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Brick Wall Texture Projection Using Parameters for 3D Game Environments

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ABSTRACT

Texture creation has been one of the important aspects in creating 3D environment. It could support an object that could be identified by the viewer. There has been software that providing the creation of a texture for a playable 3D game asset. The purpose of this research was to find the method of making a wall texture and to show the in-app parameters that could be applied. The objective of this research is to find any possible limitation toward using the software. As a step to make exploration thoroughly, a brick wall design has been made with initial modelling in ZBrush and Maya app. Followed by the usage of Substance 3D Painter as a variable to control the texture modification. There was more in-depth explanation in creating a defined surface texturing with in-app technical parameters.

Keywords: texture, 3D game asset, in-app parameters, texture projection

1. Introduction

Games constitute a form of entertainment media that may be experienced either through traditional means or via digital platforms [1](Saputra & Andelina, 2025). As technology getting more advanced, the game industry had come to get an idea on how to create a realistic texture or material that exist within the virtual world. There are few techniques on how to achieve it, by using combination of software. For this research, three software are used: Autodesk Maya, ZBrush and Substance 3D Painter.

The appropriate texture could support the game environment. The purpose of texture creation is carried out on the 3D object, which will provide patterns and realistic colours that consist of materials adjustment to achieve a visual similar to the original reference [2](Lievianto, K.V., et.al, 2024 diganti nomor). The material adjustment process will use the texture's information to determine the shading and lighting [3](Tovar et al., 2020 ganti nomor). The creation of texture could also define the type of objects that populate in an environment. An object's representation will be considered successful when it has a connection to the environment [4](Cantrell & Yates, 2012 diganti nomor).
For this research, a brick wall texture is used as the output for texture projection. Lot of 3D environments in game have used brick wall that could be repeated as a part of game optimization. Optimization is needed so the viewer and game player could avoid technical issues [5](Leja et.al 2025 ganti nomor) In this research, texture adjustments are made using parameters in Substance Painter.

1.1. Literature Review

A literature review is used as the starting point of the research, to help with determining the type of topic and methodology regarding projection mapping. Books and journal articles related to 3D texture are analysed. Although no exact research with similar subtopic found, it is enough to be considered as reference. The table below shown the detail of related works.

Table 1 Related Works with Similar Topic

No	Title	Topic	Source
1	Beginning PBR Texturing	Creating a Physically Based Rendering (PBR) using Substance Painter. The PBR is part of texturing workflow which covers the baking, material masking and procedural texturing within Substance Painter. This book also covers about texture integration with Blender, Maya and Marmoset app by using low poly and high poly workflow.	[6](Kumar 2020)
2	Realistic Asset Creation with Adobe Substance 3D	This book contains information about assets making workflow with Adobe Substance 3D app: Designer, Stager, Painter.	[7](Shah 2022)
3	Computer Graphics Meets Image Fusion: The Power of Texture Baking to Simultaneously Visualise 3D Surface Features and Colour	Journal article about baking a 3D texture from a real-life image reference into a 3D model. The author used a low and high poly creation to capture a high-detailed surface with simple UV map.	[8](Verhoeven 2017)
4	When a Tree Model Meets Texture Baking: An Approach for Quality-Preserving Lightweight Visualization in Virtual 3D Scene Construction	This journal article covers texturing wireframe using high and low poly 3D tree object baking. The author also mentions about rendering the texture in Unreal Engine using mesh maps.	[9](Zhang et.al 2023)

2. Research Method

2.1. Research Design

This research is using qualitative approaches with software in-app experiments. Qualitative research means creating an interpretation of the data [10](Creswell, 2009 ganti nomor). The experiments' part is done with creation of 3D brick object in Maya for low poly model and sculpting in ZBrush afterwards. Followed by the usage of Substance 3D Painter as a variable to control the texture modification. There is more in-depth explanation in creating a defined surface texturing with in-app technical parameters.

This research is created to see limitations of texture creation. Limitations can be seen from aspects such as theme, genre, world size, perspective, technology, time and money [11](Ahearn, 2017 ganti nomor). By defining these aspects, a specific model can be created to match the aesthetic of the 3D games environment.

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2.2. Procedure

The procedure used for this research are as shown below. The procedure for this research started with literature review, where similar research was analysed and considered as reference. The final step is adding layers and modifying the wall brick parameters in Adobe Substance 3D Painter app. The Substance 3D Painter allowing to organize the 3D mesh and able to bake texture for texturing effect [7](Shah 2022, Ganti nomor). This texturing workflow is made with the approach of using references study from author's private collections. The workflow below is made for creating a game asset which contain high and low poly object establishment, which distinguishes from film asset creation [6](Kumar 2020, Ganti nomor)

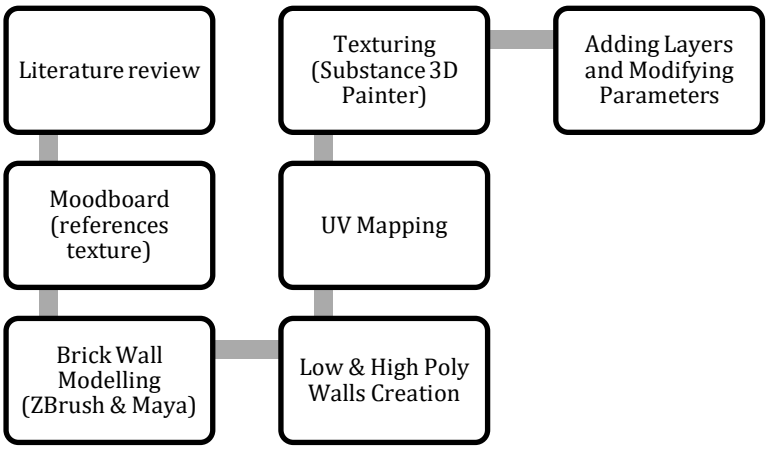

Figure 1 Procedure of 3D Texture Projection Creation

3. Results and Discussion

3.1. Moodboard

A moodboard is made beforehand, to provide a reference for the brick wall. PureRef app is used to compile images for the reference. The images of brick wall are collected from various place in England, United Kingdom. The brick design mostly created during the baroque and medieval era, with heavy discolouration and uneven surface. Some walls also had archway in the doors and window section.

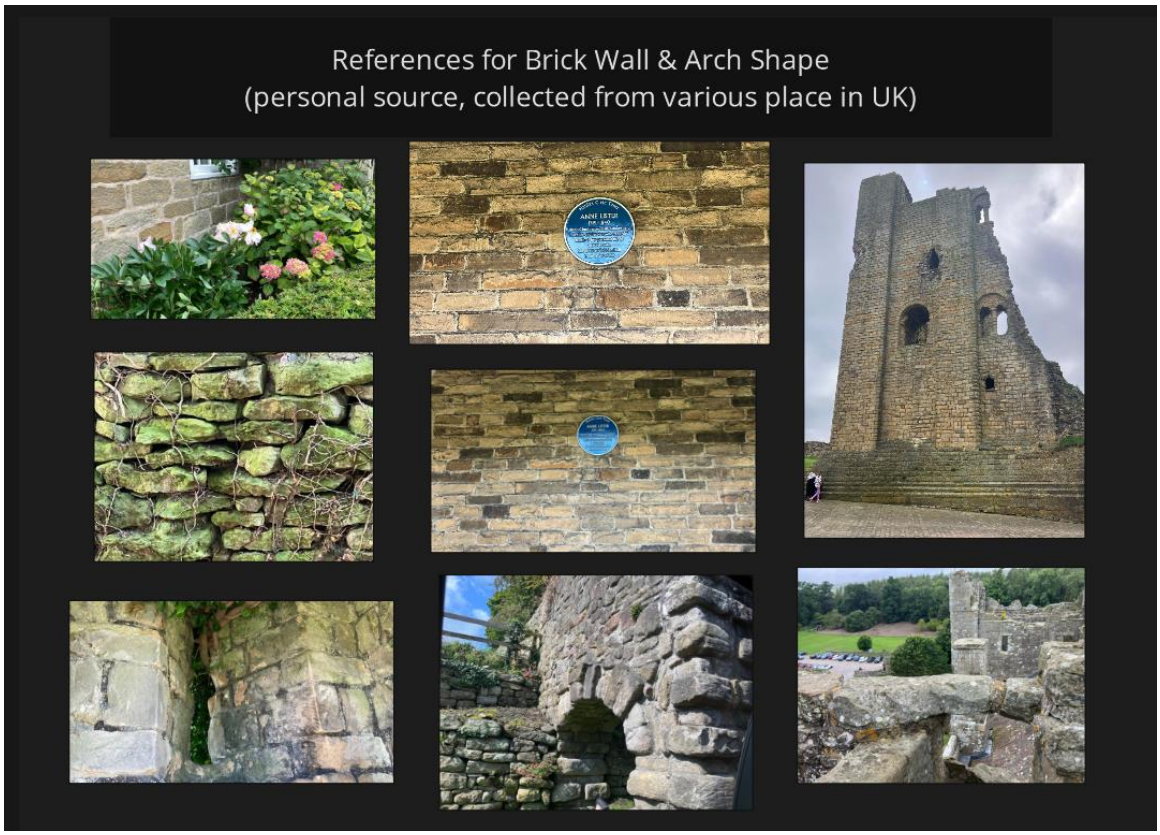

Figure 2 Moodboard with Reference Image

3.2. Object Modelling and Low-High Poly Creation

From these references, four type of brick wall are modelled, with two walls having archway. Each wall has two version: low polygon and high polygon. Before construction of low and high poly version, a 3D object of two blocks brick stone is built in ZBrush. Two bricks are sculpted using standard brush feature in ZBrush as a template for brick walls.

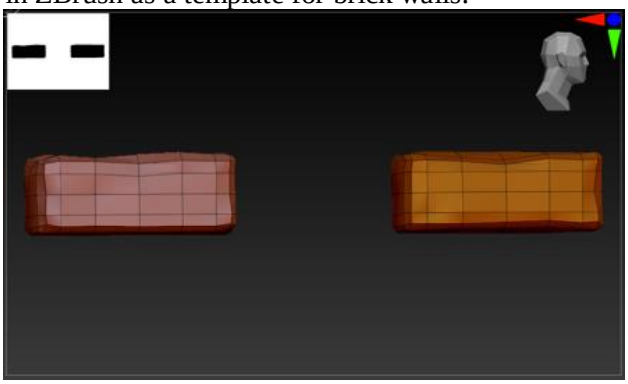

Figure 3 Two starting stone sculpting in ZBrush

After sculpting process, the bricks are exported to Maya for wall compositing stage. The wall's structures are built by stacking the bricks. The brick size is modified in order to create the random and uneven wall surface. The wall types consist of wall with uneven borders and the opposite one. To help with the stacking process, the grid in Maya is turned on, in each angle of viewport.

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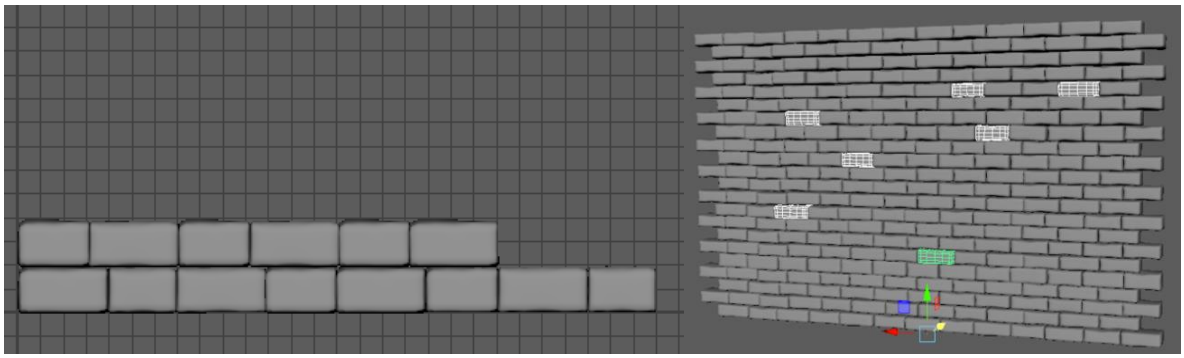

Figure 4 Brick stacking process in Maya

Following the wall composition, the high poly models are created as a reference for the low poly models. High poly model is an object with high detail, and more polygons compare to low poly. For more semi-realistic composition, the rotate, move and scale feature within Maya app are used. The images below show the final design of high poly version of each brick wall.

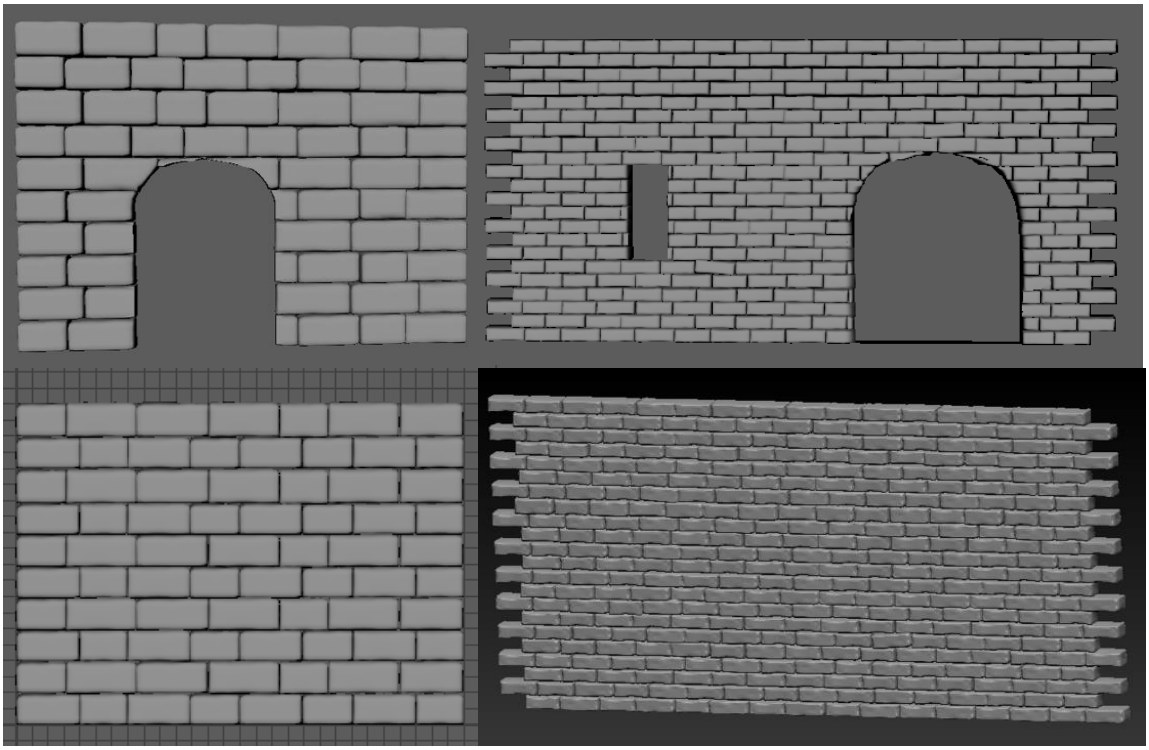

Figure 5 High poly walls with corner edge and edgeless design

3.3. UV Mapping

Creating well-optimized UV maps for any 3D model is essential for achieving high-quality textures [12](Lanier 2015 diganti nomor). The combination high and low poly models will be used for texturing purposes in later stage. After the making of low poly models, some of the edges and faces are cut for UV mapping. The UV map is a foundation of texture from a model. While automatic UV feature is available at Maya app, making UV from beginning will create a more descent results [3](Tovar et al., 2020 ganti nomor). The first step of doing UV mapping is by seam placement on the edge of the 3D mesh, that depends on the shape of the object [13](Venancio, 2023 ganti nomor). The images below show the low poly version of brick walls with their UV map. The UV map

consist of stacked UV section to optimise the overall process of game asset creation, including reducing the mesh map baking time. The image on figure 7 shows the low poly version of brick wall with edge with its customization. A further modification is needed for object with more complex shape.

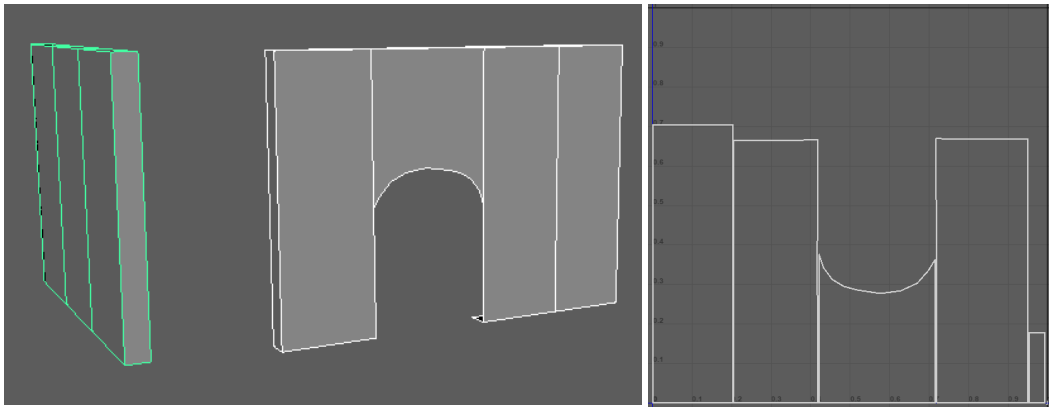

Figure 6 Low Poly wall (left) and UV map

Before making the UV map, the wall with corner edge is assigned to different UV mapping process. Cleanup options feature is needed for properly high poly baking process later in Substance Painter app. The triangular edges are results from "fix by tessellation" feature. Without applying tessellation feature, the UV map could not be built as Maya app cannot read the vertex data of the edge part. The "4-sided faces" is chosen as the edge part is square-shaped. The cleanup process must be done due to the unmatched polygon on the UV seams, and it is a common problem when optimizing topology in Maya [3](Li, et.al 2021, diganti nomor)

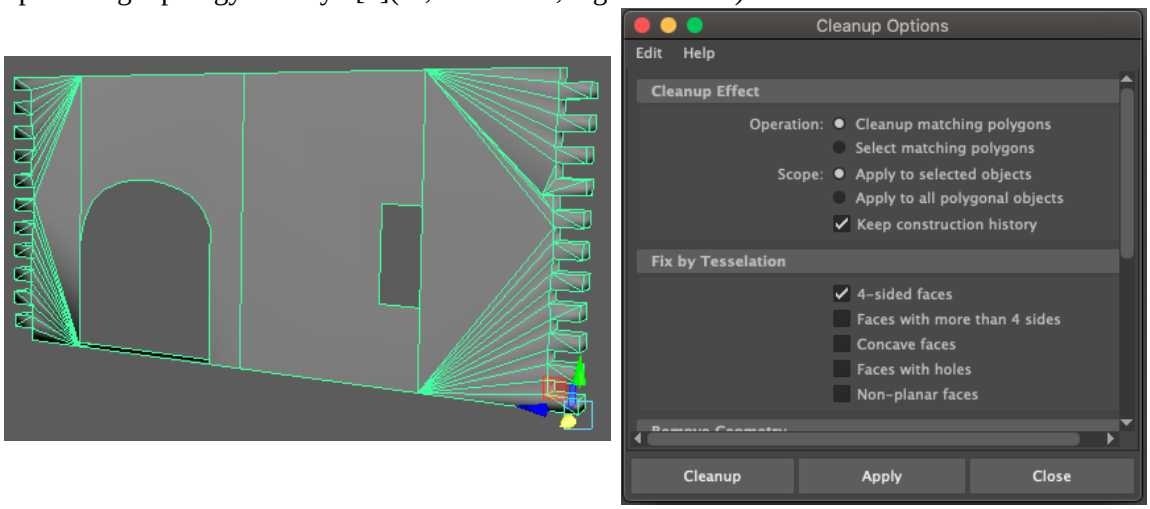

Figure 7 Low poly wall with corner edge and cleanup option feature

3.4. Texture Adjustment

The last step is to adjust the texture in Substance 3D Painter app. The low and high poly walls are exported to Substance 3D Painter as FBX file. Low poly files are used for the initial part. Then high poly models are imported when making the mesh map texture. As the base of texture layer, every brick wall has been added fill layer with the same filtering settings. Images below show screenshots of properties – fill settings that pose as the texture projection. For the projection type, 1 wall with archway is set to "UV projection" and the other 3 walls are set to "tri-planar projection"

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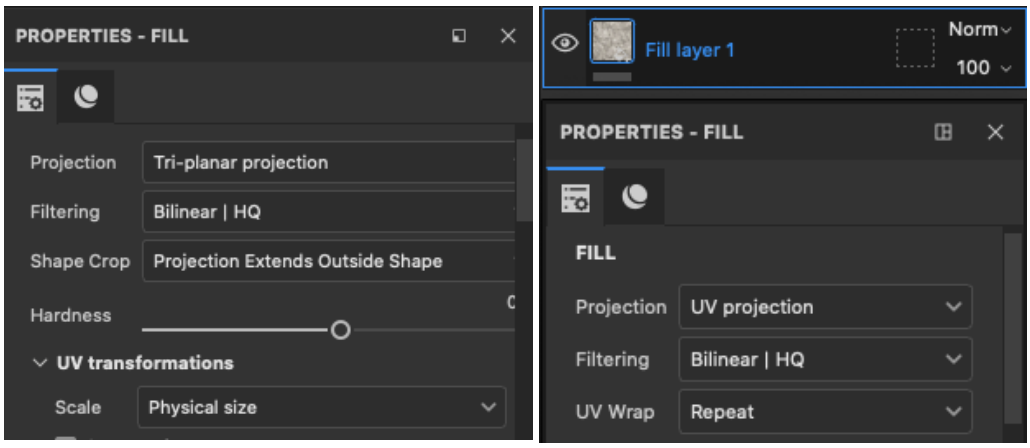


Figure 8 Projection setting after the baking process in Substance 3D Painter

Parameter and technical parameter feature on Substance Painter app can make texture into looking more realistic. Parameter feature consists of colour and bump map modification, while the technical parameter feature consists of mesh map (normal, height, AO) modification. Changing the amount of bump intensity and the height range can make the surface have more depth. It also helps creating light and shadow appearance on the texture so the viewer can see the outline of each stack of bricks.

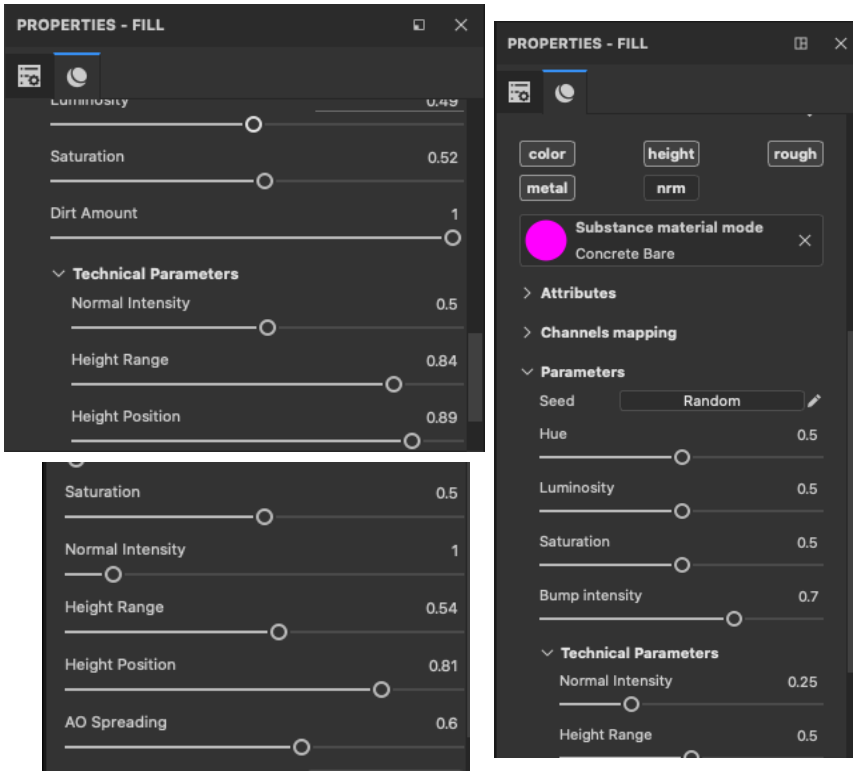
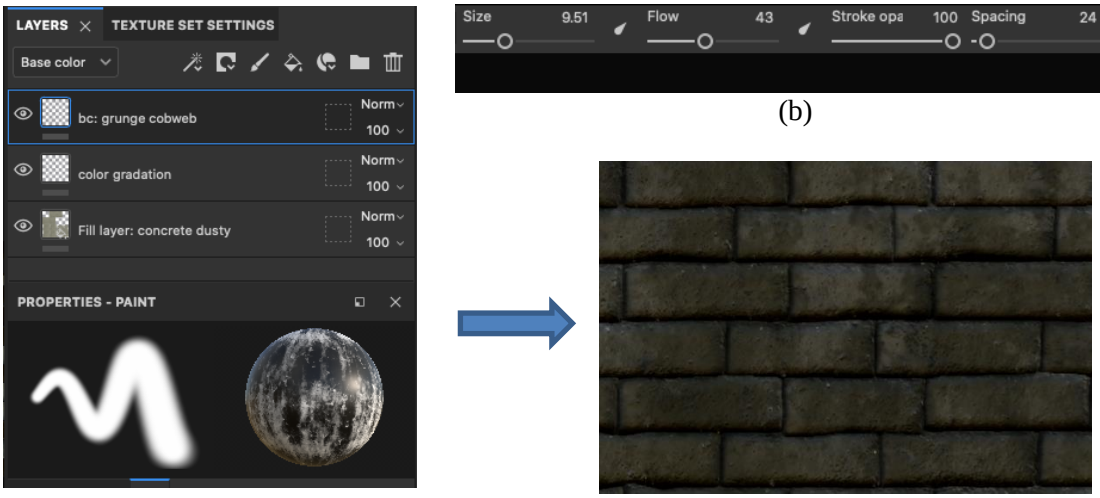


Figure 9 Parameters of texture adjustment for brick walls

The layer with these parameters (as shown on figure 9) act as a base colour map and does not classify as a 3D additional surface texture. Another new layer is added to modify the texture and surface colour without disturbing the existing fill layers.

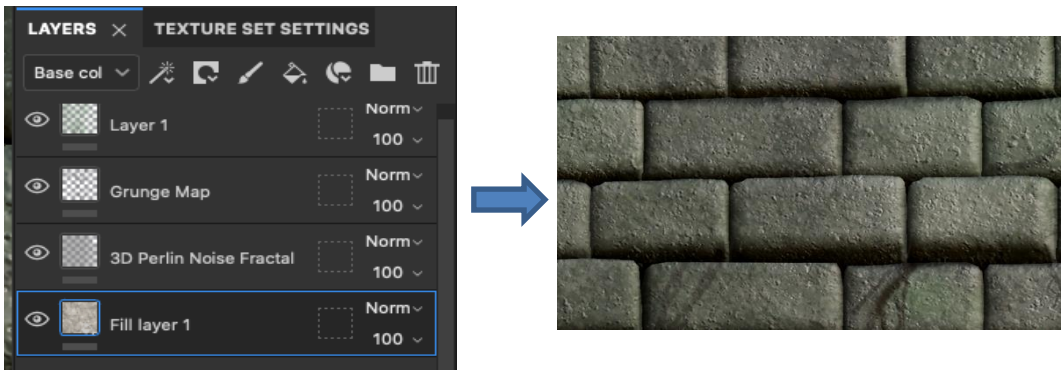
Each wall design has about 3 additional layers with different function. Another Substance 3D Painter feature with similar parameter is used to demonstrate more modification that has been made toward texture creation. The images below (figure 10) show outcome and modification of the added new feature. While working toward colour gradation on the wall, the amount of size, flow and stroke opacity are modified to show a more natural looking texture. For the scratch and pebble effect, a new base colour brush with filter called “grunge cobweb” is added and placed above the colour gradation layer.



(a) (b) (c)

Figure 10 (a)New layer addition, (b)Stroke addition and (c)Brick wall outcome

For the type of wall with bigger bricks, a mouldy and old wall effect are created with grunge map brush and customised base colour swatches. With the similar method, the amount of size, flow and stroke opacity are also modified for more flexibility in designing the texture.



(a) (b)

Figure 11 (a) Layers customization and (b) Outcome of mouldy brick wall

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With different brushes and base colour layer that made within the Substance 3D Painter app, the brick walls composition has done with the following results (figure 12). All the images aren't rendered as the screenshots are taken in the painting mode view.

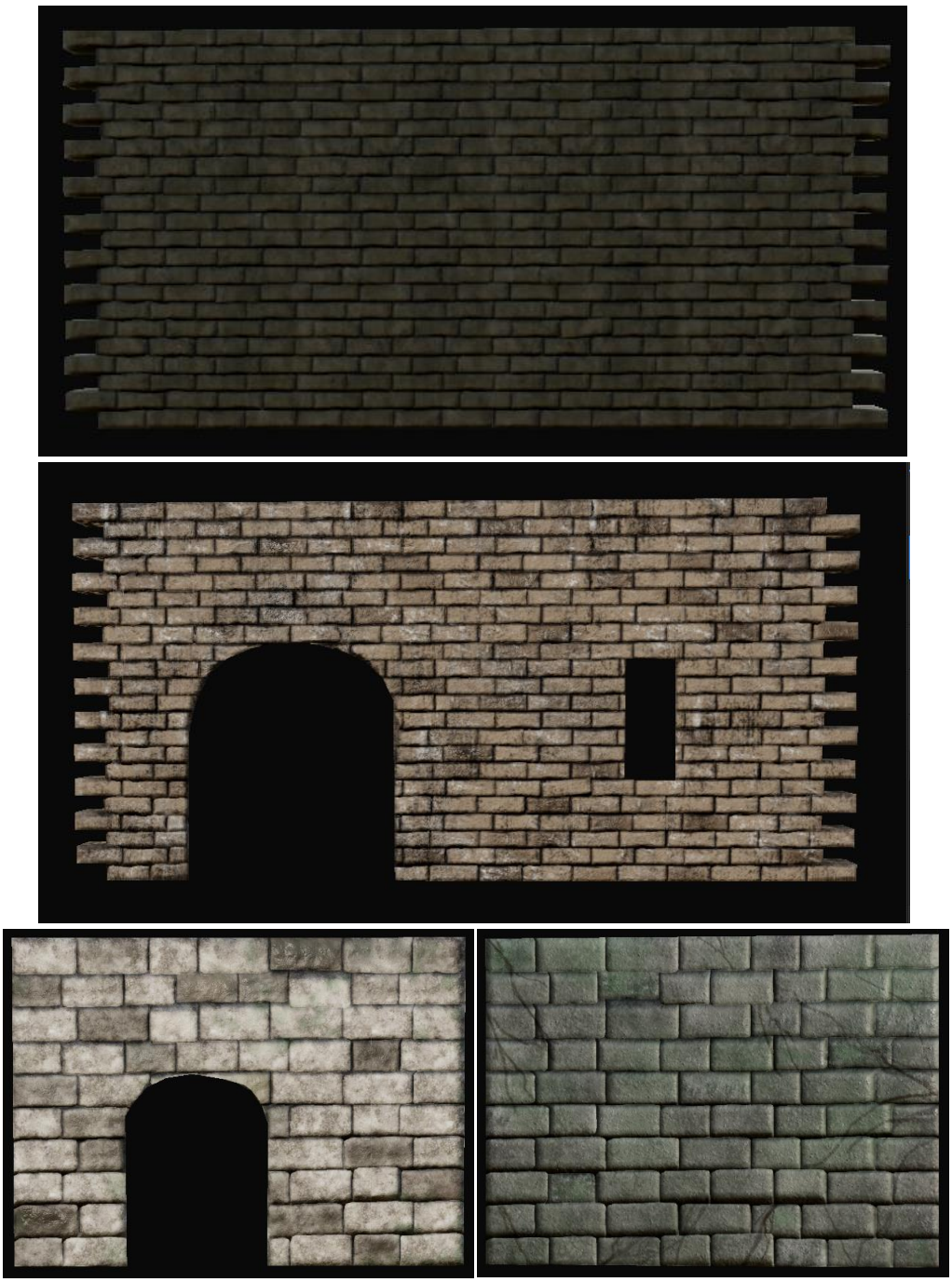

Figure 4 Final results of 4 brick walls texture projection

4. Conclusion

The research has made a new knowledge toward flexibility on modifying texture using Substance 3D Painter. Additional research on using the other in-app feature may be developed to make a more advanced and higher quality texture. This research also allowing new possibility on experimenting with different type of brick walls. There has been modification toward creating the UV map and the final texture. A proper literature review was needed to help any technical issue that could be avoided.

A proper rendering with different could be used for better view of the final wall texturing result. Fortunately, the in-app viewer is adequate to support the research as it is shown descent detail of the texture mesh maps.

For further development, same method and technique could be applied for creating different objects, such as floor, or furniture with hard organic surface.

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