assets have a considerable market value for mobile game developers, as the global market for mobile gaming was estimated to be worth \$60 billion in 2022 and is expected to increase to \$80 billion by 2027. Low-poly game assets are a valuable tool for developing engaging games that connect with players due to their enhanced performance, simplicity of creation, and aesthetic flexibility. Utilizing low-poly game assets can assist developers in satisfying players' increasing expectations and carving out a lucrative niche in this cutthroat market.

1.2 Motivation

- I. The functionality of games on mobile devices has been enhanced.
- II. Efficiency in terms of time, resources, and expenditures.
- III. Versatility in creating distinct and enticing aesthetics.
- IV. Responding to the demand for aesthetically pleasing mobile games
- V. Creating landscapes, structures, and visually striking characters
- VI. Streamlining the production cycle and allocation of resources
- VII. Optimizing resource utilization for smoother gameplay
- VIII. Enhancing marketability and player engagement
- IX. Balancing aesthetic quality and performance efficiency.

Incorporating low-poly 3D game assets in mobile casual strategy games is motivated by enhanced performance on mobile devices, cost-effectiveness, adaptable aesthetics, and the demand for aesthetically pleasing games. These assets optimize resource utilization, expedite production, and generate visually distinctive environments and characters. By balancing aesthetics and performance, developers can increase marketability and player engagement while minimizing costs.

1.3 Research Objective

The primary purpose of this investigation is to investigate the process of creating and utilizing low-poly 3D game assets in mobile casual strategy games. The following specific objectives will guide the study:

- I. Explore the techniques and methodologies for creating low-poly 3D game assets, including polygon optimization, texture mapping, and animation techniques.
- II. Examine the impact of low-poly aesthetics on game performance, considering factors such as frame rates, loading times, and the overall smoothness of gameplay.
- III. Investigate the balance between aesthetic quality and performance efficiency in developing low-poly assets, analyzing how different approaches affect the visual appeal and gameplay experience.
- IV. Analyze case studies of successful mobile casual strategy games that have effectively implemented low-poly 3D graphics, identifying the strategies and design choices that contributed to their success.
- V. Provide recommendations and best practices for game developers and designers on leveraging the advantages of low-poly aesthetics, ensuring optimized game performance, and delivering visually appealing mobile casual strategy games.

By addressing these research objectives, this study aims to contribute to understanding the creation, implementation, and impact of low-poly 3D game assets in mobile games. The findings will provide developers with valuable insights and practical guidance, enabling them to make informed decisions and improve their games' overall quality and performance.

1.4 Research Questions

- I. How do developers create low-poly 3D game assets for mobile casual strategy games, and what are the most important approaches and tactics?
- II. Is there a tradeoff regarding framerate, loading time, or gameplay smoothness when opting for low-poly visuals?
- III. What is the spot between visual polish and playability for low-poly elements in mobile casual strategy games?
- IV. What are the design choices and processes behind the most successful low-poly 3D mobile casual strategy games?
- V. How can high-quality, low-poly 3D game assets be made using collaborative approaches and project management strategies?
- VI. How can game designers and developers make the most of low-poly aesthetics to provide aesthetically pleasing mobile casual strategy games while ensuring efficient performance?
- VII. What are some guidelines for UV mapping and texture baking when making low-poly items?
- VIII. How much polygon reduction does a low-poly model require?
- IX. How can we achieve smooth and accurate UV mapping with the reduced complexity of low-poly assets?

This study aims to solve the abovementioned research to shed light on the creation, use, and effect of low-poly 3D game components in mobile casual strategy games. The findings will provide game designers and developers with valuable information that will improve the games' quality and functionality.

1.5 Expected Outcome

The following are some of the hoped-for results of this research project:

- I. A thorough comprehension of the techniques and methods for creating low-poly 3D game assets for mobile casual strategy games. A comprehensive understanding of the techniques and methodologies for creating low-poly 3D game assets for mobile casual strategy games. This knowledge will provide insights into optimizing polygon counts, texture mapping, and animation techniques specific to low-poly aesthetics.
- II. Understanding of how low-poly art styles affect gameplay. The study will ascertain how low-poly elements impact performance metrics, including frame rate, load time, and gameplay fluidity. The result should be a deeper comprehension of how low-poly visuals enhance mobile game performance.
- III. I am balancing visual appeal and performance efficiency while creating low-poly components. The study aims to identify the most promising methods for improving aesthetic quality while preserving top-notch functionality.
- IV. Compelling low-poly 3D graphics in mobile casual strategy games: a critical analysis. The intended outcome is a better understanding of the standard design decisions and implementation techniques used by these games, which other developers aiming for the same level of success may then apply.
- V. Working effectively in a team and implementing effective project management practices are essential for creating high-quality low-poly 3D game assets. Successful projects result from well-established norms for team communication, work distribution, timeline adherence, and quality control.
- VI. Strategies and methodologies for optimizing the benefits of low-polygon graphics in video game design. This study aims to aid game developers in enhancing immersion and engagement in their games by offering practical recommendations on optimizing game performance and designing visually appealing mobile casual strategy games.

The ultimate goal of this study is to improve the quality and performance of mobile casual strategy games on a budget by providing valuable insights, knowledge, and practical recommendations regarding the development, implementation, and utilization of low-poly 3D game assets.

CHAPTER 2

Background Study

2.1 Introduction

This background study presents an overview of existing texturing knowledge and research in the context of 3D game asset generation. Understanding the historical, theoretical, and practical elements of texturing may help game developers and designers produce aesthetically attractive and engrossing gaming experiences. The parts that follow will expand on this foundation by delving into the methodologies, tools, and best practices for texturing 3D game materials.

2.2 Key features for creating casual games

A casual game is simple and easy to play, with mechanics, short play periods, and visually attractive elements that appeal to a large audience. It delivers quick entertainment, encourages social interaction, and is accessible in a variety of genres, providing simple experiences for both casual and non-traditional gamers.

Here is a list of important factors to consider while developing a casual strategy game using 3D game assets:

- I. Visual Appeal: Create a pleasant and aesthetically attractive art style that will appeal to casual players.
- II. Low-Poly Models: For optimum efficiency and short loading times, use low-poly 3D models.
- III. Color Palette: Choose a lively and unified color palette that complements the tone of the game.
- IV. Character Design: Create character designs that are charming, relatable, and unique so that gamers can connect with them.
- V. Environment Variety: To keep gamers interested, provide different and intriguing surroundings.

Below I mention the names of several popular games which are casual strategy games. The data given here is taken from several websites. Which we have crosschecked and listed in various ways.

No.	Game name	Company	Country	Release Date
1	Clash of Clans	Supercell	Finland	2012-08-02
2	Boom Beach	Supercell	Finland	2014-03-26
3	Castle Clash	IGG.COM	China	2013-10-22
4	The Battle of Polytopia	Midjiwan AB	Sweden	2016-02-04
5	Bloons TD 6	Ninja Kiwi	New Zealand	2018-06-14
6	Domi Nations	Big Huge Games	United States	2015-04-01
7	Hexonia	TOGGLEGEAR	Korea	2019-01-27
8	Mushroom Wars 2	Zillion Whales	Russia	2016-10-13
9	Age of Strategy	Zero Touch	Hungary	2013-10-26
10	Rusted Warfare - RTS	Corroding Games	Australia	2017-07-15

Table 2.2.1- Casual strategy games list

2.3 Literature Review

Using low-poly 3D game assets in the mobile game industry has gained significant attention recently. This literature review provides an overview of research and scholarly discourse on low-poly asset creation for mobile games, focusing on the strategy game genre.

Low-poly 3D game assets offer advantages in mobile game development, optimizing performance for smooth gameplay on devices with limited processing capabilities. Research (Smith, 2021) highlights the reduced computational demands of low-poly models, resulting in improved frame rates and shorter loading times, enhancing player satisfaction.

Furthermore, low-poly assets contribute to player engagement and immersion through their unique visual appeal. The stylized visuals of low-poly games create a distinct identity, attracting and retaining players in a competitive market (Brown, 2022).

However, challenges exist in achieving visual fidelity while reducing the polygon count. Efficient asset creation techniques, including polygon reduction, texture optimization, and shaders, are crucial for visually appealing low-poly models.

Time and cost considerations are also important factors. High-poly and low-poly assets can be resource-intensive and expensive, necessitating effective project management and collaboration.

Best practices have been identified to address these challenges. Emphasizing stylized visuals and leveraging the strengths of low-poly assets is vital. Collaborating with a multidisciplinary team of experts, such as 3D modelers and animators, ensures high-quality asset production. Procedural techniques and asset reusability streamline the workflow, reducing time and costs.

In conclusion, using low-poly 3D game assets in the mobile game industry, specifically in casual strategy games, offers performance optimization and visual distinctiveness. However, achieving visual fidelity while managing time and costs requires efficient asset creation and project management practices. By leveraging the strengths of low-poly assets and following best practices, developers can create visually captivating and performance-optimized mobile games.

2.4 Scope of The Problem

Understanding the extent of the problem in low poly 3D game assets is critical for novices since it assists in identifying the unique problems and factors that must be addressed during asset production. Recognizing these difficulties allows game creators to employ suitable approaches, tools, and best practices to overcome them and build aesthetically beautiful, optimized, and interesting games.

Some common aspects within the scope of the problem may include:

- I. **Visual Fidelity:** Low poly 3D gaming assets, by definition, contain less polygons than high poly elements. This constraint can have an impact on the degree of detail and visual fidelity that can be attained, making it difficult to create items that look aesthetically appealing and realistic to players.
- II. **Performance Optimization:** While low poly assets perform better than high poly models, getting optimal performance might still be difficult. To maintain seamless gameplay and prevent performance concerns like as frame rate dips or excessive loading times, it is critical to balance the visual quality and performance efficiency of the assets.
- III. **Texturing and Detailing:** Texturing approaches for low poly models must be carefully considered in order to generate believable and detailed textures that increase the visual quality of the item. It might be difficult to get appropriate textures and surface details while keeping the asset optimized.
- IV. **Artistic Style and Consistency:** Developing a unified and aesthetically attractive graphic style while working with low poly 3D objects can be difficult. It is critical to provide uniformity across diverse assets and to retain the intended aesthetic direction in order to offer a unified and immersive gaming experience.
- V. **Asset Creation Workflow:** Modelling approaches, UV unwrapping, texturing, and optimization are all factors to consider when developing an effective workflow for producing low poly 3D gaming assets. It is critical to streamline the asset generation process in order to achieve project deadlines and produce high-quality materials.

2.5 Research Area and Construction's

The research and construction realm is a dynamic and captivating exploration, fueled by curiosity to uncover new insights, unravel complexities, and construct novel solutions. This journey takes place through virtual and tangible canvas, navigating theories, methodologies, and hands-on construction. The journey embodies the spirit of pioneers, architects, and artisans, who dared to dream and construct, bridging the gap between thought and action.

2.5.1 Hybrid modeling

Low-poly hybrid modeling blends polygonal and procedural approaches to produce economical, visually appealing 3D elements utilizing polygonal and procedural methods.

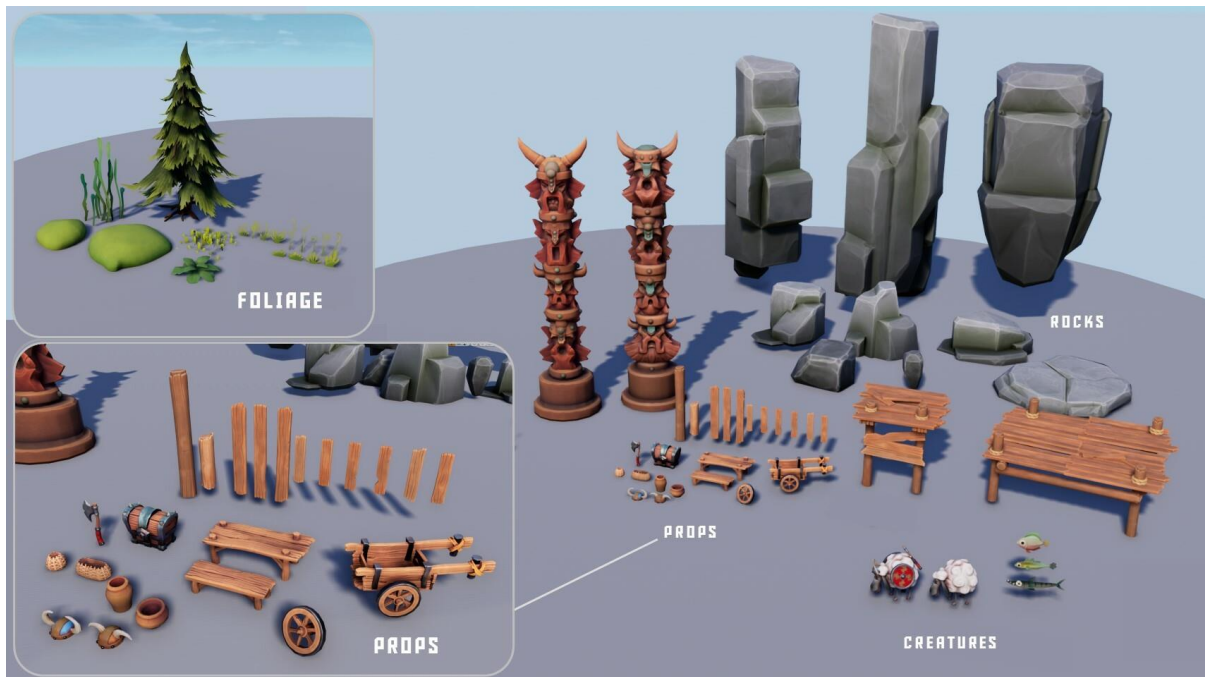


Figure 2.5.1.1- Hybrid modeling reference

Key features of hybrid modeling in low poly:

- I. Polygonal Base: Begin with a simple polygonal base mesh to establish the primary shape of the asset.
- II. Procedural Detailing: Employ procedural modeling techniques, such as using modifiers or procedural textures, to add intricate details without significantly increasing the polygon count.
- III. Subdivision Surfaces: Use subdivision surfaces to maintain smoothness and refine the model's appearance while still keeping the overall polygon count low.
- IV. Retopology: Perform retopology on high-poly models to create a clean and optimized low-poly version while preserving the essential details.
- V. Normal Map Baking: Use normal map baking to transfer high-poly details onto the low-poly model, achieving the illusion of increased complexity without the need for additional polygons.
- VI. Texture Efficiency: Utilize texture maps effectively to enhance the model's visual appeal while avoiding unnecessary polygonal complexity.

Benefits of hybrid modeling in low poly:

- I. **Faster Workflow:** Combining different modeling techniques allows for a more efficient and streamlined workflow.
- II. **Optimal Performance:** Hybrid models strike a balance between visual quality and performance, making them ideal for real-time applications like games.
- III. **Versatility:** Hybrid modeling offers creative flexibility, enabling artists to achieve complex results with fewer polygons.
- IV. **Resource Optimization:** By reducing the polygon count, hybrid models consume fewer system resources, enhancing overall efficiency.

Overall, hybrid modeling in low-poly is a powerful approach that leverages various techniques to create visually appealing and efficient 3D assets suitable for real-time applications, particularly in the context of games and interactive experiences.

2.5.2 Organic Modelling

Organic modeling in low poly is a 3D technique for representing natural shapes with limited polygons, enhancing performance and visual appeal in video games, animations, and real-time applications.

Key characteristics of organic modeling in low poly:

- I. Natural Shapes: Organic modeling captures complex, irregular shapes in nature, including animals, humans, trees, and rocks.
- II. Minimal Polygon Count: Models use limited polygons for optimal real-time performance.
- III. Subtle Detailing: Organic low-poly models use texturing and shading techniques to convey complexity without intricate high-poly models.
- IV. Artistic Stylization: Organic low-poly models use artistic stylization for visual interest and minimal polygonal detail.
- V. Rigging and Animation: These models are often rigged and animated to bring them to life in interactive environments or animations.

Benefits of organic modeling in low poly:

- I. Efficient Performance: Reduced polygon count enhances real-time performance, making it ideal for video games and simulations.
- II. Quick Rendering: Organic low-poly models render faster, saving processing time with fewer polygons.
- III. Versatility: Low-poly models enhance visual quality without compromising functionality.
- IV. Mobile-Friendly: Organic low-poly models are lightweight, ideal for mobile devices with limited processing power.

Overall, Organic low poly modeling balances performance and aesthetics, making it popular for creating visually appealing 3D assets in interactive and entertainment media.

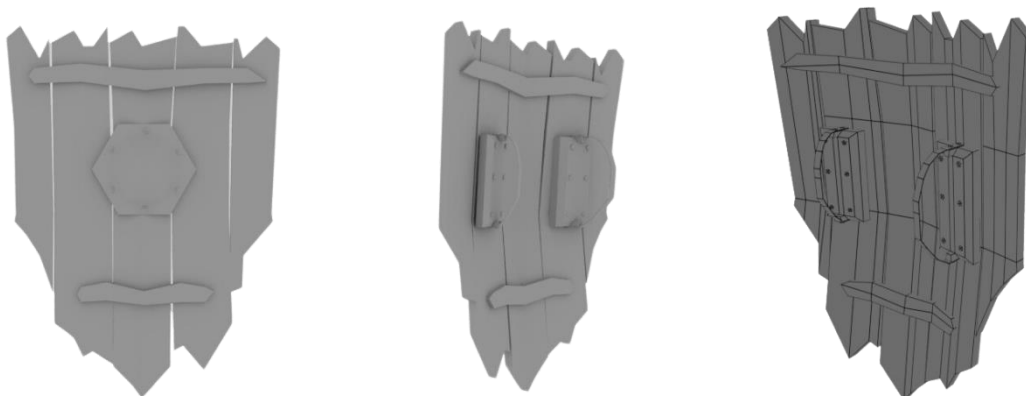


Figure 2.5.2.1- Organic modeling reference

2.5.3 Shape psychology

Shape psychology studies how shapes and forms evoke emotional responses in individuals, impacting user experience and perception of low-poly 3D game assets.

Importance of shape psychology in the project:

- I. Emotional Impact: Shape psychology enables designers to strategically use shapes to evoke emotions, improving player engagement and immersion.
- II. Aesthetic Appeal: Shape psychology enables visually appealing low-poly assets that resonate with audience and align with game theme.
- III. User Interaction: Shapes in game assets affect user interaction, mechanics, and dynamics.
- IV. Game Identity: Shapes in game assets establish a recognizable brand identity, making the game memorable and distinguishable.
- V. Storytelling: Shapes can be employed to convey information, symbolism, or thematic elements, enriching the storytelling aspects of the game and creating a more immersive experience for players.

By incorporating shape psychology into the design and creation of low-poly 3D game assets, the project can achieve a harmonious balance between aesthetics, emotions, and user engagement, ultimately enhancing the overall quality and impact of the game.

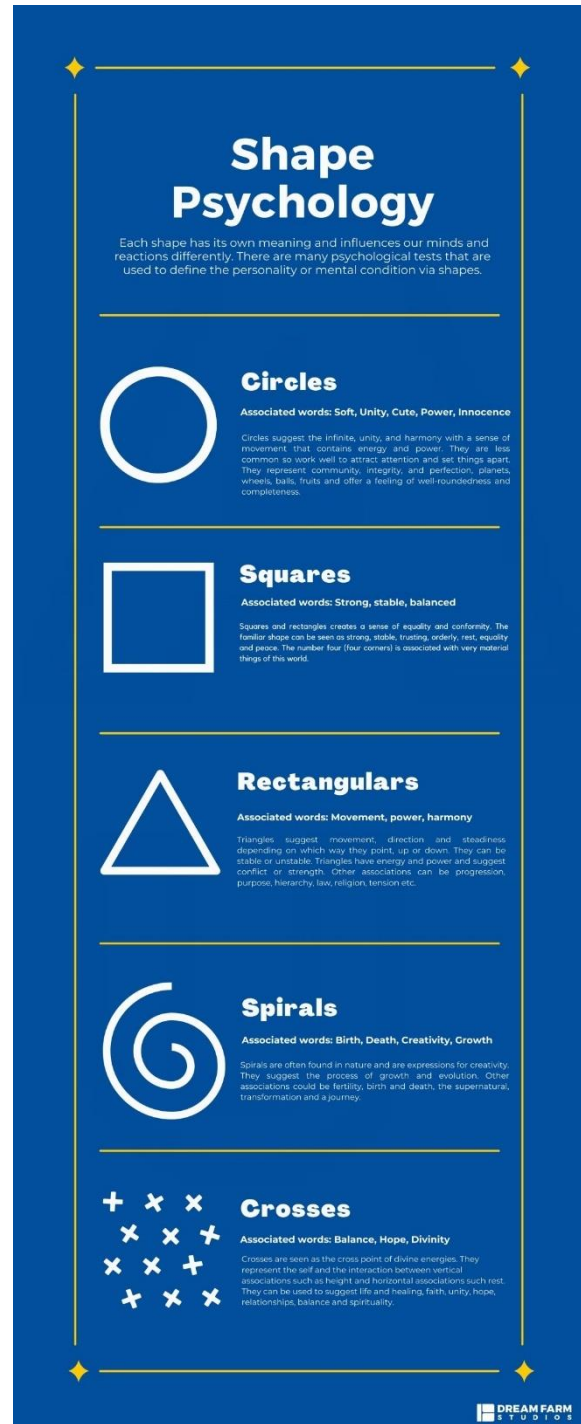


Figure 2.5.3.1- Shape psychology chart (Dream Farm Studio)

2.5.4 Visual breathing space

Visual breathing space, also known as negative space or white space, is empty areas surrounding design elements, providing balance and clarity in visual presentations.

Importance of visual breathing space in the project:

- I. **Focus and Clarity:** Visual breathing space in low-poly 3D game assets enhances clarity, uncluttered hierarchy, and facilitates player interaction and understanding.
- II. **Aesthetics:** Well-planned negative space enhances game assets' aesthetics, making them visually appealing and engaging.
- III. **User Experience:** Visual breathing space enhances user experience by reducing noise and distractions, enabling focus on essential elements.
- IV. **Readability:** Negative space enhances readability by making important information easily distinguishable and distinguishable.
- V. **Emphasis on Main Elements:** Visual breathing space guides players through game assets, highlighting main elements and focal points, emphasizing key features.
- VI. **Sense of Balance:** Negative space in design creates balance, harmony, and a polished visual presentation.

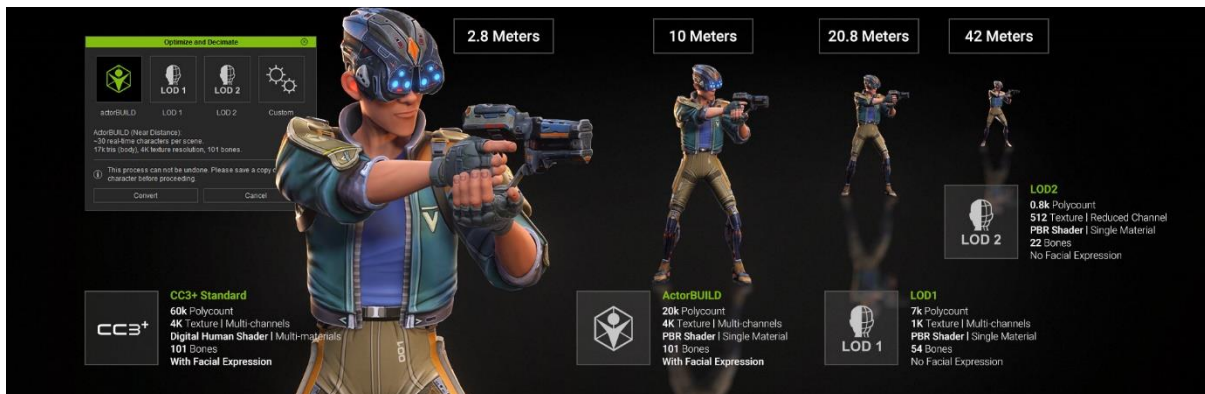


Figure 2.5.4.1- Camera distance (Visual breathing space)

In summary, Visual breathing space is crucial in low-poly 3D game assets, improving aesthetics, readability, and user experience, making the game visually appealing and immersive.



Figure 2.5.4.2- LOD (Level of details)

CHARACTER LOD COMPARISON TABLE

APPLICATIONS	HIGH RES FILM	AAA GAME	MOBILE/AR/AEC	CROWD	
Character Level	Subdivision Export	CC Avatar(CC3+)	ActorBUILD	LOD 1	LOD 2
Character Type	CC Avatar		actorBUILD	Humanoid	
Bone Number	CC Standard (101)			54	22
Polycount <small>*Including cloth and hair</small>	240k up	60k up	20k	7k	0.8k
Mesh Reduction Type	-	-	Convert Base	Remesh	
Facial & Lipsync	0			X	
Shader	Digital Human		PBR	PBR	PBR
Texture Size	4096 multi-channels for 4 body materials		4096	1024	512
Material Number	Multi-Material		One	One	One
Camera Distance	0M	2.8M	10M	20.8M	42M

Figure 2.5.4.3- Character LOD comparison table

CHAPTER 3

Research Method and Workflow

3.1 Introduction

The process section is crucial for creating low-poly 3D game components for mobile casual strategy games. It outlines a methodical approach to creating aesthetically appealing and performance-optimized components. This chapter covers essential phases, approaches, and best practices in low-poly asset production, highlighting the artistry and mechanics involved in creating interesting game components that enhance the immersive environment of mobile casual strategy games.

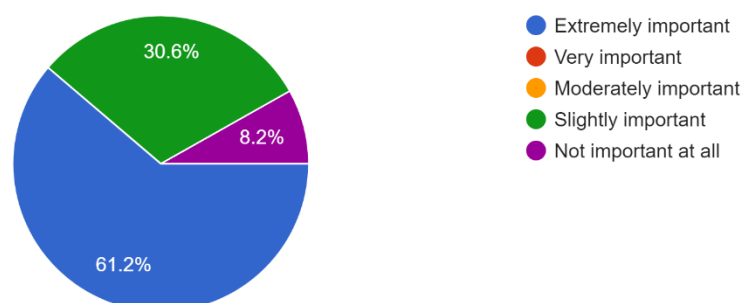
3.2 Survey

We have done several surveys based on our projects. Which was very important in our work and based on this survey we do all our research and projects. In our survey, the employees of several game companies who make these casual casual strategy games have participated. In addition, several 3D artists participate who are directly or indirectly involved with casual casual strategy games. All participants here participated anonymously. No one agreed to give their personal identity or data. But we will share virtual profile links of those companies and those 3D artists in reference chapter as much as possible. We read several research papers and online portals and prepare some questions related to our project, give several options accordingly. Here those who participated chose from that option and gave their opinion.

Below we will present the data of this survey through a pie chart.

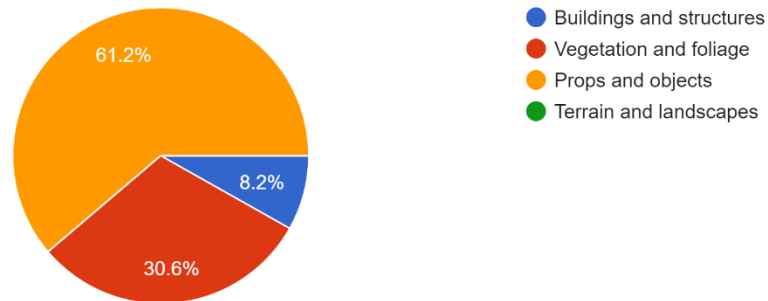
How important is the quality of low poly game assets in enhancing the overall visual appeal of a game?

49 responses



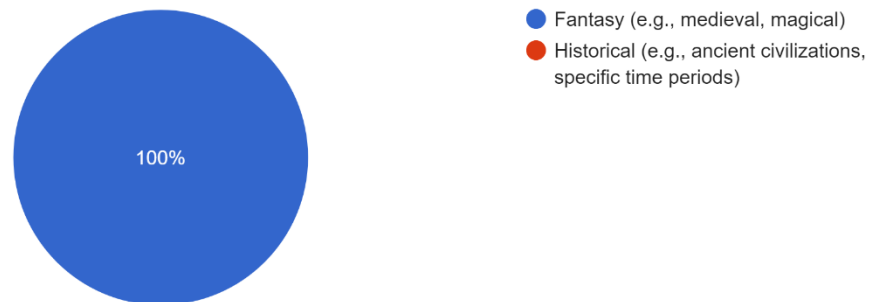
Which type of low poly game assets do you find most essential for creating an immersive game environment?

49 responses



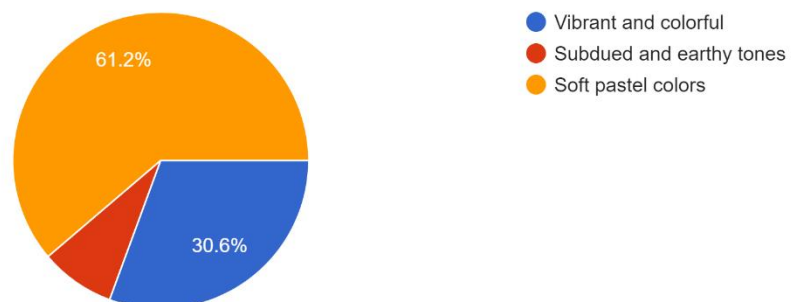
Which setting or theme would you prefer for the low poly game assets?

49 responses



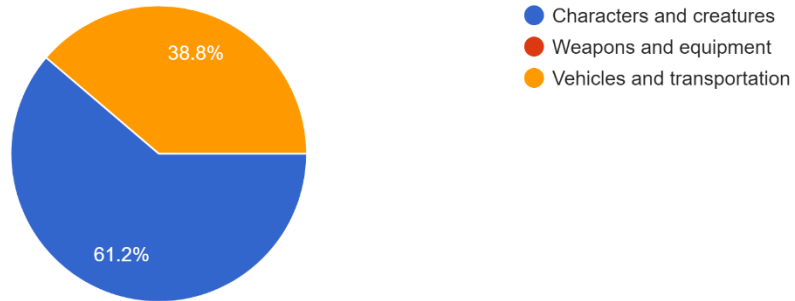
Which color palette would you prefer for the low poly game assets?

49 responses



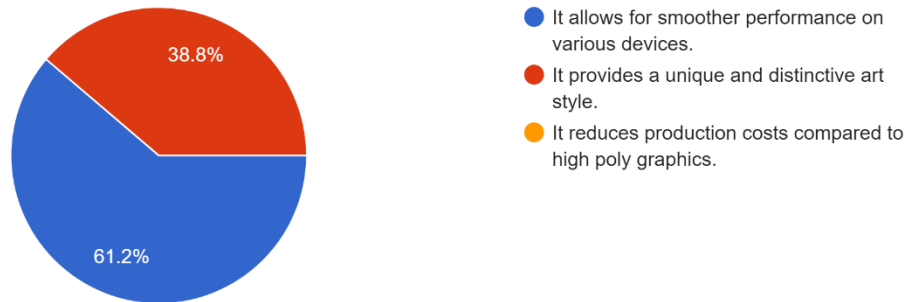
Among the following low poly game asset categories, which do you believe requires the most attention to detail?

49 responses



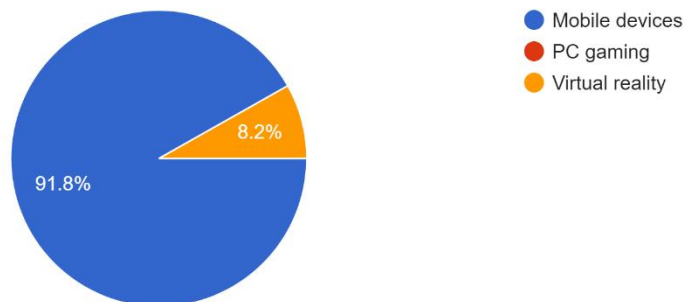
In your opinion, what are the advantages of using low poly graphics in games?

49 responses



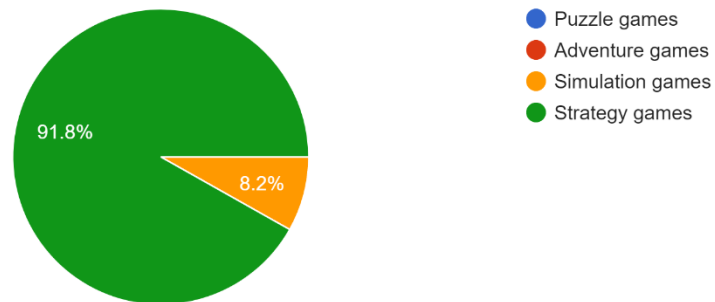
Which platforms do you believe benefit the most from low poly games?

49 responses



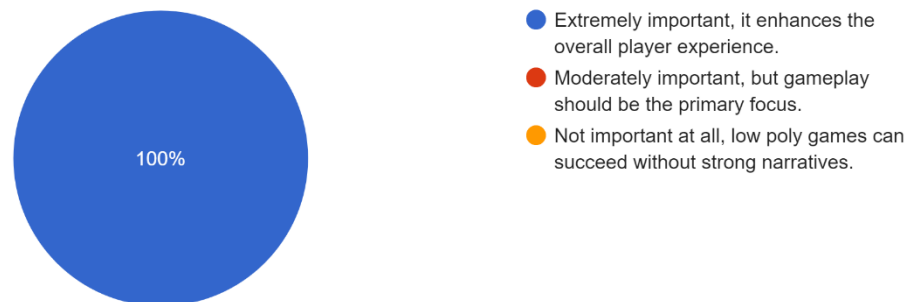
Which low poly game genres do you believe have gained the most popularity in recent years?

49 responses



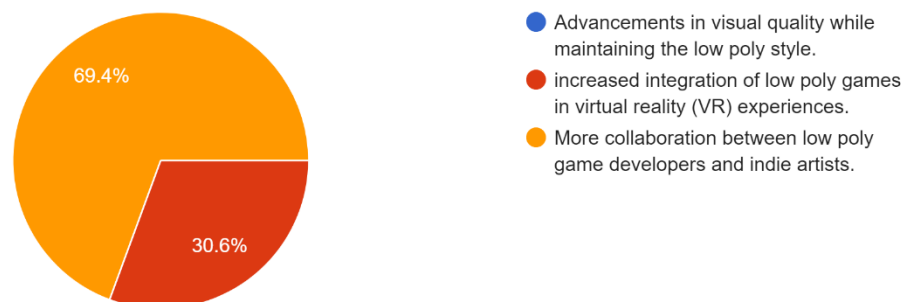
How important is it for low poly game developers to incorporate storytelling and narrative elements in their games?

49 responses



What future trends do you anticipate in the low poly game industry?

49 responses



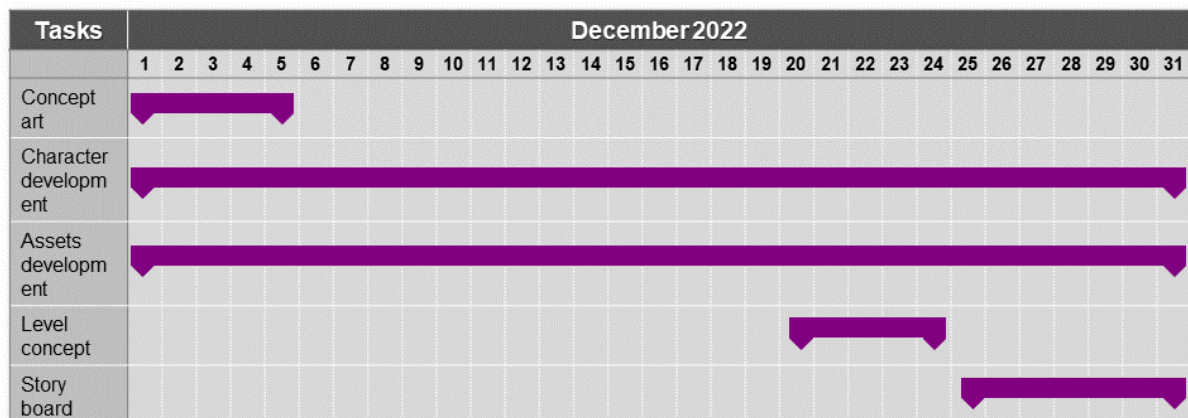
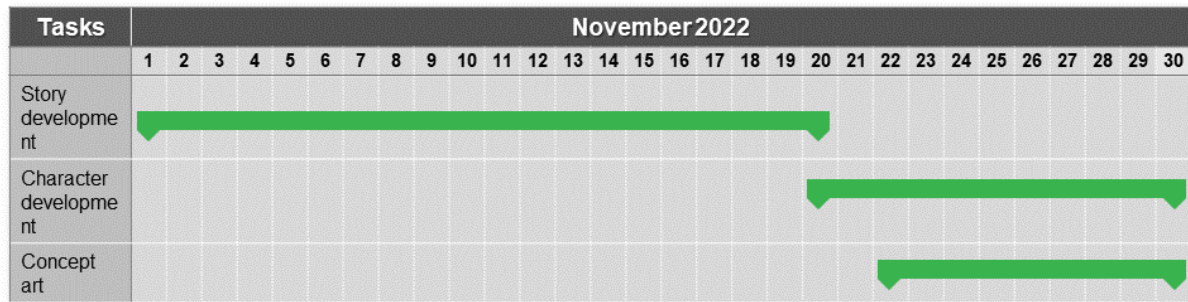
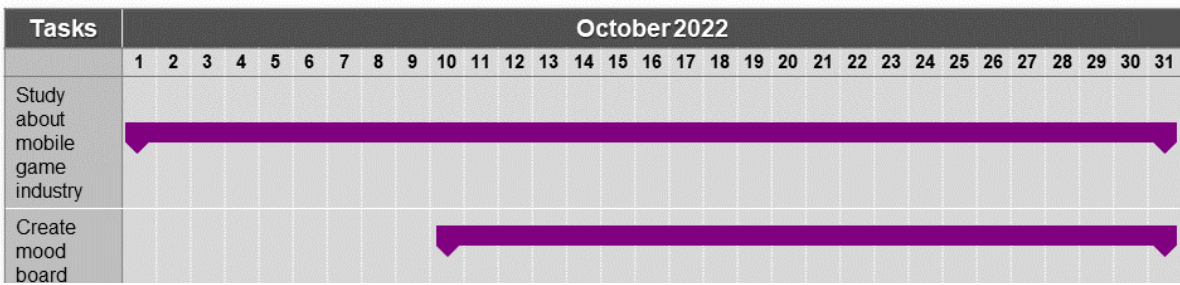
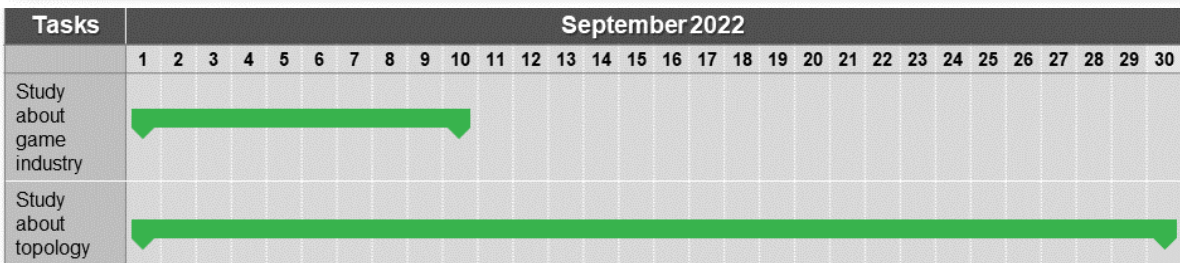
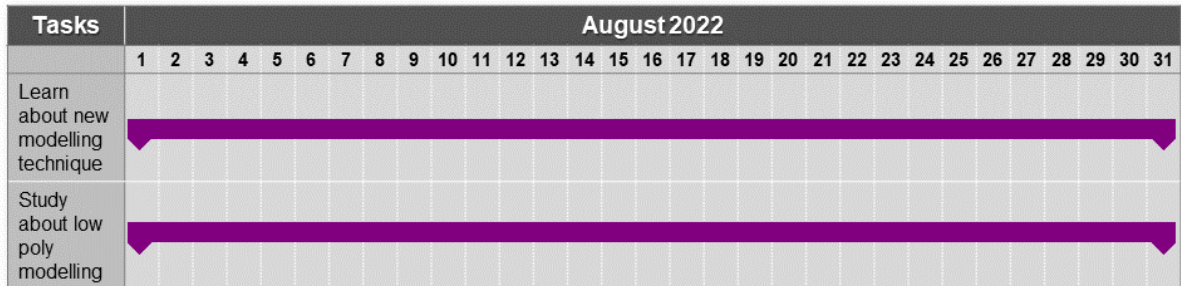
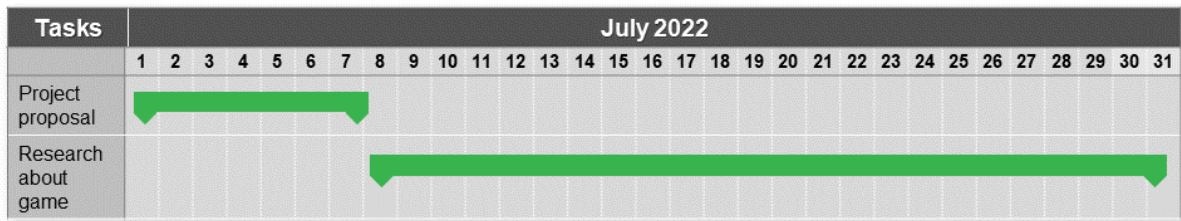
3.3 Gantt chart

Gantt chart is a visual project management tool for tracking tasks, managing resources, and detecting bottlenecks.

For our low-poly 3D game assets project, a Gantt chart is crucial as it helps in:

- I. Planning: Clear project roadmap for efficient planning and organization.
- II. Coordination: Visual task representation enhances team collaboration and alignment.
- III. Time Management: Gantt chart tracks progress, identifies delays, and ensures project completion.
- IV. Resource Allocation: Efficient resource allocation ensures well-distributed team efforts in projects.

Overall, Gantt chart crucial for managing low-poly 3D game assets project.



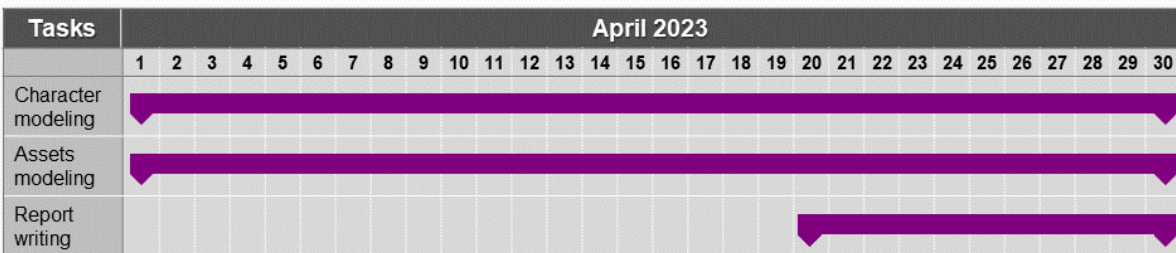
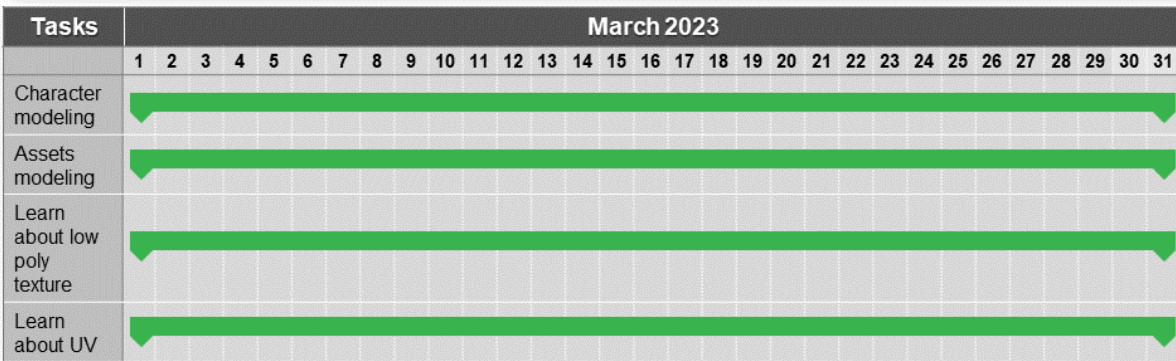
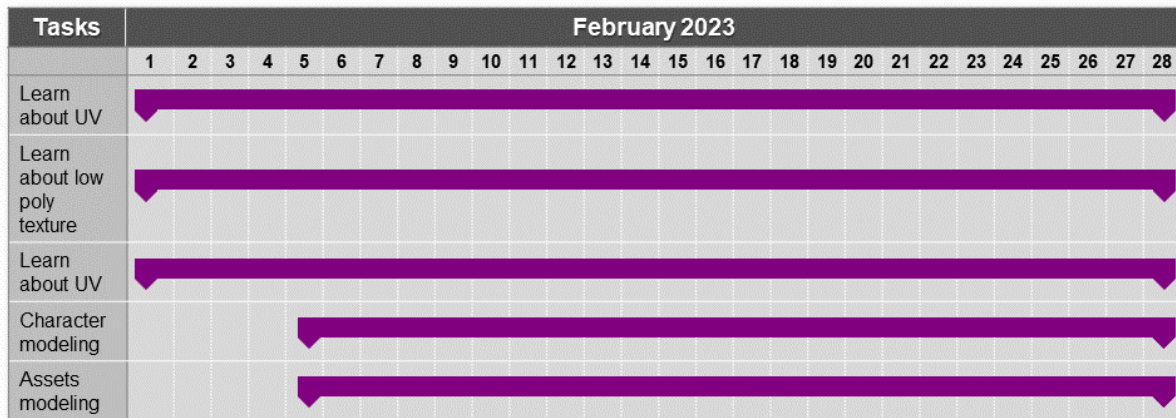
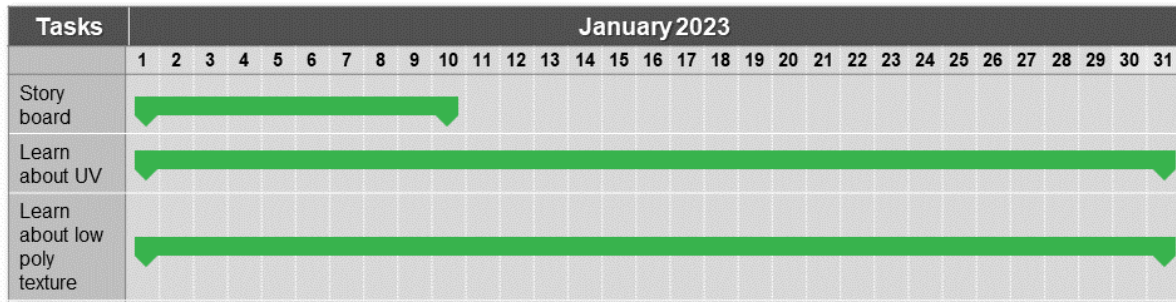


Table 3.3.2- Gantt chart

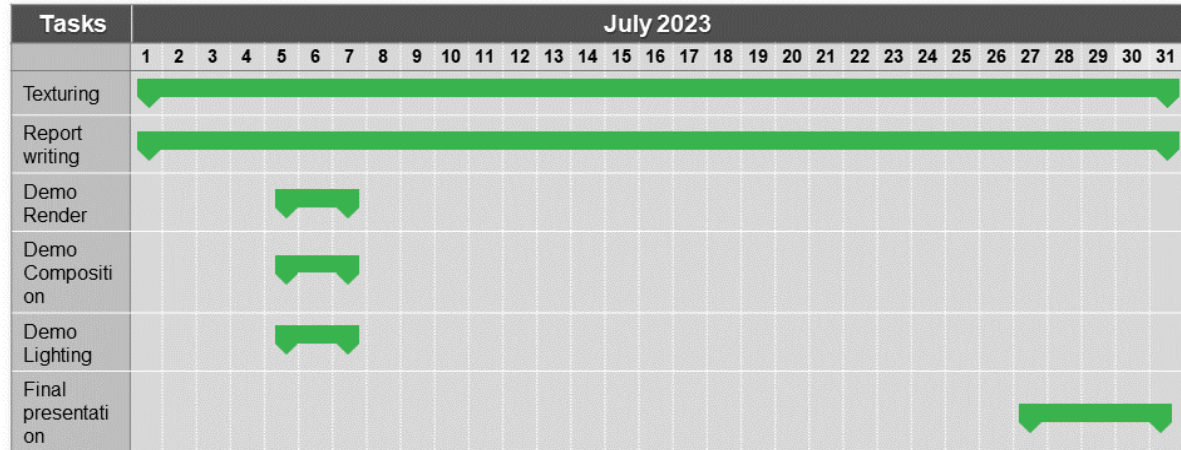
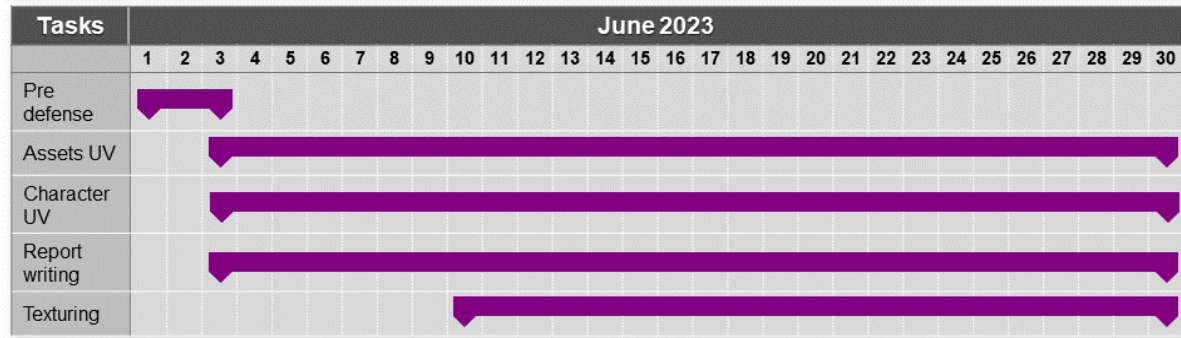
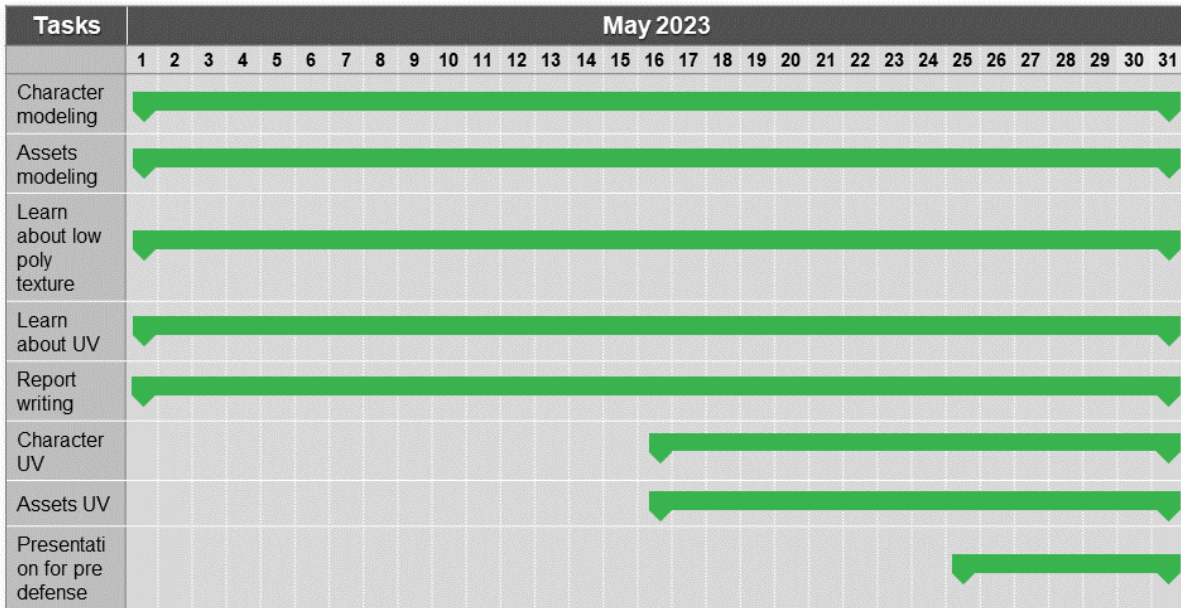


Table 3.3.3- Gantt chart

3.4 Main story in a brief

Once there was a hero who guarded a precious gem. He and his team built a settlement around the jewel to protect it from those who wished to steal it. One day, while the hero was away, a group of enemies attacked the village hoping to claim the gem. The enemies captured the entire village and killed everyone. When the hero returned, he made it his mission to retrieve the precious jewel and free the village from the enemy's hold. And so, our game begins...



Figure 3.4.1- Game Icon

3.5 Story Board

A storyboard is a visual representation of a project's storyline, guiding stakeholders through essential scenes, events, and actions.

For our low-poly 3D game assets project, storyboarding is vital as it provides the following advantages:

- I. Visualizing the Game: Storyboarding conceptualizes game's storyline, characters, and mechanics, improving design.
- II. Communicating Ideas: Understanding the project vision, objectives, and creative direction is made possible by effective communication among team members.
- III. Planning and Organization: Storyboarding is used to plan game progression and level design in order to provide a compelling user experience.
- IV. Identifying Issues Early: Visually map game elements to identify design flaws and address narrative gaps.

Overall, Storyboard is crucial in low-poly 3D game assets project, guiding development, collaboration, and enhancing product quality.

01.



The hero cautiously enters the monster village

02.



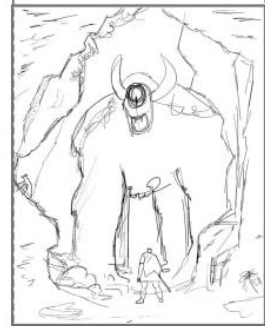
The hero encounters goblins lurking in the shadows of the village

03.



The hero reaches the heart of the cave, where a giant pig, the guardian of the treasure, awaits.

04.



The hero discovers a giant guarding the entrance to a hidden cave.
Hero character facing a towering giant

05.



The hero enters a dark cave, revealing a group of menacing aliens.

06.



The hero engages in battle with the dragons, skillfully dodging attacks and striking back.

07.



Hero character victorious, standing with the treasure

Figure 3.5.1- Story Board

3.6 The software we used

- I. Autodesk Maya 2023
- II. Adobe Substance 3D Painter
- III. Marmoset Toolbag

Autodesk Maya 2023 using for low poly modelling and UV mapping. Then Adobe substance 3D painter for texturing and baking map. Then Marmoset Toolbag using for final output render.



Figure 3.6.1- Used software for this project

3.7 Software Description

The Software Description part delves into the complex world of software, emphasizing its role in bringing ideas to life. It exemplifies the marriage of human intellect with computer capability, enabling us to sculpt, shape, and mould our ideas. The chapter highlights the marriage of creativity and technology, which enables us to explore, experiment, and create in novel ways.

3.7.1.1 Autodesk Maya 2023

Autodesk Maya is a prominent 3D computer graphics software that is used in the film, broadcast, gaming, and architecture industries. It allows users to construct realistic 3D objects by using modeling, animation, and rendering. Maya's flexibility, extensibility, and ease of use make it a must-have tool for 3D professionals in a variety of fields.

In our research, Autodesk Maya, a strong 3D computer graphics software, was used for low-poly modeling, generating fast, visually appealing models with low polygon counts. Its UV mapping capabilities provided faultless texture application and boosted object realism. Maya's agility enabled us to succeed in other aspects of 3D asset development, contributing to the project's success. Its user-friendly interface and extensive tool set streamlined production and produced professional-quality output.



Figure3.7.1.1.1- Autodesk Maya logo

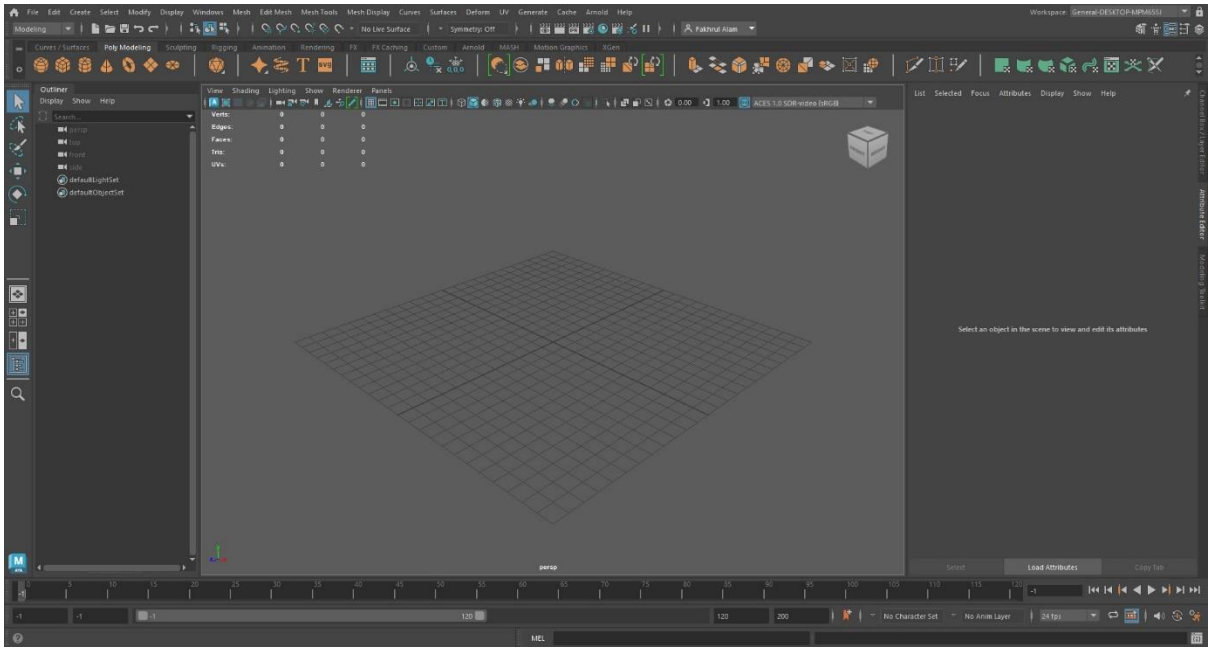


Figure3.7.1.1.2- software main interface

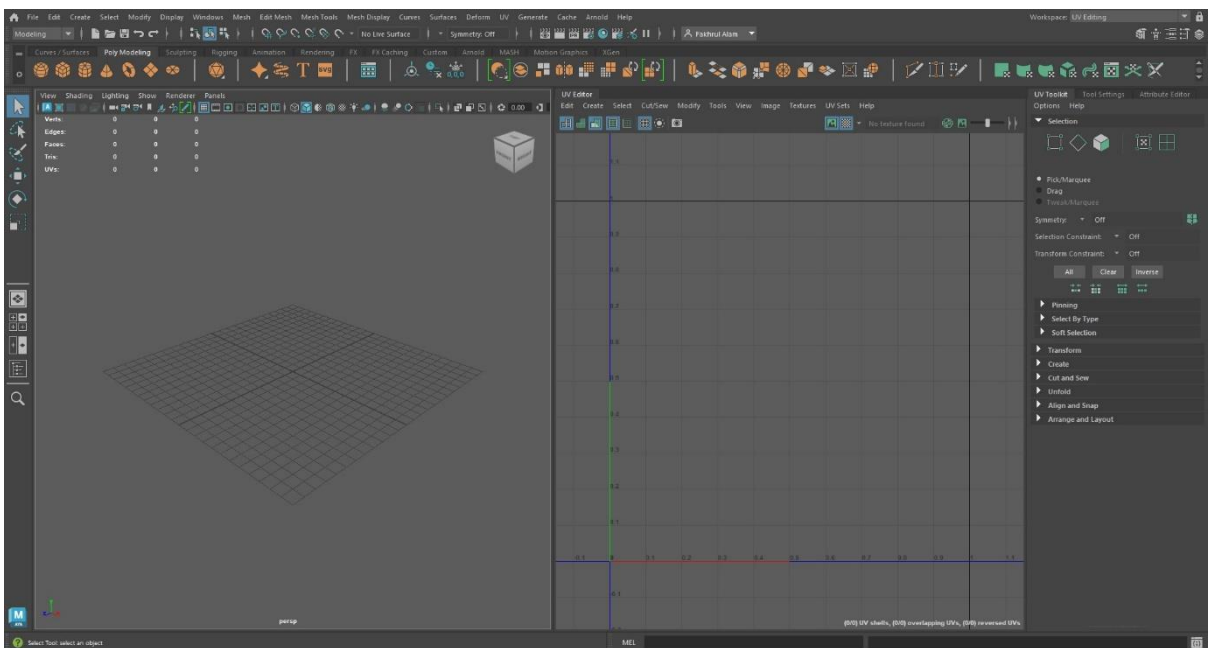


Figure3.7.1.1.3- UV interface

3.7.1.2 The problem we faced

- I. Software Crashes: Maya 2023 may encounter periodic crashes, particularly when doing heavy workload operations such as exporting huge low-poly models with UVs, disrupting production and perhaps leading to data loss or time-consuming recoveries.
- II. Performance Constraints: Maya 2023 may encounter performance issues with complicated low-poly models, impacting workflow productivity.
- III. Learning Curve: For beginners, navigating Maya's comprehensive capabilities for low-poly modeling and UV generation might be difficult.
- IV. Limited UV Tools: Maya's built-in UV tools may lack some advanced functionality, necessitating the use of other plugins or apps.
- V. Exporting Issues: When exporting low-poly models with UVs to other software or game engines, compatibility issues may arise.

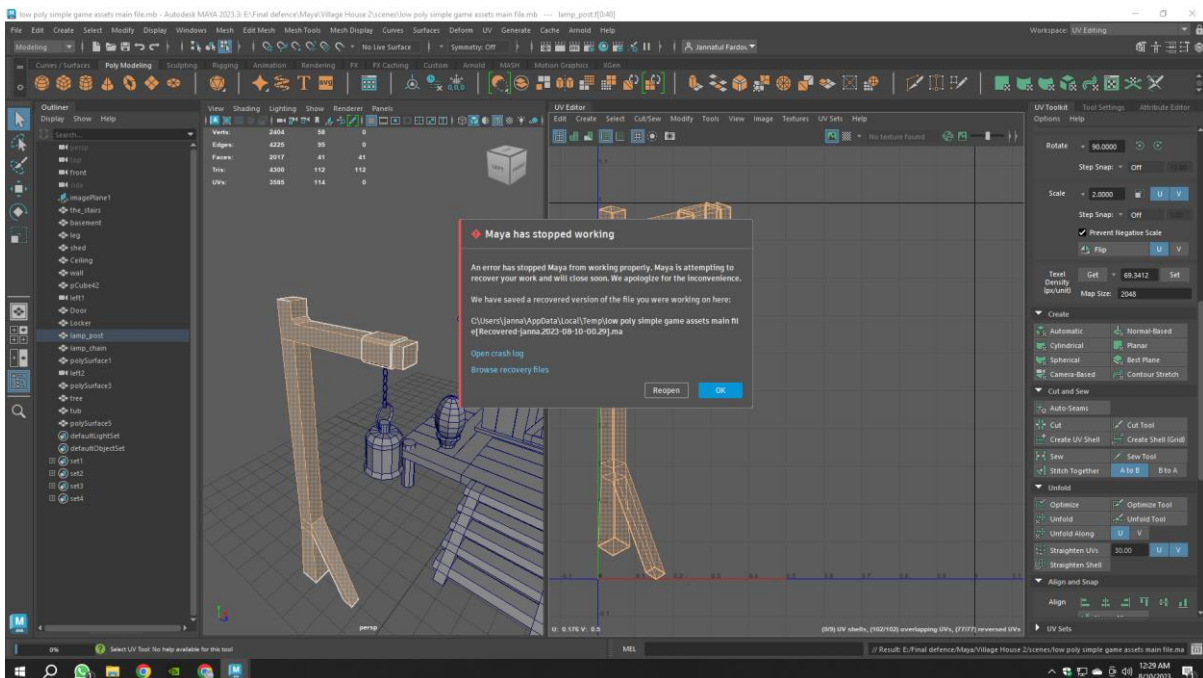


Figure 3.7.1.2.1- Software Crashes

3.7.2.1 Adobe Substance 3D Painter

Adobe Substance 3D Painter is a sophisticated 3D texturing application that enhances realism in models, characters, and surroundings. Its user-friendly interface and real-time 3D painting enable artists to create dynamic, changeable textures. It supports PBR processes and seamless integration, making it a popular choice for professionals seeking high-quality texturing solutions.

Adobe Substance 3D Painter was used for texturing low-poly models, resulting in realistic and visually appealing textures. Its straightforward UI and real-time 3D painting capabilities expedited the development process, while the Substance material system-maintained consistency and realism. Overall, it was an invaluable tool for improving low-poly object visual appeal.



Figure 3.7.2.1.1- Adobe Substance 3D printer logo

3.7.2.2 The problem we faced

- I. GPU- This software needs a high config GPU. Without this is a horrible experience.
- II. Resource Import- Sometimes we need extra material for texture. When we download a material from 'adobe substance community assets' then some materials are not imported.
- III. Sometimes this software hangs and crashes.

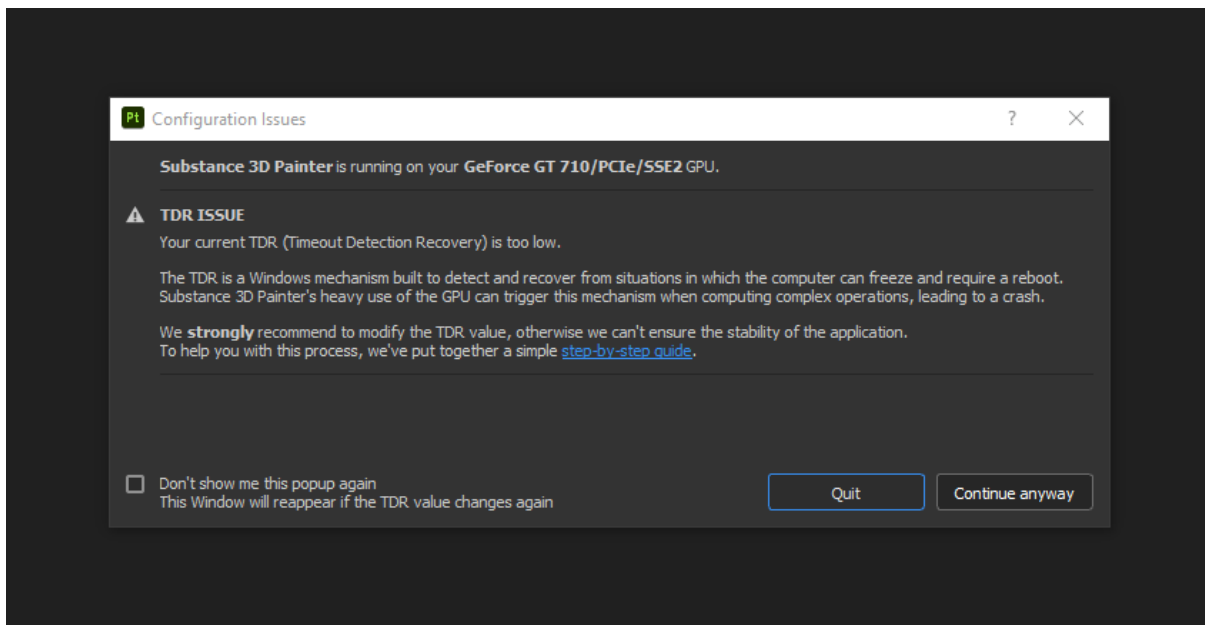


Figure 3.7.2.2.1- GPU Issue

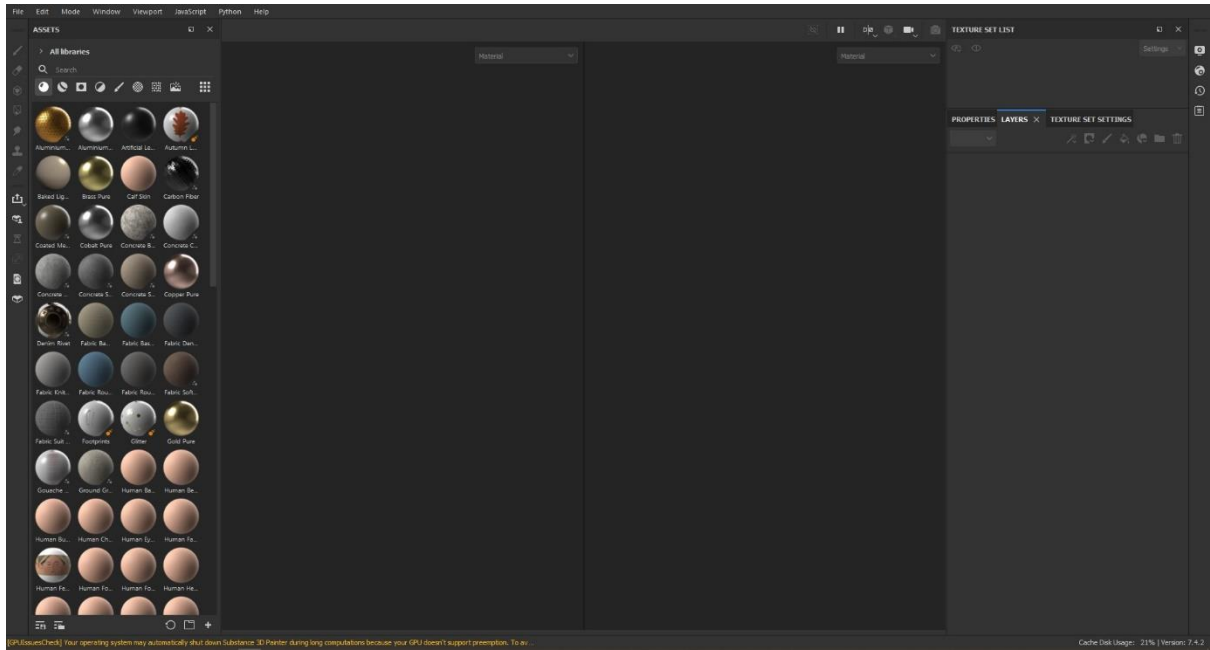


Figure 3.7.2.2.2- software main interface



Figure 3.7.2.2.3- software main interface

3.7.3.1 Marmoset Toolbag

Marmoset Toolbag is a high-performance real-time rendering and texture baking application used in game development and 3D graphics. It provides customers with an easy-to-use platform for presenting, rendering, and evaluating 3D objects in real time. Marmoset Toolbag offers visually appealing and photorealistic presentations of 3D objects with its rapid rendering capabilities, interactive lighting, and post-processing effects. It also offers texture generation tools for producing high-quality textures, making it a popular option for displaying and presenting 3D models and game components.



Figure 3.7.3.1.1- Marmoset Toolbag logo

3.7.3.2 The problem we faced

- I. **Compatibility Challenges:** Marmoset Toolbag may encounter compatibility issues with certain hardware configurations, affecting rendering and performance.
- II. **Animation Limitations:** While offering some animation features, Marmoset Toolbag is primarily designed for static 3D models, lacking the depth of dedicated animation software.
- III. **Resource Intensiveness:** Rendering high-resolution textures or complex scenes can strain system resources, causing potential slowdowns or crashes on less powerful machines.
- IV. **Artistic Learning Curve:** Mastering Marmoset Toolbag's interface and workflow may require time and practice, posing a challenge for newcomers.
- V. **Price Consideration:** While offering a free trial, the full version comes at a cost, which might impact users on a budget seeking free alternatives.

3.8 Our work method

- I. Low poly game assets: Since we are doing mobile gaming, we choose low poly game ties from many different game types.
- II. Hybrid Model: We follow hybrid modeling technique to make our work faster and easier. This makes game assets more optimized.
- III. Organic Modelling: Organic modeling captures complex, irregular shapes in nature, including animals, humans, trees, and rocks. Models use limited polygons for optimal real-time performance.
- IV. Topology: A key component of 3D modelling is topology, which has a direct impact on the efficiency, aesthetics, and animation of the model. For the creation of 3D models that are both aesthetically pleasing and useful, a well-structured topology is necessary. Topology is very well maintained at our per game assets.

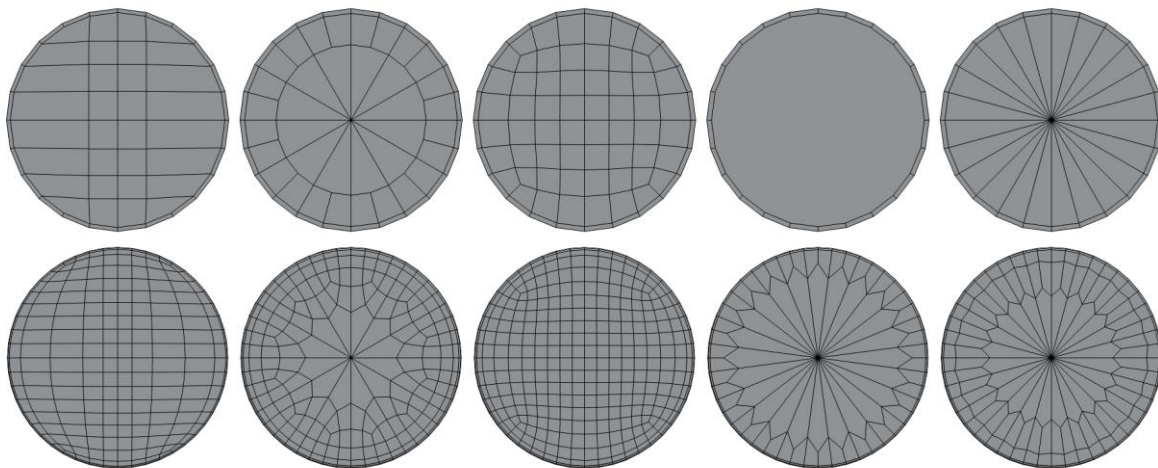


Figure 4.2.1- Visual representation for understanding topology

- V. Shape psychology: Shape psychology studies how shapes and forms evoke emotional responses in individuals, impacting user experience and perception of low-poly 3D game assets.
- Circle: innocence, youth, energy, femininity
Square: maturity, stability, balance, stubbornness
Triangle: aggression, masculinity, force



Figure 4.2.2- Visual geometry shape for understanding shape psychology

- VI. Visual breathing space: Visual breathing space is crucial in low-poly 3D game assets, improving aesthetics, readability, and user experience, making the game visually appealing and immersive.

3.9 Maya workflow

- I. First, we look at a reference according to our model.
- II. As I have created the assets, I create a base of my model in low poly as a reference.
- III. In this case I maintain the topology from the beginning
- IV. After making the base model I create the UV map
- V. While creating UV map, map size is 2048 (2k) and try to keep Texel density of all UV shells same.
- VI. Then I rename each part of my base model separately so that it is easier to find it later and it is easier to place the material.
- VII. After that select the entire model and assign a material id. So that I can texture the model as an object in Adobe Substance Painter.
- VIII. The last thing I do is select the entire model and export it to FBX format for the next step.

Below I have added some pictures for ease of understanding.

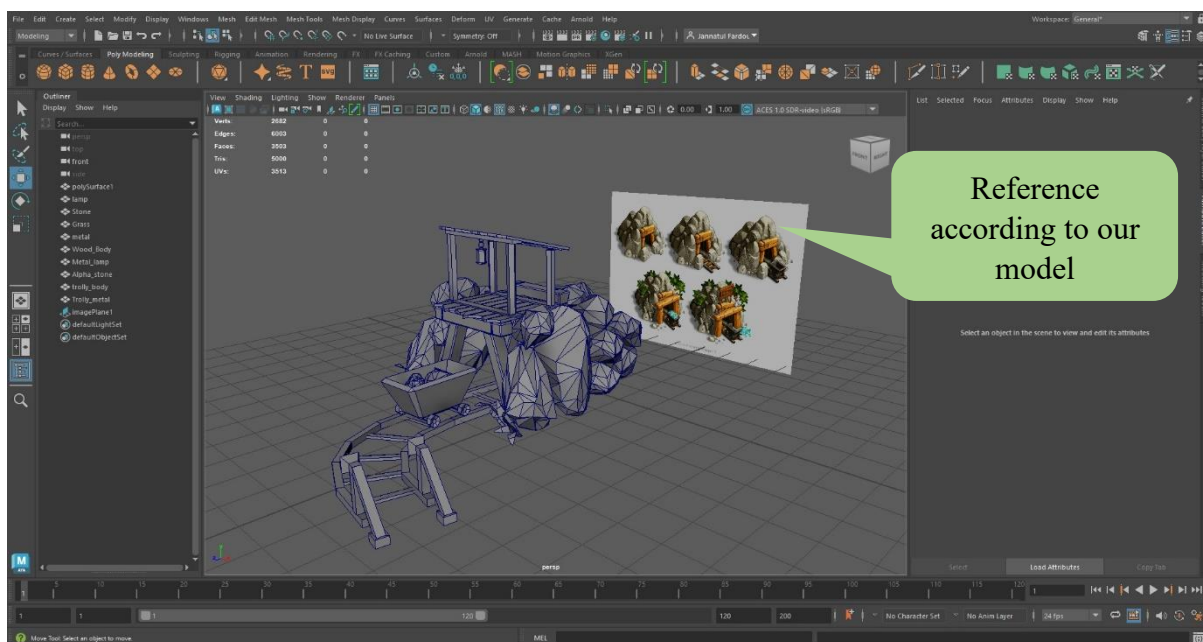


Figure 3.9.1- Screenshot 1

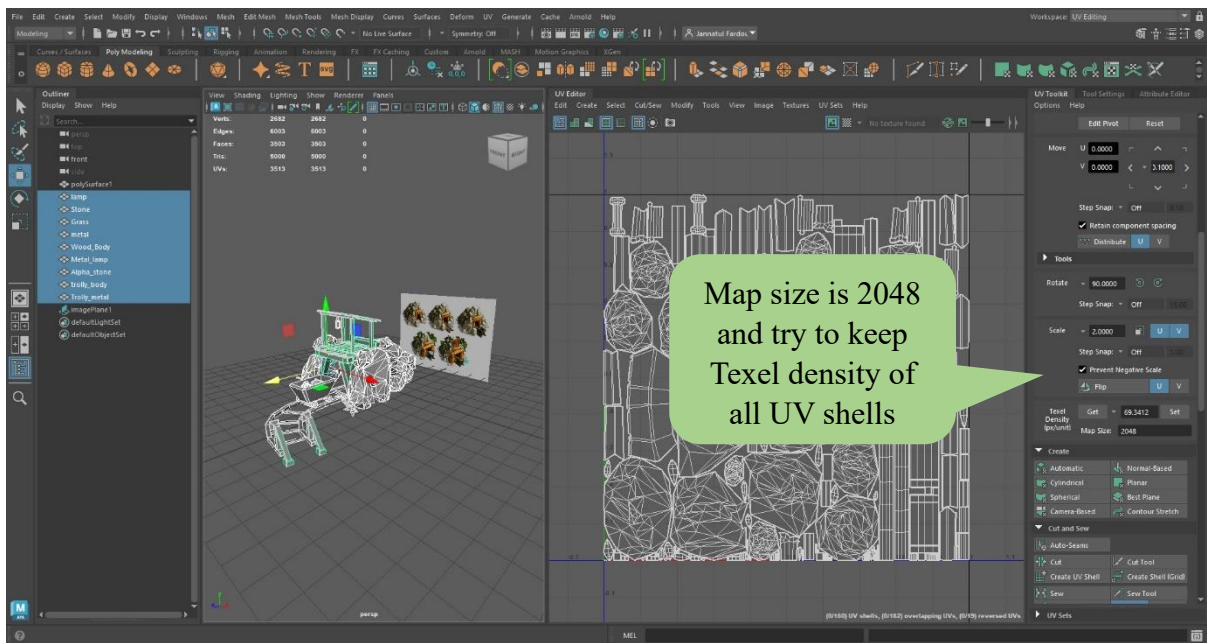


Figure 3.9.2- Screenshot 2

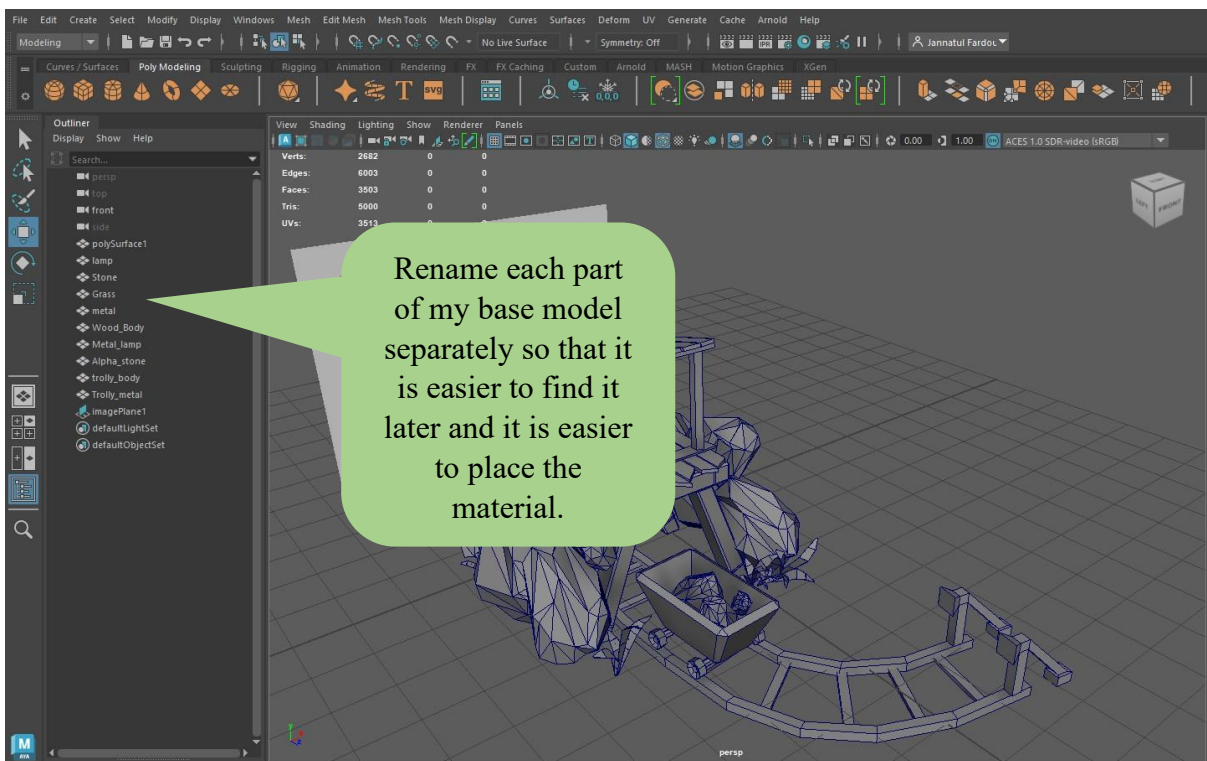


Figure 3.9.3- Screenshot 3

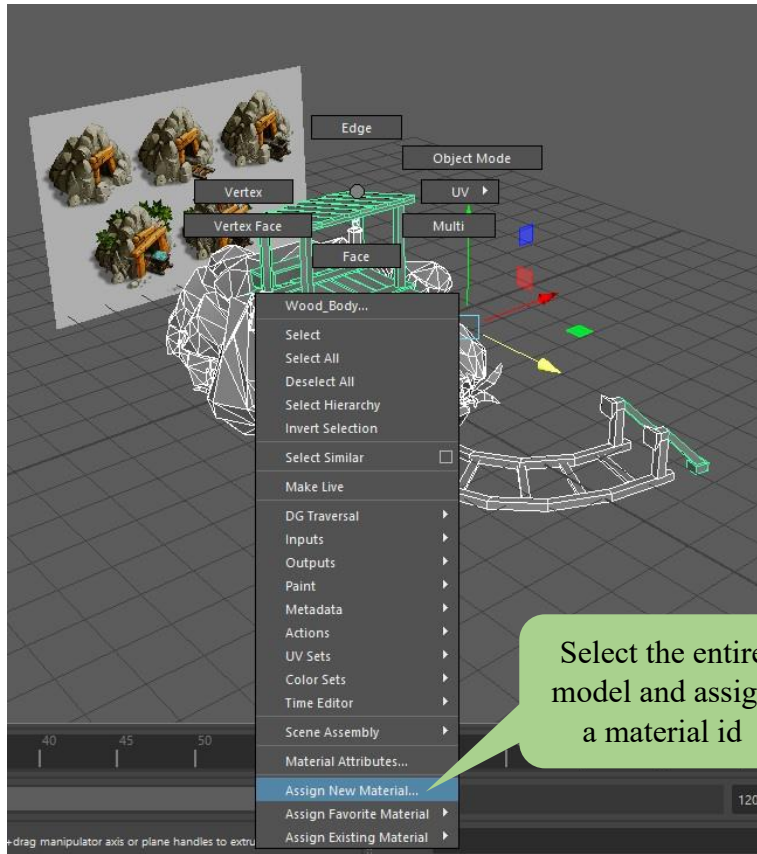


Figure 3.9.4- Screenshot 4

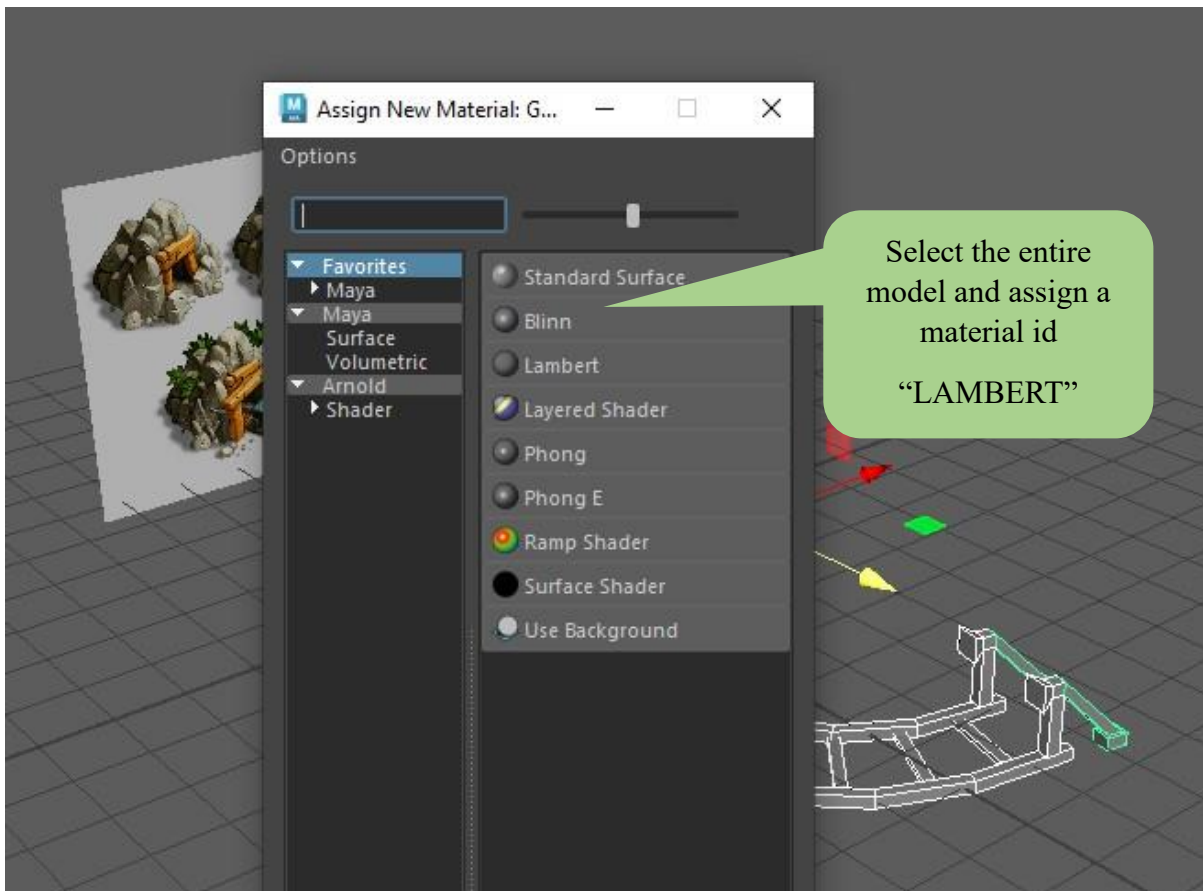


Figure 3.9.5- Screenshot 5

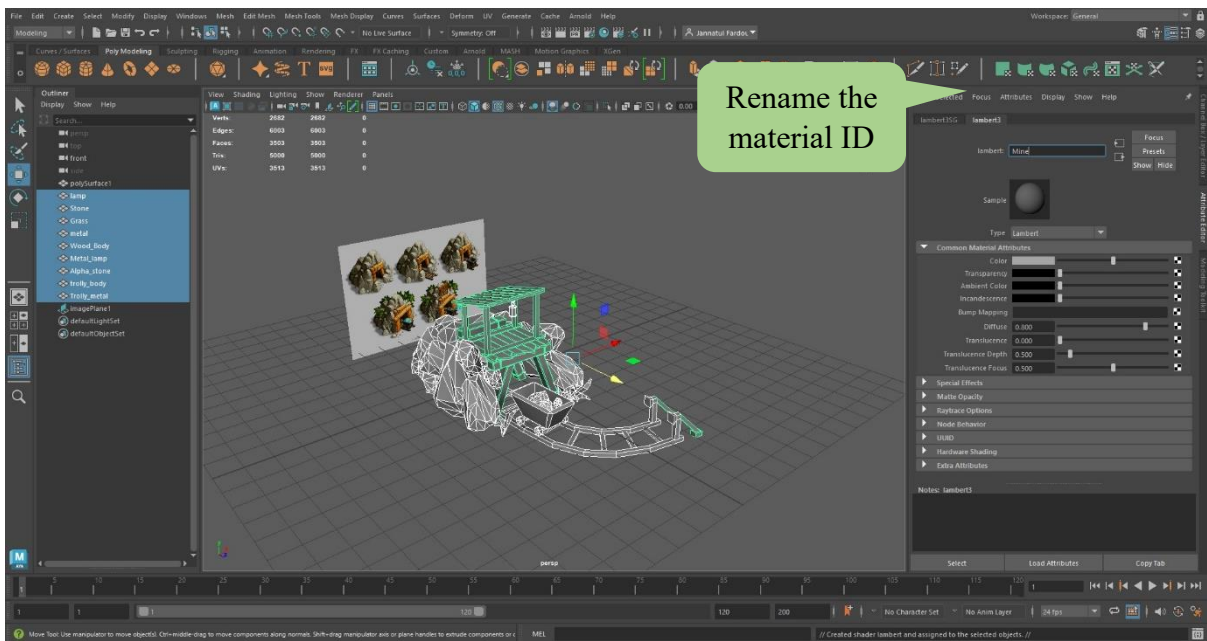


Figure 3.9.6- Screenshot 6

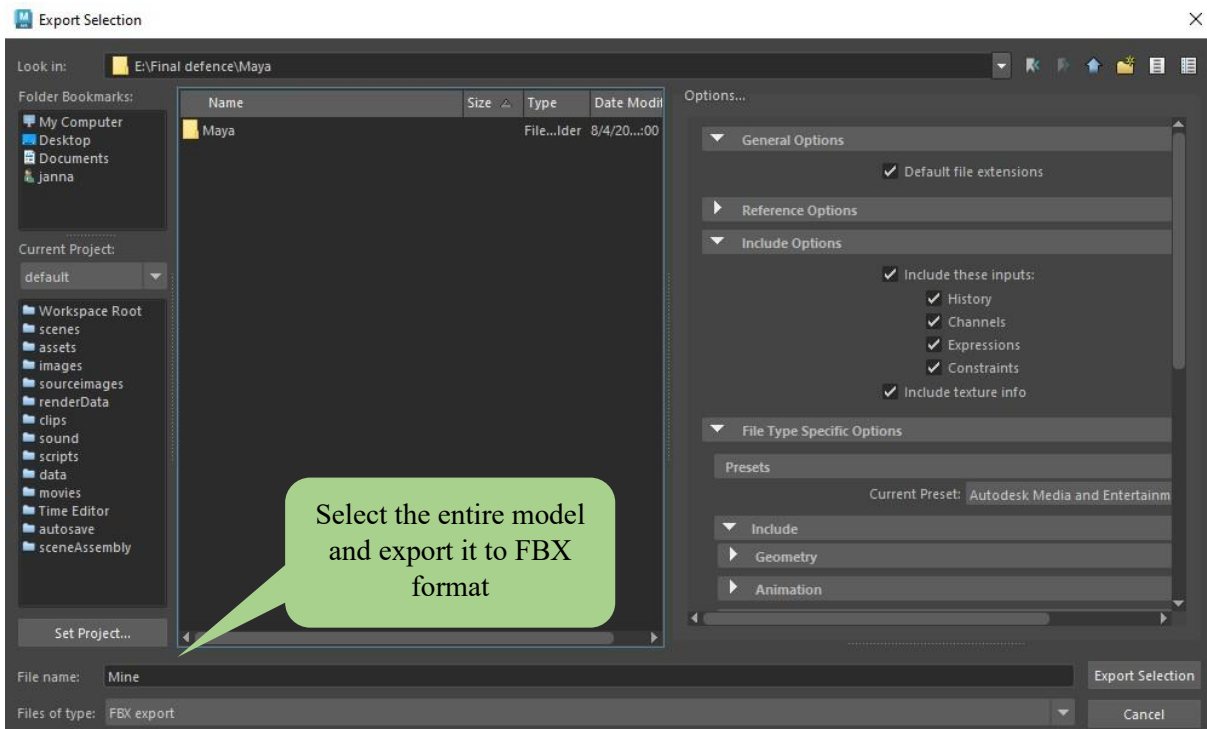


Figure 3.9.7- Screenshot 7

3.10 Adobe Substance 3D Painter workflow

- I. Import Model: Import the 3D model into Substance Painter. Supported formats include FBX. This time I select Unreal Engine 4 (Starter Assets) as the template. Also select document resolution 2048 (2k).
- II. UV Unwrapping: Ensure the model has UV mapping applied. Proper UV unwrapping allows the 3D model's surface to be accurately represented on a 2D texture map.
- III. Baking Textures: At this stage I bake the model to generate other maps like Normal, Ambient Occlusion, or Curvature to transfer details to a low-poly model. I select 2048 (2k) while doing bake mash
- IV. Texture Painting: Begin painting textures onto the model using a variety of brushes, masks, and tools. Substance Painter allows for both manual painting and smart materials application.
- V. Real-Time Preview: Continuously preview the model in real-time to see how the textures affect the final appearance.
- VI. Texture Output: At this stage I export the maps for the next step.

Below I have added some pictures for ease of understanding.

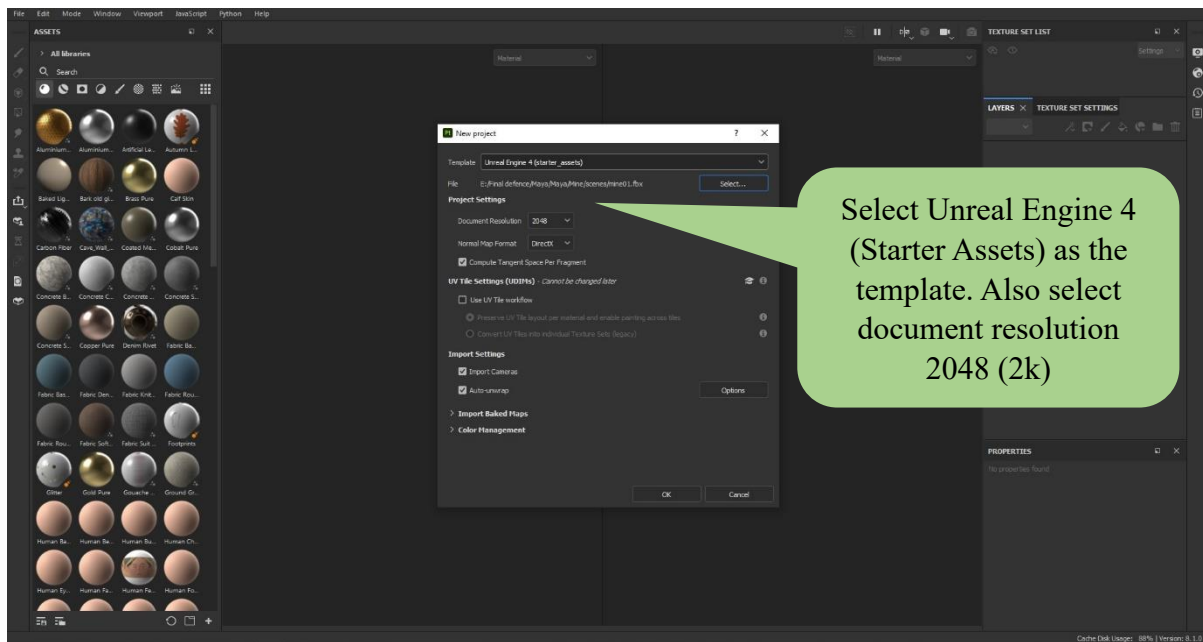


Figure 3.10.1- Screenshot 1

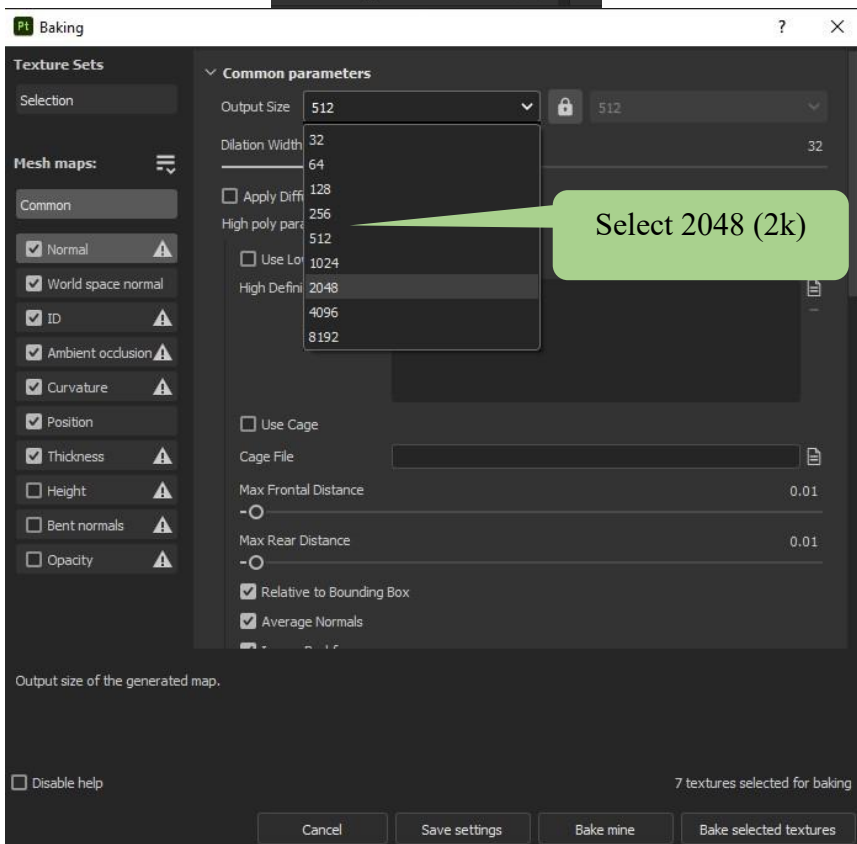
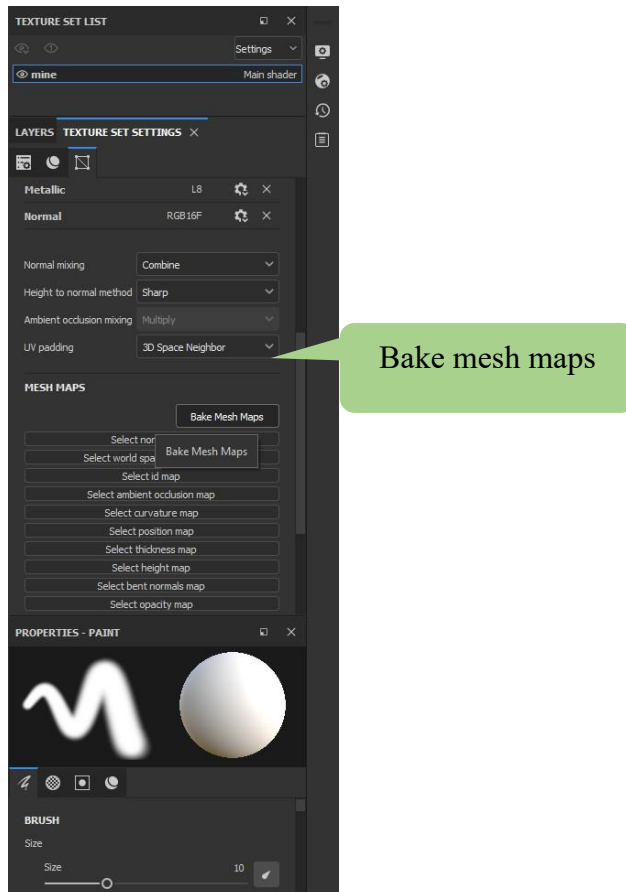


Figure 3.10.2- Screenshot 2

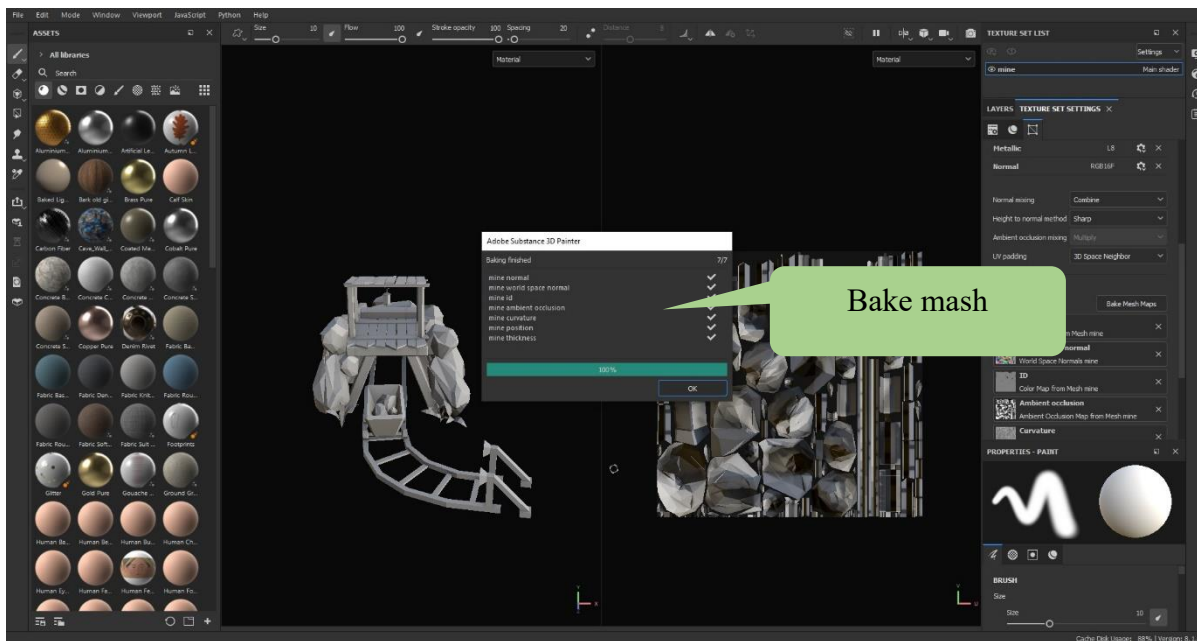


Figure 3.10.3- Screenshot 3

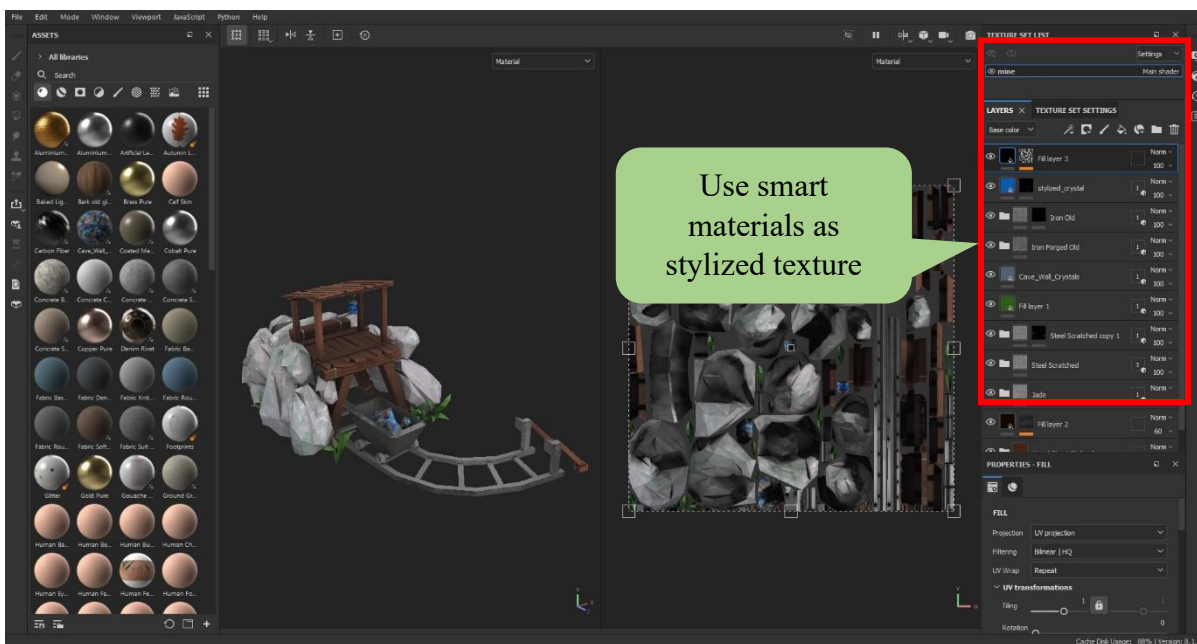


Figure 3.10.4- Screenshot 4



Figure 3.10.5- Screenshot 5

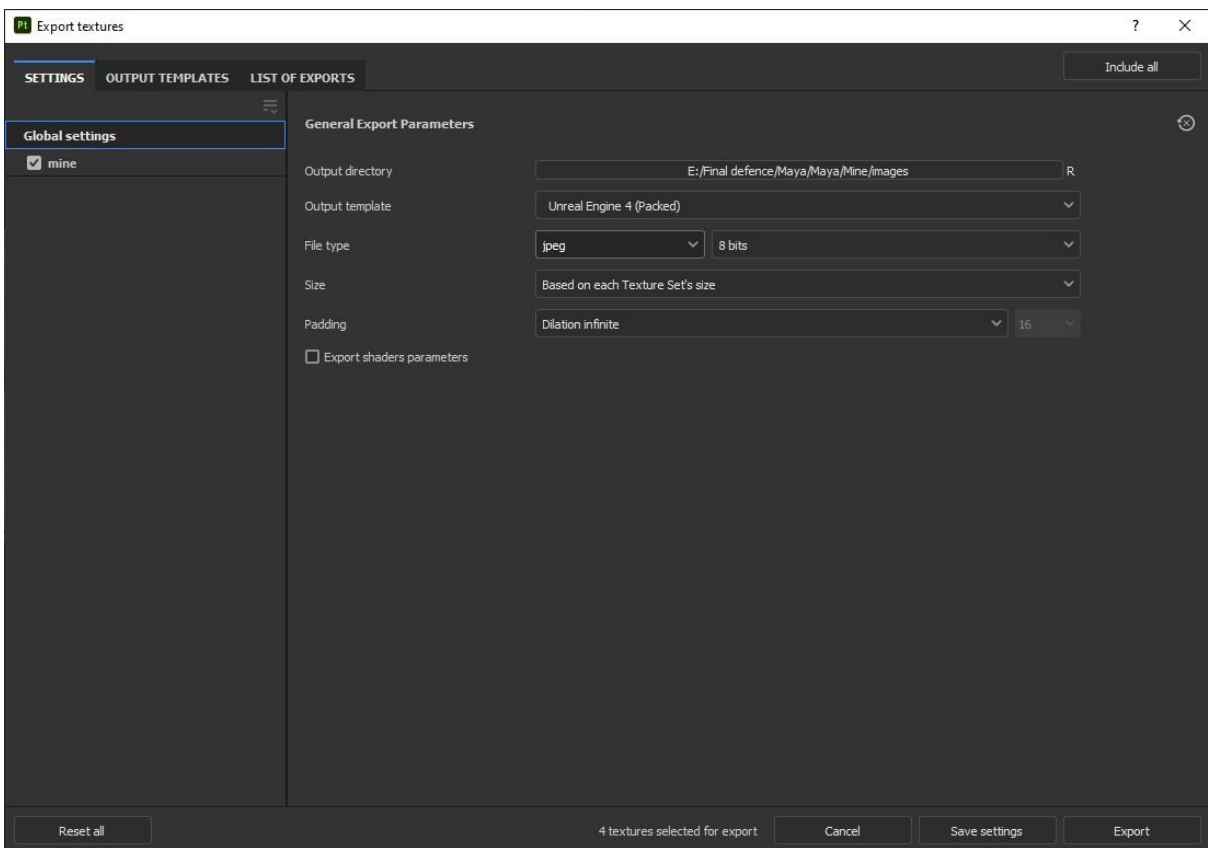


Figure 3.10.6- Screenshot 6

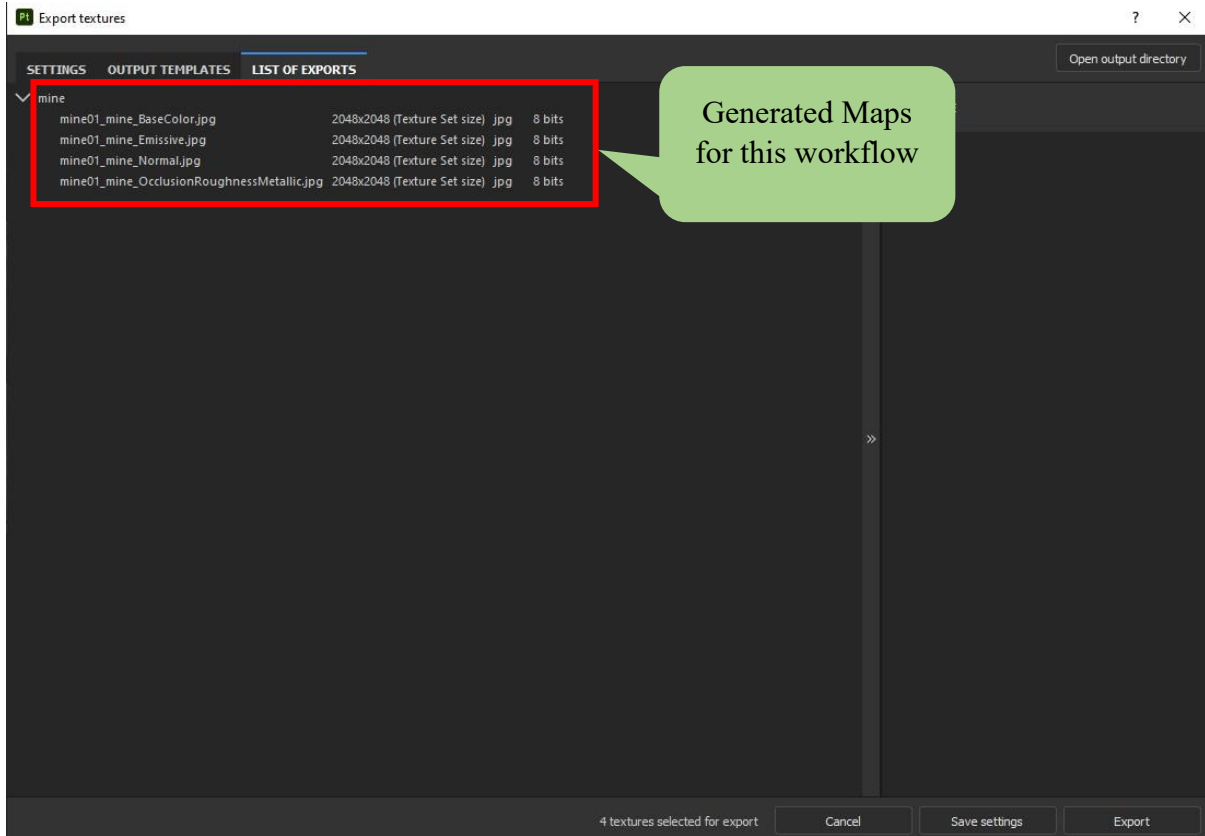


Figure 3.10.7- Screenshot 7 (Generated Maps)

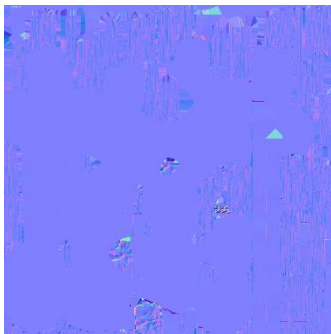


Figure 3.10.8- Normal Map

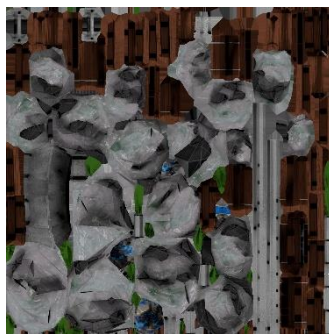


Figure 3.10.9- Base color

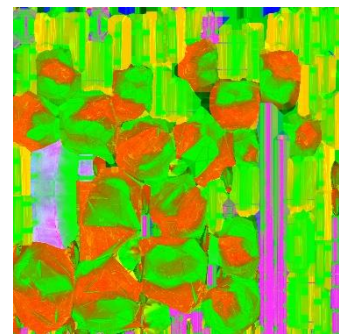


Figure 3.10.10- Roughness metallic

3.11 Marmoset Toolbag workflow

- I. First open the marmoset toolbag and take the shadow catcher to understand the shadow of the model.
- II. Next, we imported our model. in FBX format.
- III. Then I go to the material option to import the material. After selecting there, a popup menu appears below. Import the previously exported map for my model there.
- IV. Next, I import the lights for my model. After selecting the type of light according to the need, I fix the parameters of the light from the menu bar below.
- V. Then I fix the various parameters of the main camera as required in the same way.
- VI. Finally, click the Render button to render. From there, after fixing the various parameters, after selecting the resolution according to my requirement, I click on the render image and complete the work.

Below I have added some pictures for ease of understanding.

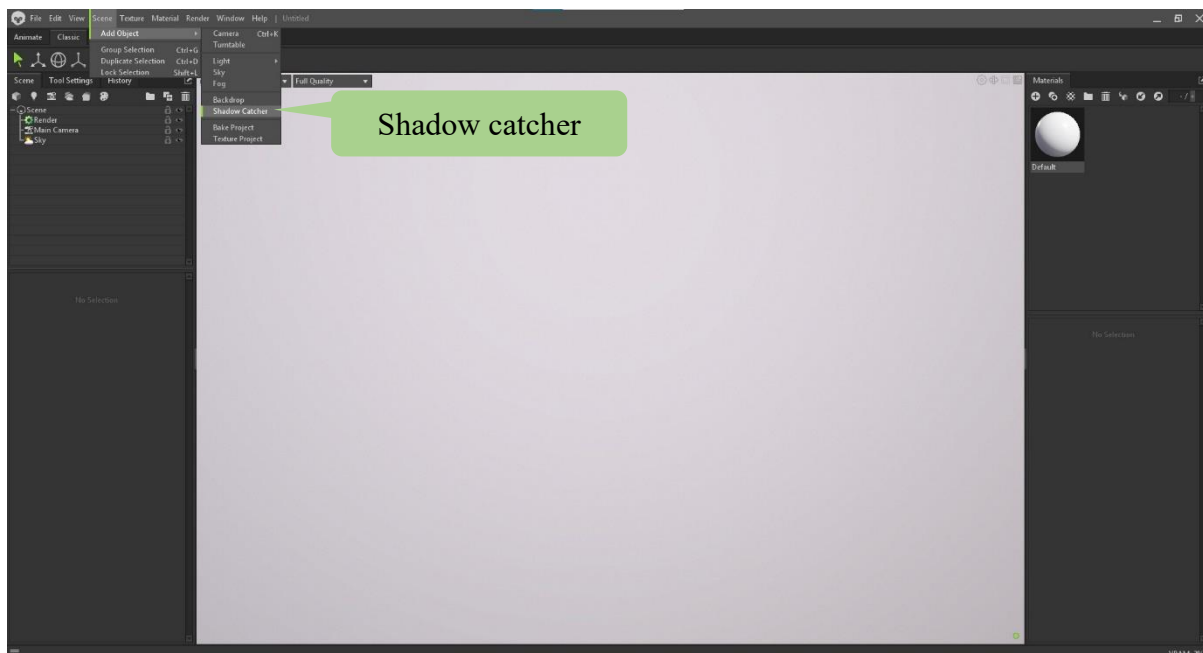


Figure 3.11.1- Screenshot 1

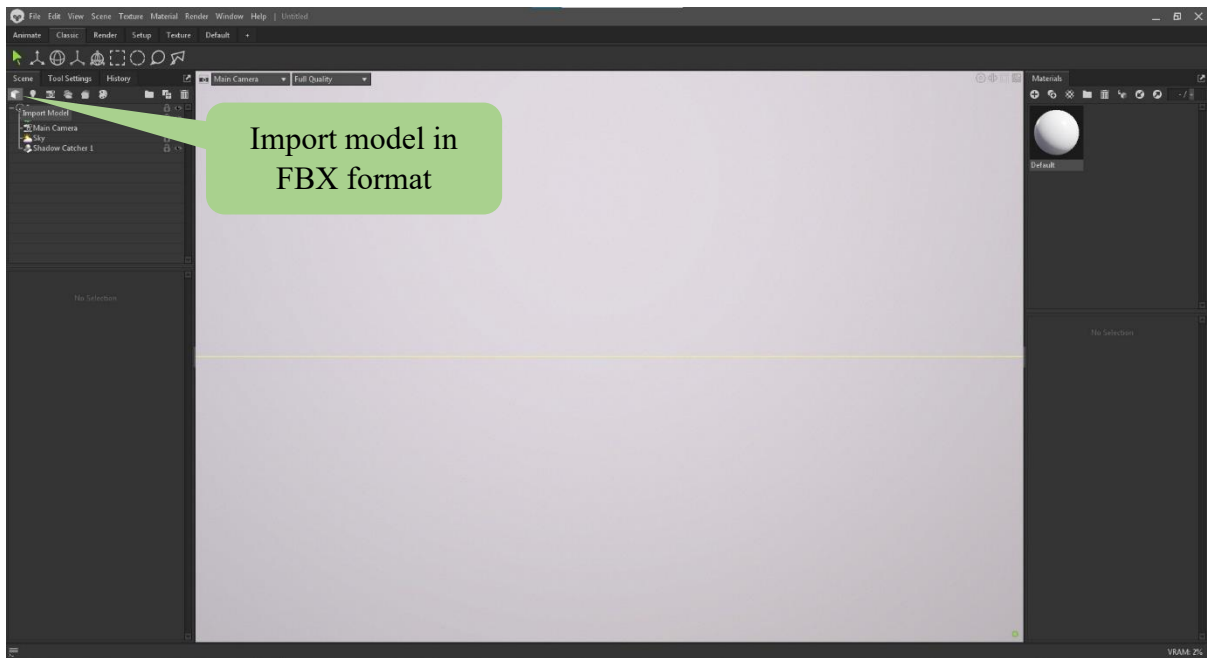


Figure 3.11.2- Screenshot 2

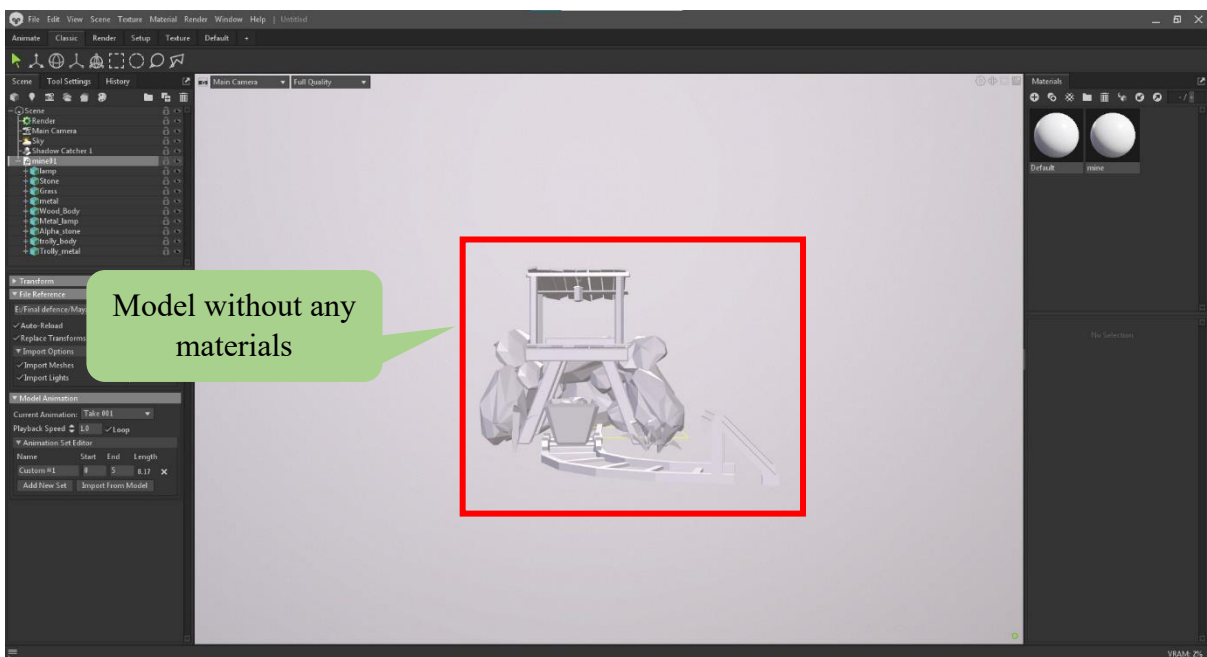


Figure 3.11.3- Screenshot 3

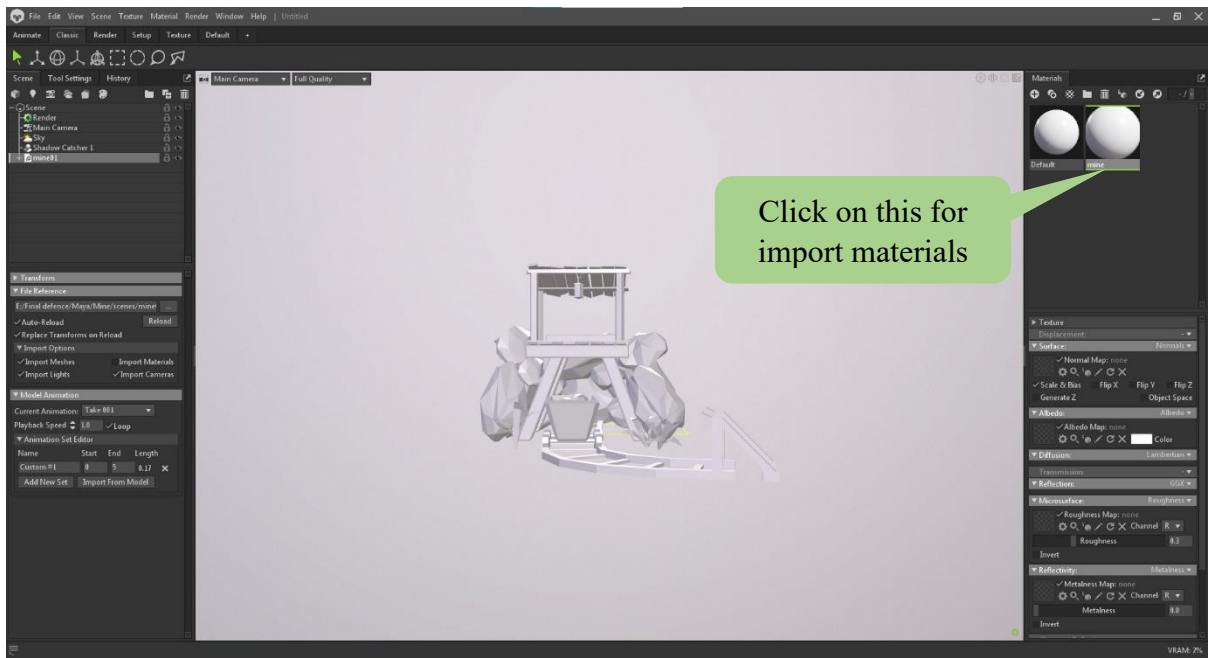


Figure 3.11.4- Screenshot 4

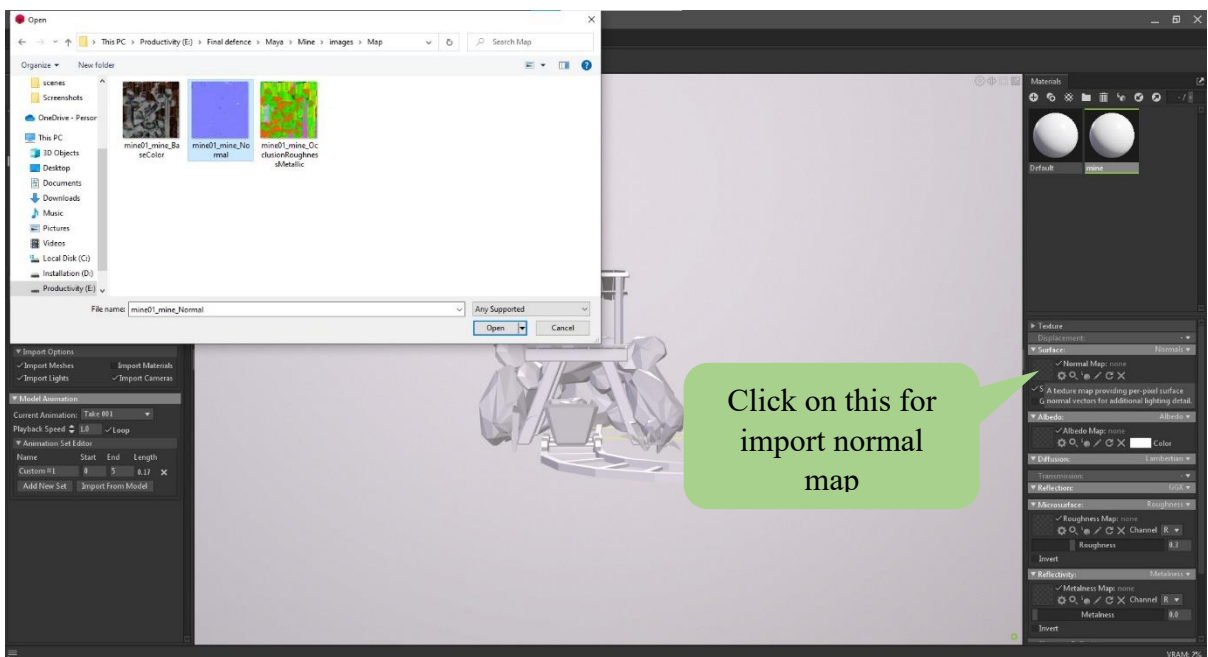


Figure 3.11.5- Screenshot 5

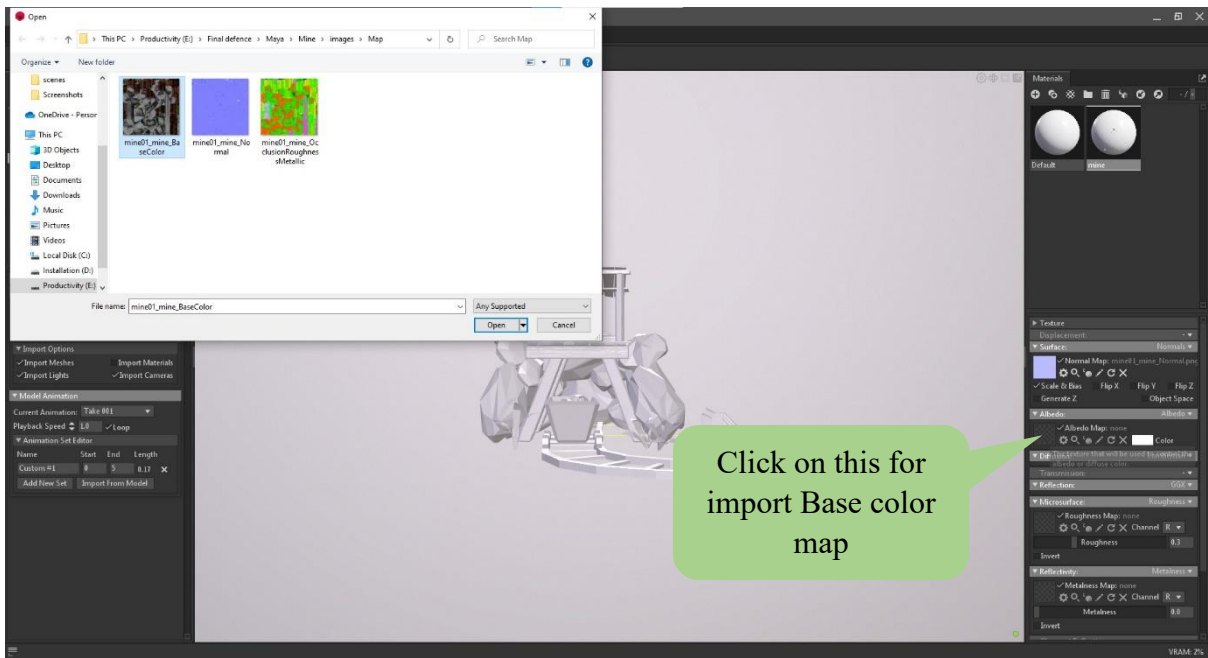


Figure 3.11.6- Screenshot 6

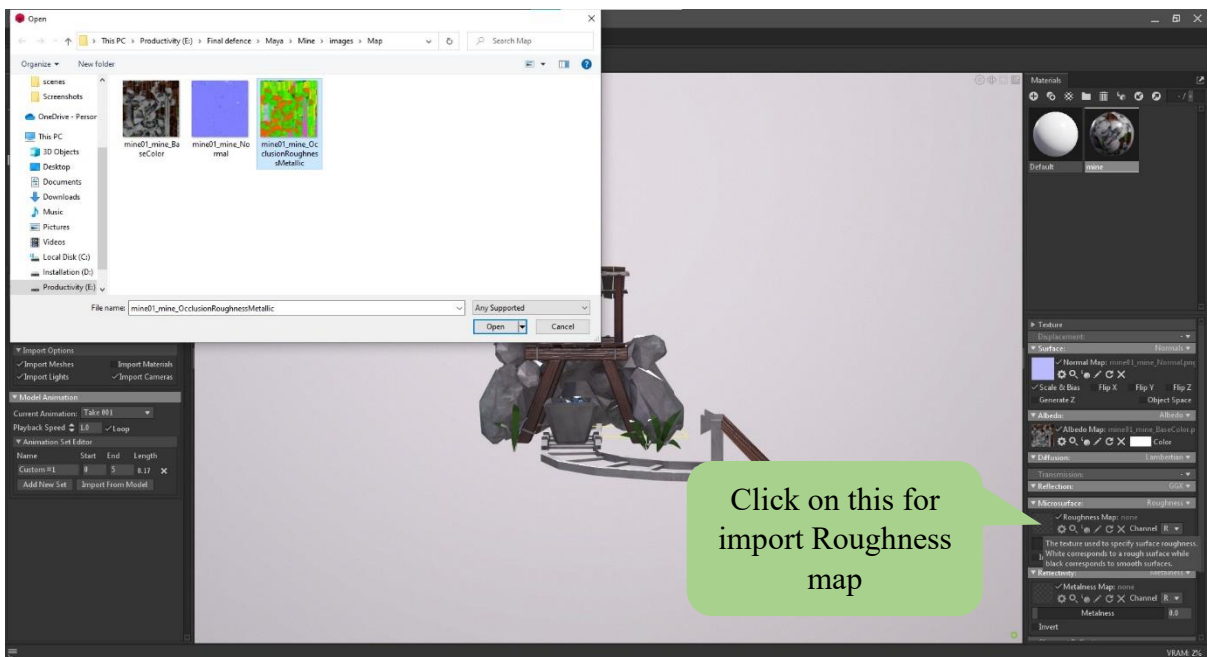


Figure 3.11.7- Screenshot 7

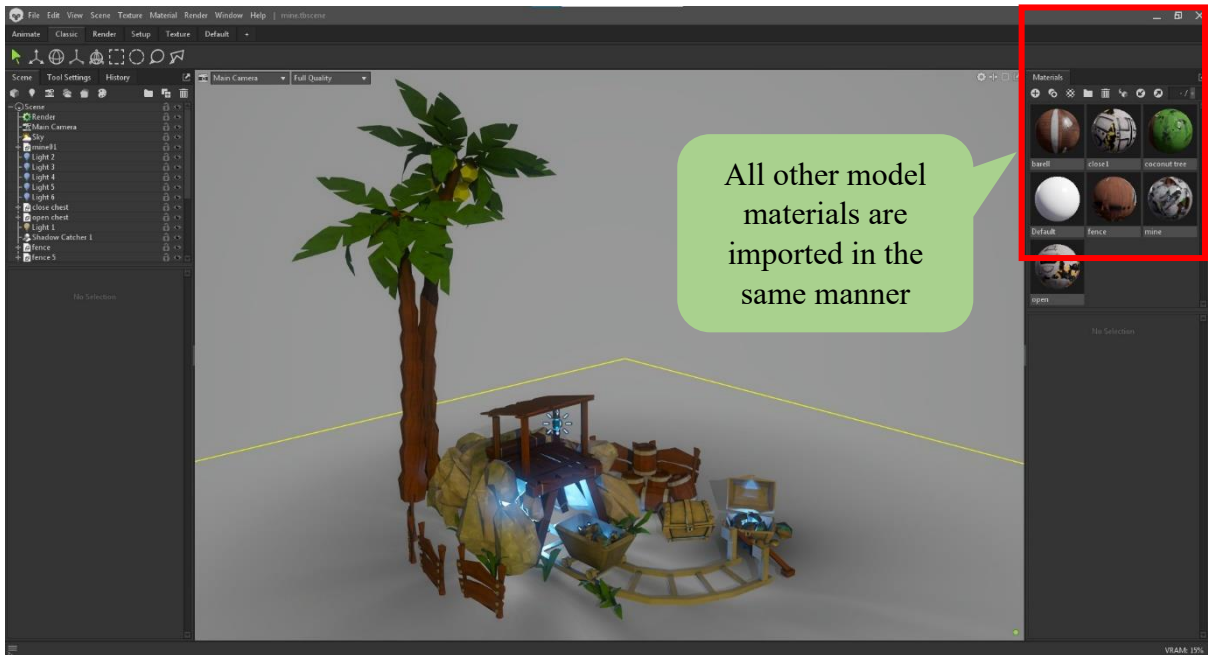


Figure 3.11.8- Screenshot 8

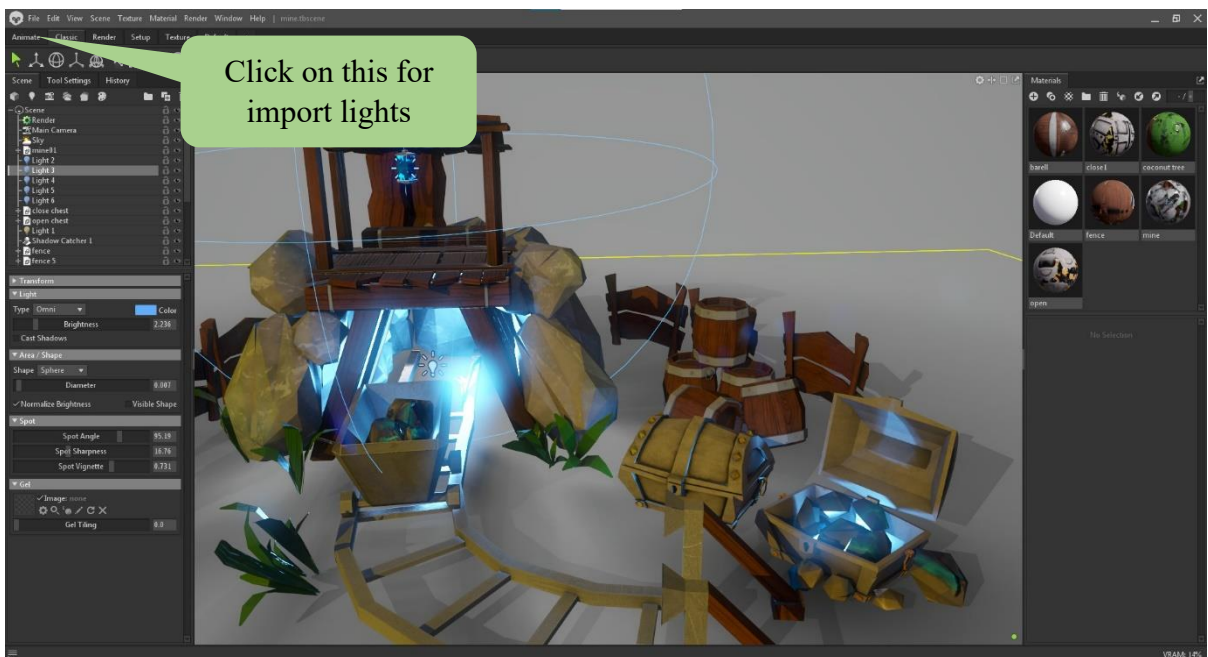


Figure 3.11.9- Screenshot 9



Figure 3.11.10- Screenshot 10

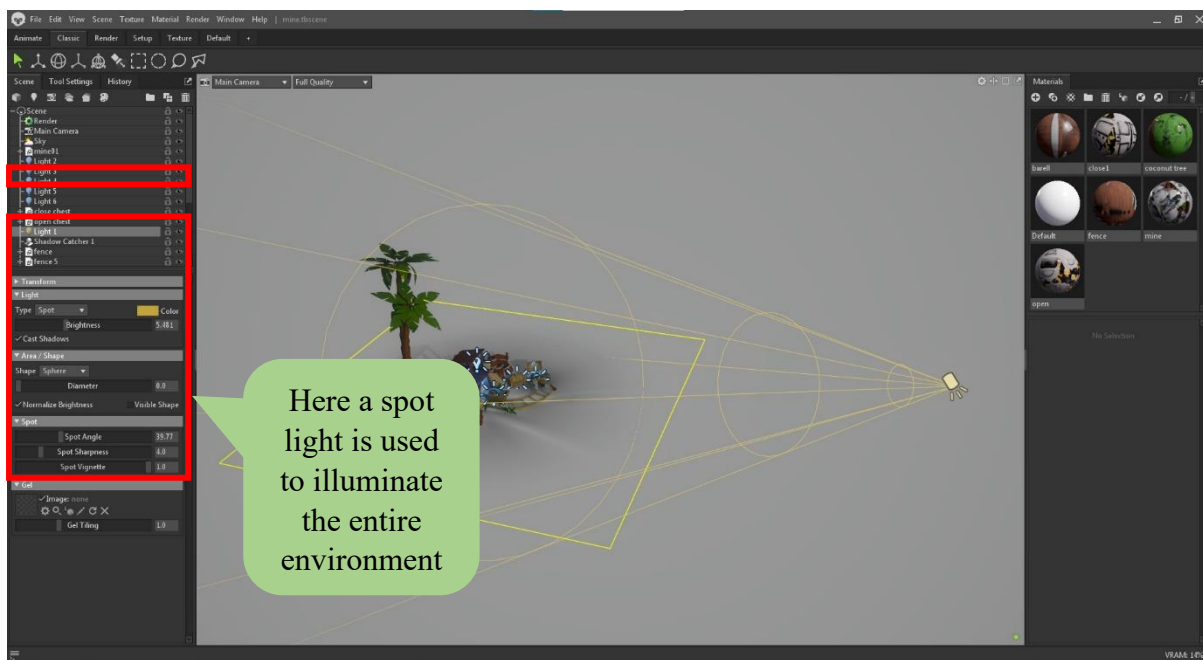
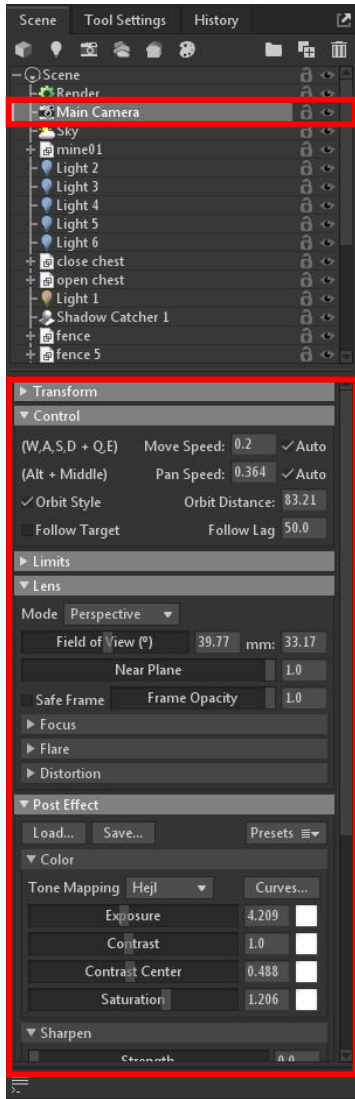


Figure 3.11.11- Screenshot 11



Fix the various parameters of the main camera as required

Click the Render button for render



Figure 3.11.12- Screenshot 12

Figure 3.11.12- Screenshot 13

CHAPTER 4

Experimental Results

4.1 Introduction

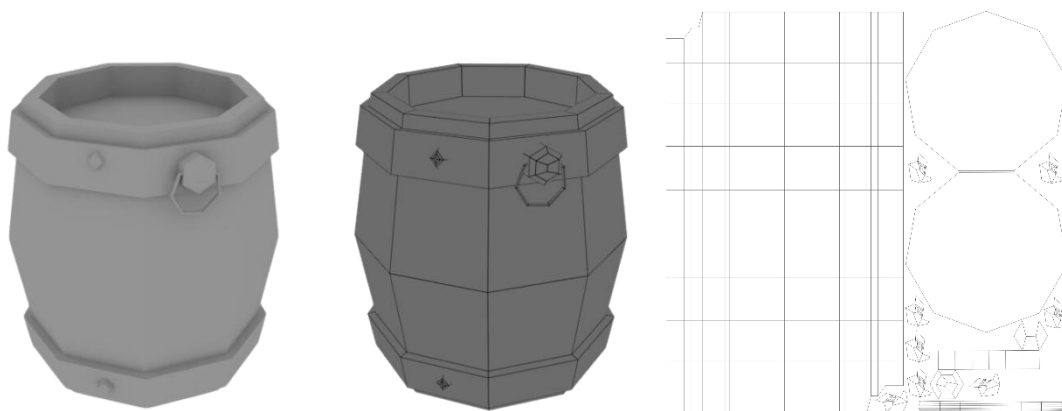
The Experimental Results chapter is the central focus of this study, presenting the results of rigorous experimentation and the rendered data derived from 3D models. These visual representations reveal the essence of the models, offering a tangible depiction of their aesthetic and functional characteristics. These renderings serve as windows into the study's objectives, highlighting the convergence of theory and practice. The chapter details the experimental setup, methods of rendering, and the distinct attributes highlighted by each model's visualization, fostering a deeper understanding of the models' performance, aesthetic appeal, and functional attributes. The chapter is not just a display of rendered images but a narrative of the study's journey from abstract concepts to concrete manifestations. The visual renderings provide a lens through which readers can grasp the implications of the research, evaluate the alignment with the study's objectives, and draw their own conclusions from the data presented. In essence, the Experimental Results chapter is a visual voyage, inviting readers to explore the 3D models' renderings and glean insights from the vivid manifestations of the study's core concepts. This experiential exploration aims to bridge the gap between theory and practice, enrich the academic discourse, and contribute to the ever-evolving realm of 3D modeling and its applications.

4.2 Base mesh, Wireframe & UV Render

Barrel

Description: A rustic wooden barrel, weathered by time and use, providing an authentic touch to the game environment.

Purpose: Adds realism and character to the surroundings, serving as interactive objects for players to discover resources or items.



Tris 536

Figure 4.2.1- Barrel demo
Render

Branch

Description: A simple tree with sprawling branches, offering a natural and serene backdrop to the game world.

Purpose: Enhances the environment's natural feel, potentially acting as obstacles or markers in gameplay.

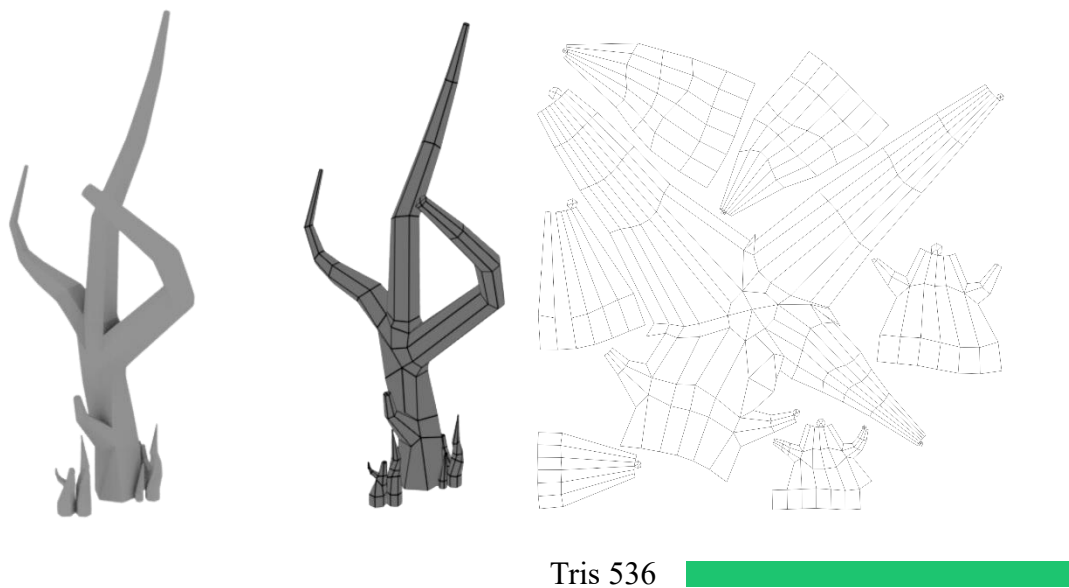
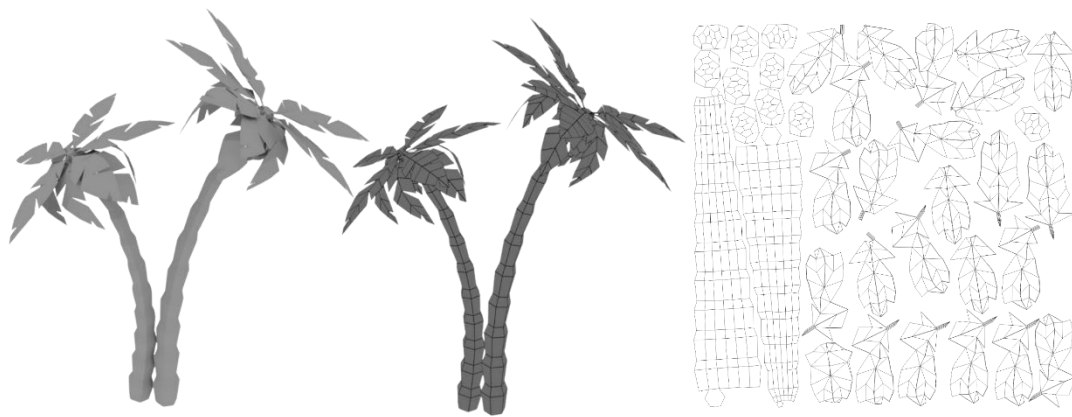


Figure 4.2.2- Branch demo
Render

Coconut Tree

Description: A tall tree with lush green leaves and coconuts hanging from its branches, symbolizing tropical settings.

Purpose: Creates a tropical atmosphere, potentially providing resources or obstacles in the game.



Tris 2696



Figure 4.2.3- Coconut tree
demo Render

Pine Tree

Description: A tall evergreen pine tree, adding a touch of wilderness and depth to the environment.

Purpose: Diversifies the scenery, potentially functioning as hiding spots or navigational landmarks.

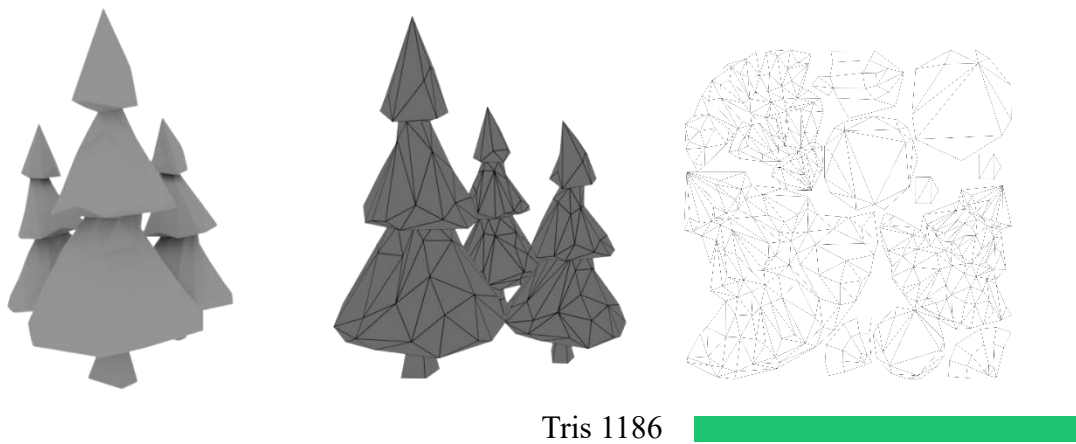


Figure 4.2.4- Pine tree demo
Render

Flag

Description: A colorful flag waving in the wind, featuring distinct symbols or colors.

Purpose: Marks specific locations, adds visual flair, and can serve as goals or checkpoints in gameplay.



Tris 2836



Figure 4.2.5- Flag demo
Render

Wooden Bench

Description: A sturdy wooden bench, inviting players to rest and appreciate the surroundings.

Purpose: Provides resting spots for players, promoting exploration and immersion.



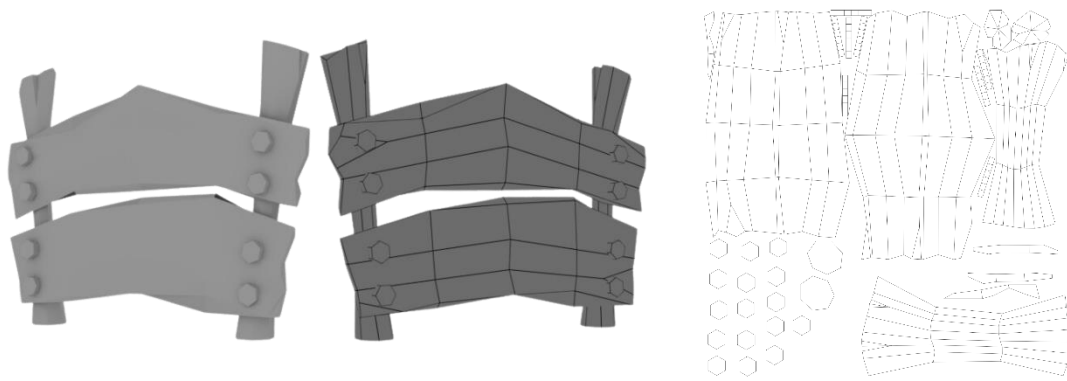
Tris 4182

Figure 4.2.6- Wooden bench
demo Render

Wooden Fence

Description: A wooden fence enclosing an area, adding a touch of structure and defining spaces.

Purpose: Marks boundaries, guides player movement, and contributes to environmental storytelling.



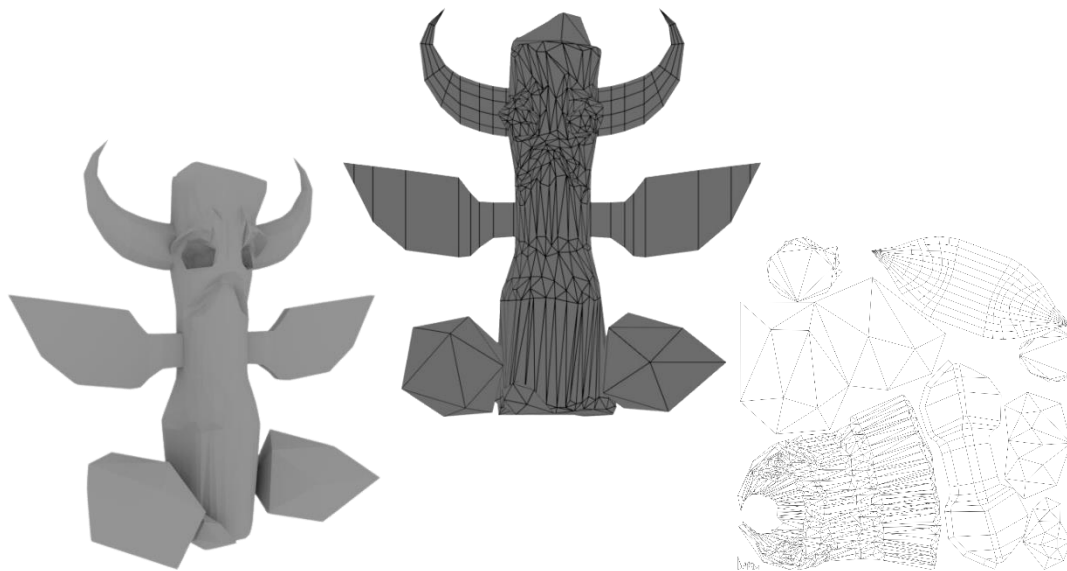
Tris 944

Figure 4.2.7- Wooden fence
demo Render

Wooden Skull

Description: Intricately carved wooden skulls with decorative details, evoking an air of mystery and fascination.

Purpose: Adds an element of intrigue and symbolism to the environment, potentially holding secrets or clues.



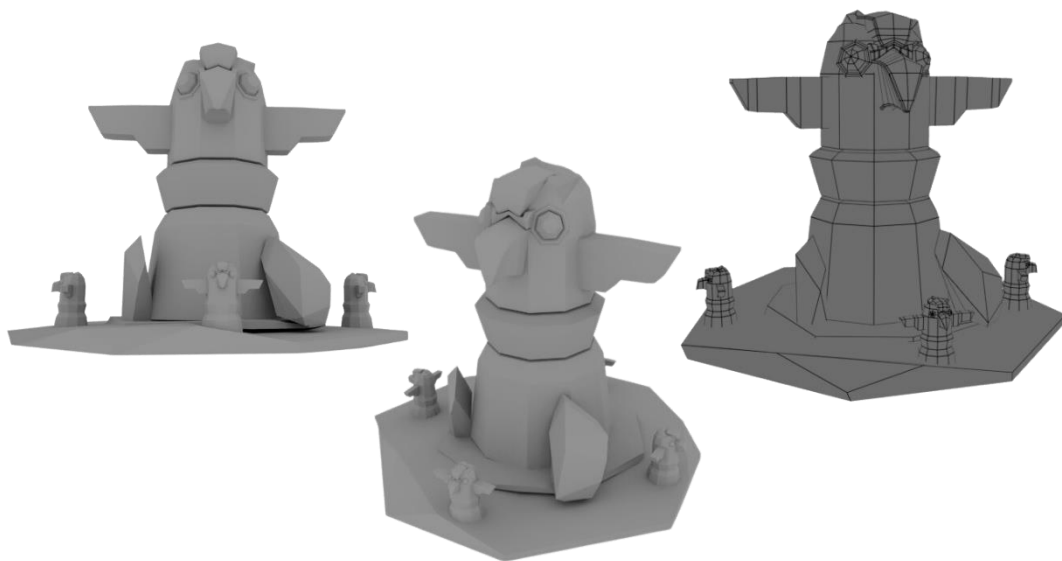
Tris 1536

Figure 4.2.8- Wooden skull
demo Render

Totem

Description: A towering totem constructed from sturdy stone blocks, adorned with intricate carvings depicting ancient symbols and stories.

Purpose: Serves as a focal point of cultural importance, potentially holding narrative significance or gameplay interactions. The stone-made totem adds a sense of mystique and history to the environment.



Tris 4078

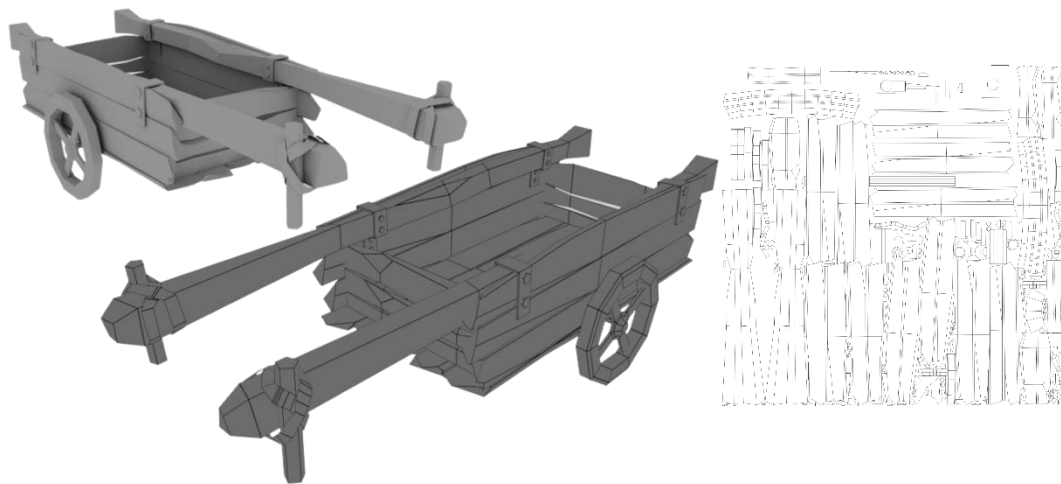


Figure 4.2.9- Totem demo
Render

Push Cart

Description: A wooden cart with wheels, suggesting transportation and trade in the game world.

Purpose: Offers visual context, potentially as an interactive object or element of gameplay mechanics.



Tris 2308

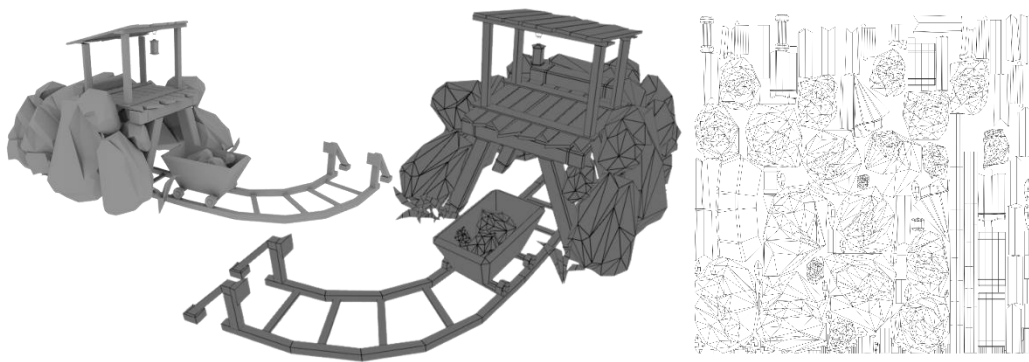


Figure 4.2.10- Push cart demo
Render

Treasure Mine

Description: An entrance to an underground mine, emanating an aura of adventure and hidden riches.

Purpose: Sets the stage for quests or challenges involving mining and exploration.



Tris 5000

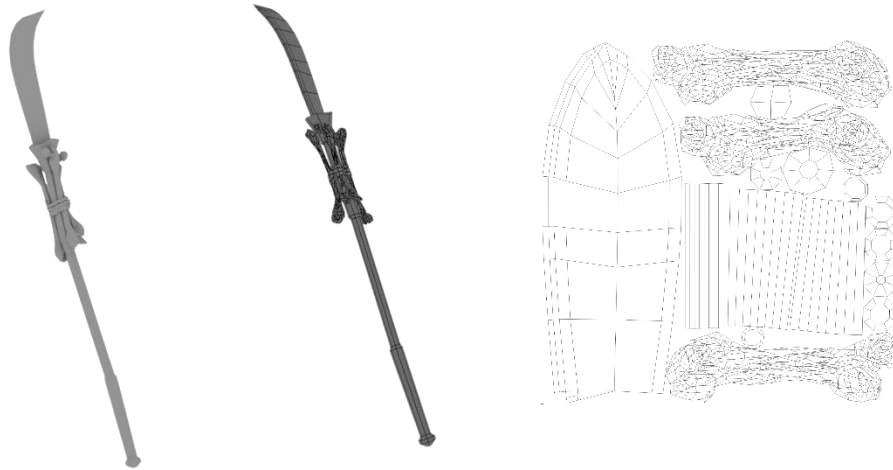


Figure 4.2.11- Treasure Mine
demo Render

Hero Sword

Description: A finely crafted sword adorned with intricate engravings and embellishments, radiating an aura of power and heroism.

Purpose: This legendary weapon symbolizes the player's prowess and strength, often bestowed upon them during pivotal moments in the game.



Tris 608

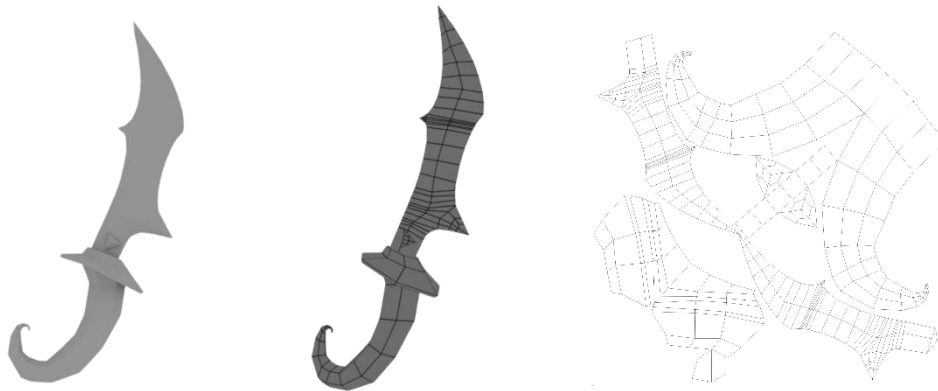


Figure 4.2.12- Hero Sword
demo Render

Stealthy Dagger

Description: A sleek and compact dagger, designed for swift and silent strikes. Its polished blade gleams with deadly intent.

Purpose: The dagger serves as a versatile tool for close combat and stealthy takedowns, enhancing the player's strategic options.



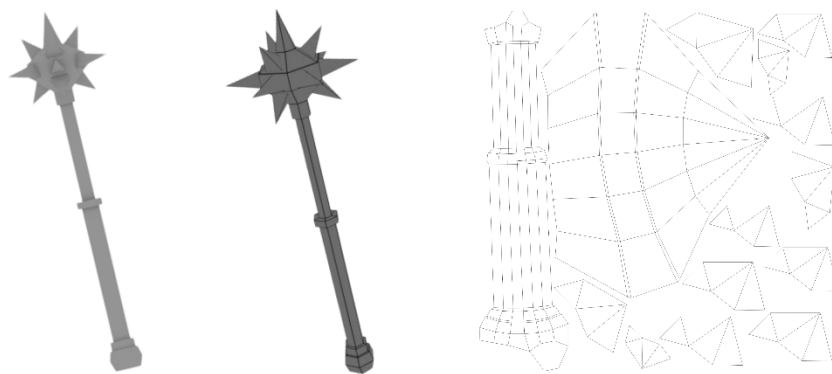
Tris 518

Figure 4.2.13- Stealthy
Dagger demo Render

Mace-1

Description: A massive mace with a weighty metal head adorned with spikes, designed to crush enemies with sheer force.

Purpose: This heavy-hitting weapon is effective against armored foes, delivering powerful blows that can stagger or knock down enemies.



Tris 266

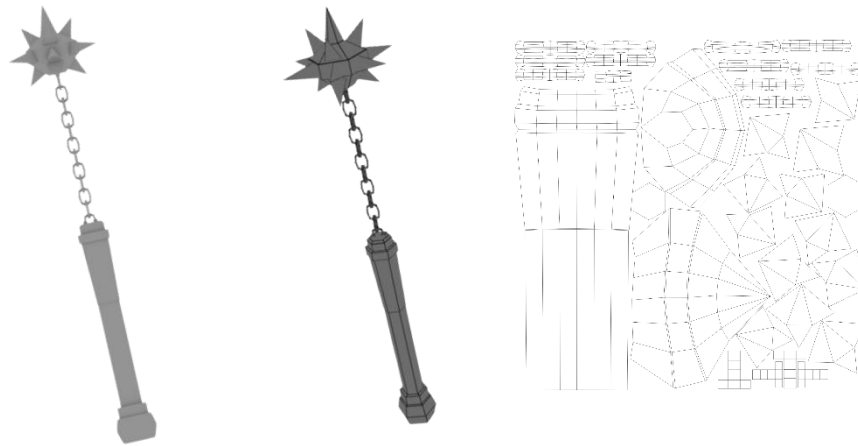


Figure 4.2.14- Mace-1 demo
Render

Mace-2

Description: A fearsome mace composed of interlocking steel chains, intricately woven to form a deadly and versatile weapon. The chains are adorned with spikes and barbs that enhance its destructive potential.

Purpose: The steel chain mace delivers a unique combination of reach and impact. Its flexible nature allows players to strike from a distance, ensnaring foes and pulling them off balance. The spikes add piercing damage, making it effective against both armored and unarmored enemies. Its dynamic design and gameplay mechanics make it a favored choice for players who value strategic and tactical combat options.



Tris 886

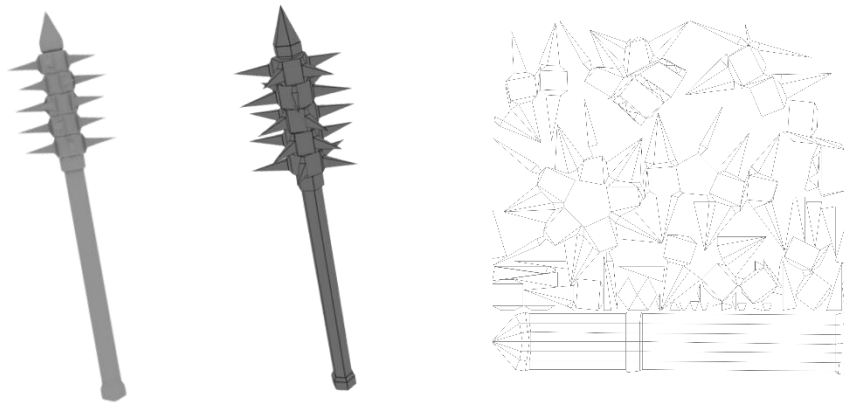


Figure 4.2.15- Mace-2 demo
Render

Mace-3

Description: Crafted with meticulous attention to detail, the Reinforced Mace of Valor boasts a solid steel core surrounded by layers of reinforced materials. The hilt is embellished with intricate engravings depicting heroic tales of valor and triumph.

Purpose: The Reinforced Mace of Valor is designed for those who seek a balanced blend of durability and impact. The reinforced construction grants it exceptional strength, allowing it to withstand intense battles without faltering. Its balanced weight distribution ensures precise strikes and efficient energy transfer upon impact. This mace is a symbol of honor and courage, inspiring players to charge into the fray with determination and resilience.



Tris 556

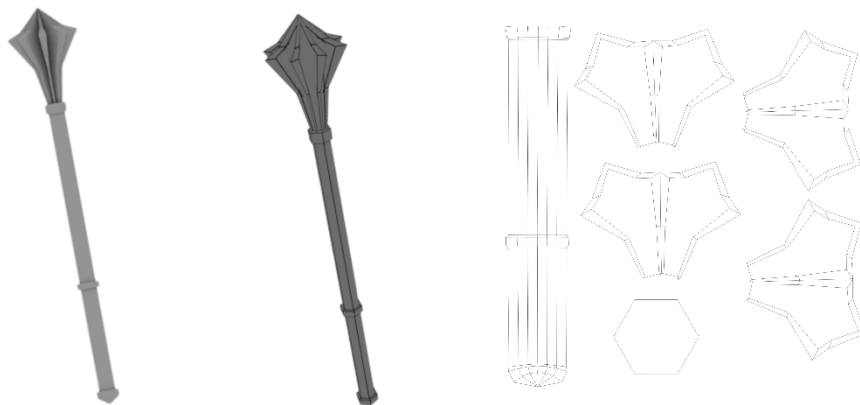


Figure 4.2.16- Mace-3 demo
Render

Mace-4

Description: This mace embodies a unique fusion of organic and industrial materials. The handle is meticulously crafted from polished wood, showcasing natural textures and patterns. Rising from the handle is a steel blade, honed to a sharp edge and etched with intricate motifs. The marriage of wood and steel creates a weapon that is both aesthetically striking and ruthlessly effective.

Purpose: The hybrid design of this mace capitalizes on the strengths of both wood and steel. The wooden handle provides a comfortable and ergonomic grip, enhancing control and reducing fatigue during prolonged battles. The steel blade, on the other hand, delivers the forceful impact required to overcome even the most formidable opponents. Whether it's swift strikes or powerful swings, this mace offers a versatile combat style that accommodates various play strategies. As players wield this hybrid mace, they wield the marriage of nature's resilience and technological prowess, ensuring they are prepared for any challenge that comes their way.



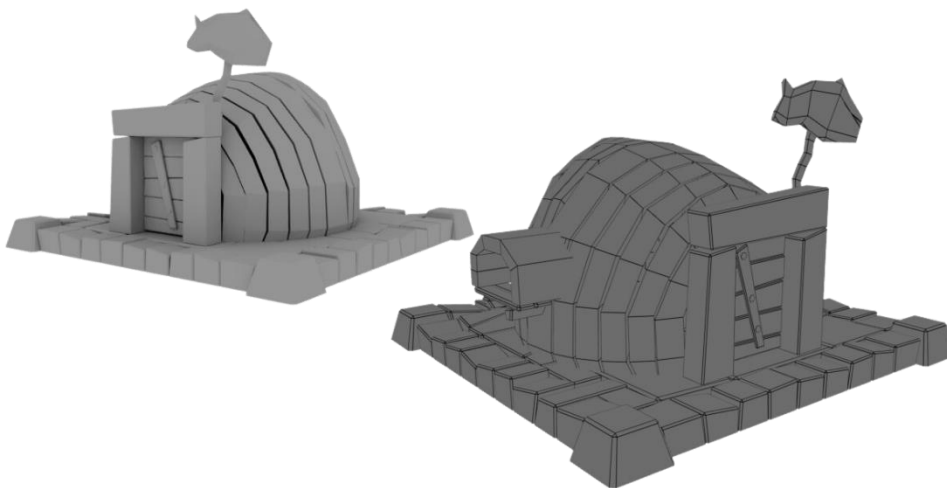
Tris 310

Figure 4.2.17- Mace-4 demo
Render

Hut

Description: The stone hut stands as a testament to the enduring craftsmanship of ancient times. Constructed entirely from sturdy stones, this quaint shelter exudes a rustic charm that resonates with history. The rough-hewn walls are adorned with subtle carvings, showcasing the artistry of the builders who fashioned it. The thatched roof adds a touch of natural warmth to the rugged exterior.

Purpose: The stone hut serves as a sanctuary, providing shelter and security in the midst of untamed landscapes. Its robust construction not only withstands the test of time but also offers protection against the elements and potential threats. As a strategic element in the game, players can strategically position the stone hut to fortify their territory or create tactical advantages during gameplay. It serves as a focal point in the virtual world, offering both functional utility and a glimpse into the ancient civilizations that once thrived.



Tris 4726

Figure 4.2.18- Hut demo
Render

House

Description: The wooden house captures the essence of comfort and human habitation. Crafted with care, the house features a wooden framework with intricately carved details that speak of skilled craftsmanship. The cozy ambiance of the interior is illuminated by the warm glow of softly lit windows, promising safety and respite.

Purpose: The wooden house serves as a vital element in the game's narrative, offering players a home base from which they can strategize, plan, and rest. Its wooden construction provides a sense of familiarity and domesticity in the midst of the gaming world's challenges. Players can customize and enhance the house, making it a reflection of their progress and achievements. As a central hub, the wooden house invites players to immerse themselves in the game's universe, fostering a connection between the virtual and the personal.



Tris 4300

Figure 4.2.19- House demo
Render

4.3 Final Render

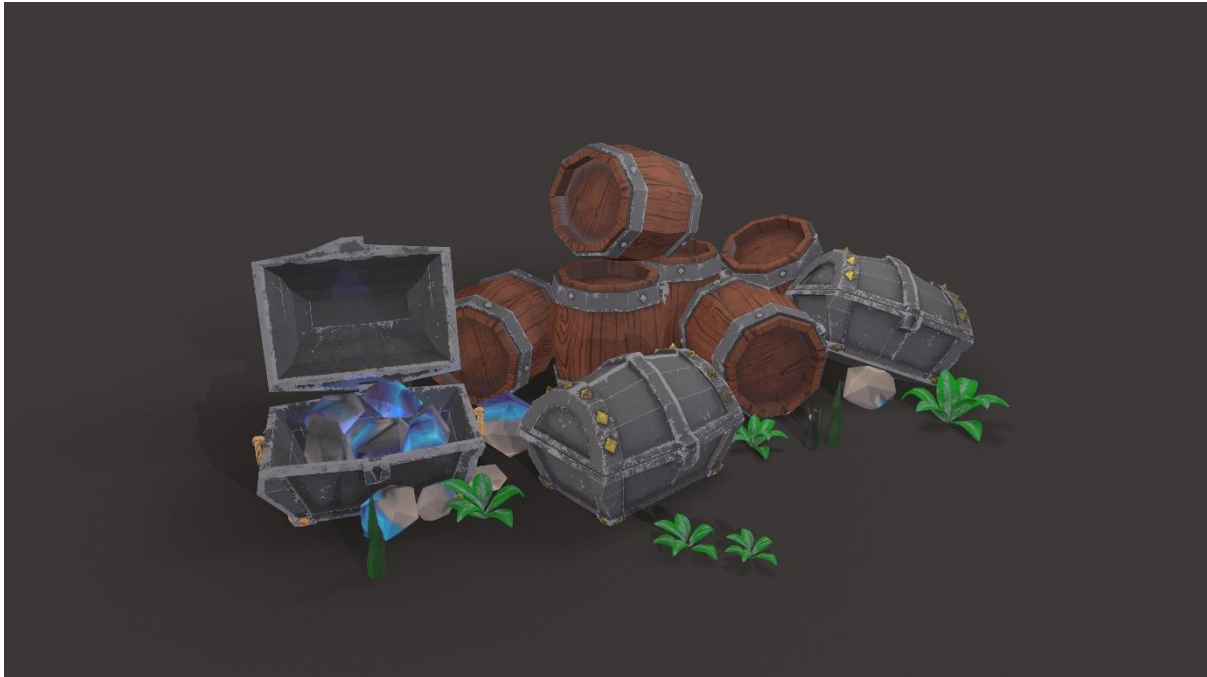


Figure 4.3.1- Barrel & Chest Box



Figure 4.3.2- Treasure Mine



Figure 4.3.3- Totem



Figure 4.3.4- Wooden Skull



Figure 4.3.5- Wooden Pushcart



Figure 4.3.6- Flag



Figure 4.3.7- Weapon



Figure 4.3.8- Foliage

CHAPTER 5

5.1 Conclusions

The exploration of low-poly 3D game assets in the context of mobile strategy games revealed a landscape rich in innovation, problems, and possibilities. As the mobile game business grows in value and complexity, the need of low-poly assets becomes clearer. These materials serve as the foundation for bridging performance optimization and visual attractiveness.

We discovered how these stylized models have reemerged as a valuable tool by investigating the historical context and the history of low-poly aesthetics. Their capacity to improve performance, facilitate cost-effective growth, and give creative freedom demonstrates their worth. The combination of aesthetic appeal and seamless gameplay in mobile strategy games reflects the delicate balance we've strived for.

We've negotiated the processes of applications such as Autodesk Maya and Adobe Substance Painter, Marmoset Toolbag learning the skills of low-poly modelling, UV mapping, and texture generation. We learnt to bring people and places to life with meticulous attention to detail and creative skill.

Despite this, we have tackled the obstacles and hazards inherent in these procedures. Software complexities, occasional crashes, and the complexities of UV unwrapping have all taught me great lessons in flexibility and troubleshooting.

We've learned that low-poly 3D game assets are more than just technical components as we've dug further into game design principles, shape psychology and visual breathing space. The combination of storyline and these materials provides dimension to the virtual environment, encouraging gamers to fully immerse themselves.

Given all of this, the value of cohesive cooperation in joint projects cannot be emphasized. Effective communication, work distribution, and timetable adherence have all proved critical in ensuring the smooth integration of multiple components.

In essence, our exploration of low-poly 3D game assets in mobile strategy games has shown a marriage of art and technology. A comprehensive grasp of both areas is required to develop appealing, performance-optimized experiences. As we finish, we acknowledge that our investigation is a single step in a large terrain, but it is an important one that contributes to the dynamic growth of the mobile gaming business. With our newfound knowledge and abilities, we are ready to create our own route on this exciting trip.

5.2 Future Scope of Work

As we stand on the cusp of the future, our journey with this project is far from over. With the wind of innovation at our backs and the knowledge gained from our current endeavors as our compass, we are poised to embark on a new phase of exploration and creation. The path we have forged through this project's intricate landscape serves not only as a testament to our dedication but also as a blueprint for the road ahead.

As we set our sights on the horizon, we envision a tapestry woven with creativity, expertise, and the relentless pursuit of excellence. The workflow that has guided us through the labyrinth of challenges and triumphs will remain our steadfast companion, illuminating the way as we navigate uncharted territories. With each step forward, we will channel the problem-solving prowess we have honed, ensuring that every obstacle is met with innovation and resolve.

Our mission extends beyond the realm of mere replication; it's about evolution. The characters and assets that have sprung to life in this project will continue to flourish under our nurturing hands. Through careful cultivation, imaginative design, and unwavering dedication, we will breathe life into every pixel, every texture, and every contour, transcending the boundaries of mere creation to craft experiences that resonate deeply with our audience.

Optimization is our clarion call. Armed with the insights and techniques that have blossomed from our current journey, we pledge to meticulously fine-tune our 3D models to harmoniously dance across a myriad of devices. From the smallest smartphone screen to the grandest of displays, our creations will resonate with equal vibrancy, engaging players across the spectrum.

In this dance between past and future, innovation and tradition, we are poised to script a narrative that's uniquely ours. The characters and assets that we bring to life will not only grace the screens of devices but will etch themselves into the hearts of players. With a blend of technical prowess and artistic expression, we are set to unravel a saga that stretches beyond the realm of bits and bytes, touching upon the very essence of immersive gaming.

As we navigate the contours of the unknown, we do so with the spirit of pioneers, the zeal of creators, and the thirst for boundless possibilities. The journey ahead beckons with challenges and triumphs yet unknown, and we stand ready to embrace it all, armed with the lessons of the present and the dreams of the future.

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