

Mesh Subdivision Parameters in Indigo

Objective

This tutorial will demonstrate how the different mesh subdivision parameters affect how a mesh is subdivided. Please note that your exporter application may not give access to all of these parameters and they also may have slightly different names.

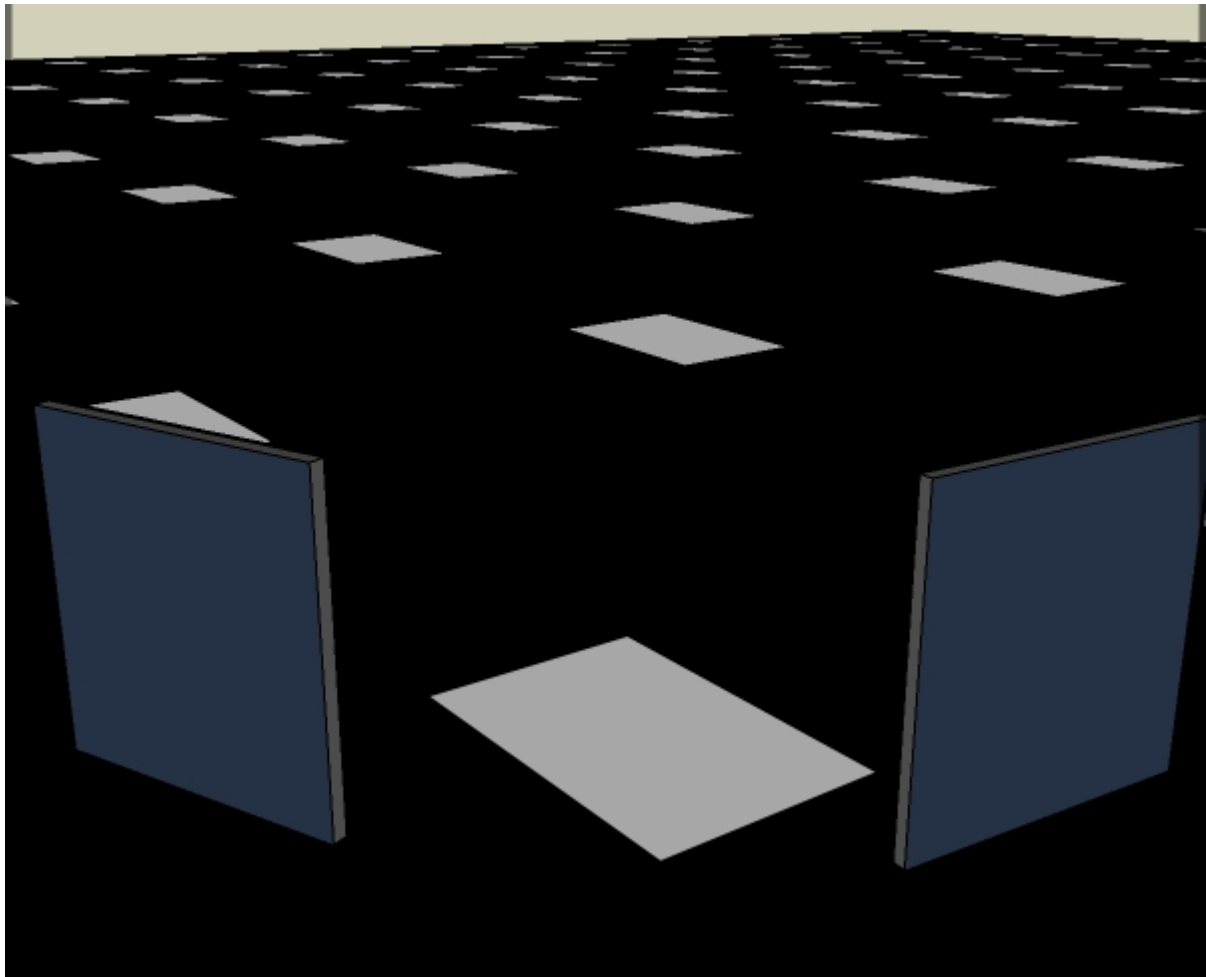


Figure 1 - Test Scene Setup

Test Scene

Figure 1 shows the test scene. There is a flat plane that has a displacement map applied as shown. The two objects in the foreground have a mirror material applied so that we can see what is happening behind the camera. The ground plane has not been subdivided at all prior to exporting to Indigo. In

other words, the plane consists of only two triangles. The ground plane material has random triangle colors enabled so that we can see the effects of the subdivision.

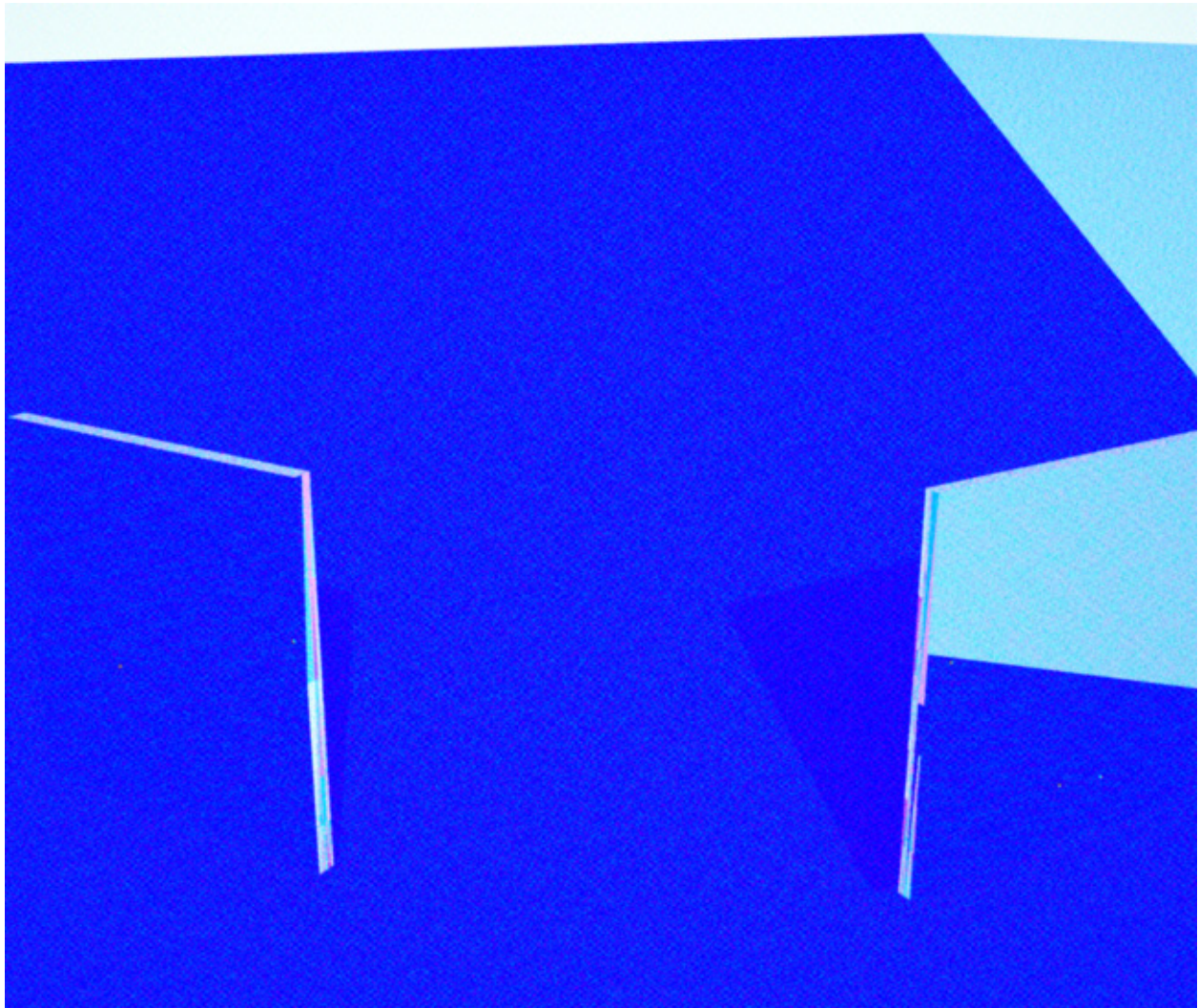


Figure 2 - Indigo Default Parameters

Parameters:

- Max Number of Subdivision: 0
- View Dependent Subdivision: On
- Pixel Threshold: 4px
- Curvature Threshold: 0.1 radians
- Displacement Error Threshold: 0.001m (Note: Indigo default is actually 0.1m)
- Displacement Map Strength (B): 0.5m

With max number of subdivisions set to 0, the results are not surprising. We don't see any subdivision and our displacement map does not come into effect.

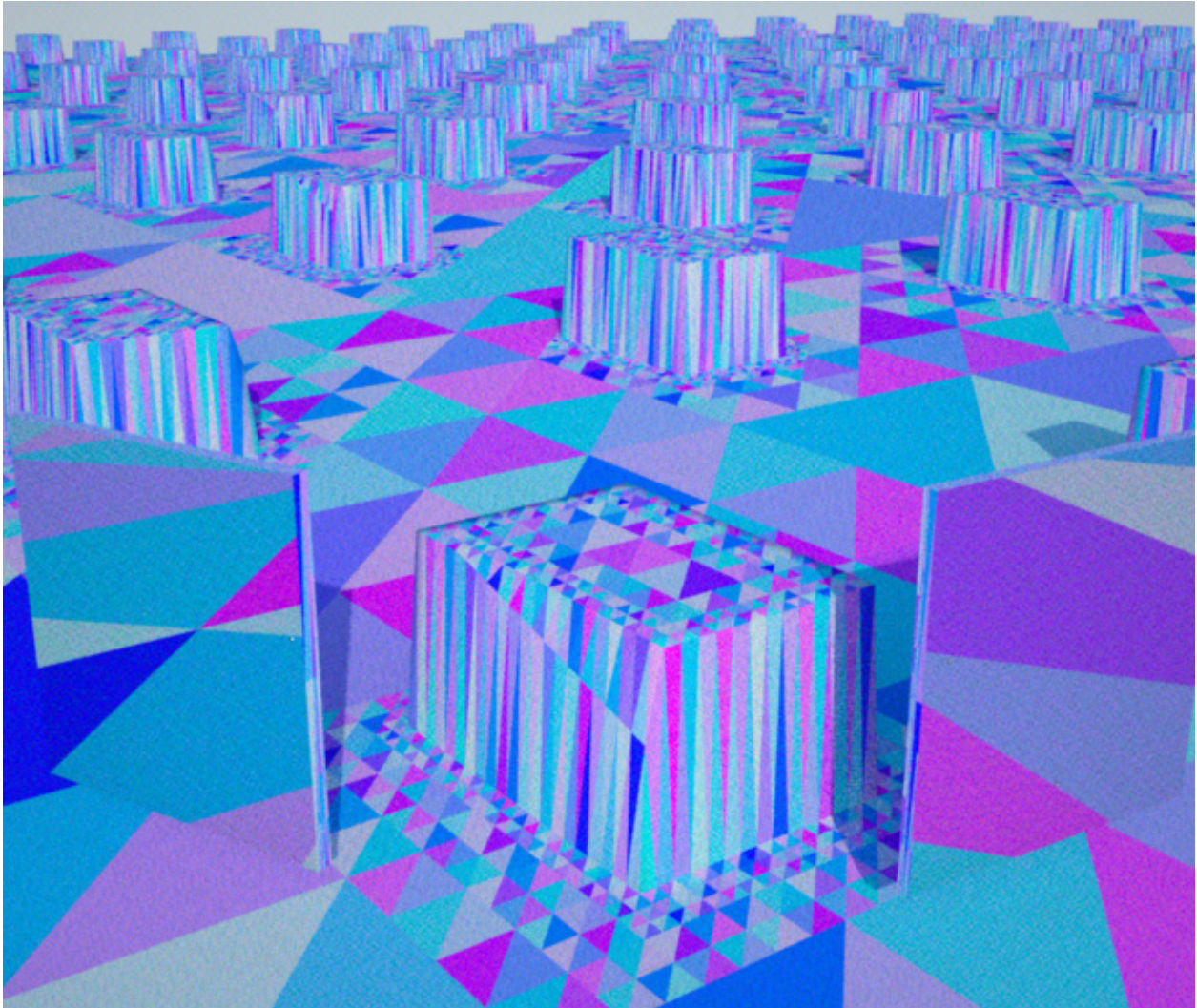


Figure 3 - Max Subdivisions changed to 10

Parameters:

- **Max Number of Subdivision: 10**
- View Dependent Subdivision: On
- Pixel Threshold: 4px
- Curvature Threshold: 0.1 radians
- Displacement Error Threshold: 0.001m
- Displacement Map Strength (B): 0.5m

By increasing the number of subdivisions to 10, We have created enough subdivision to produce a decent resolution displacement map. Since the curvature threshold is set to 0.1 radians (5.7 degrees), the triangles that are lower than this amount of curvature (i.e. the flat areas) are not subdivided any more than necessary. Since we have view dependent subdivision enabled, we can see that the triangles in the mirror are not subdivided more than necessary. Also, since the pixel threshold is set at 4px, triangles will only be subdivided if they are larger than 4px.

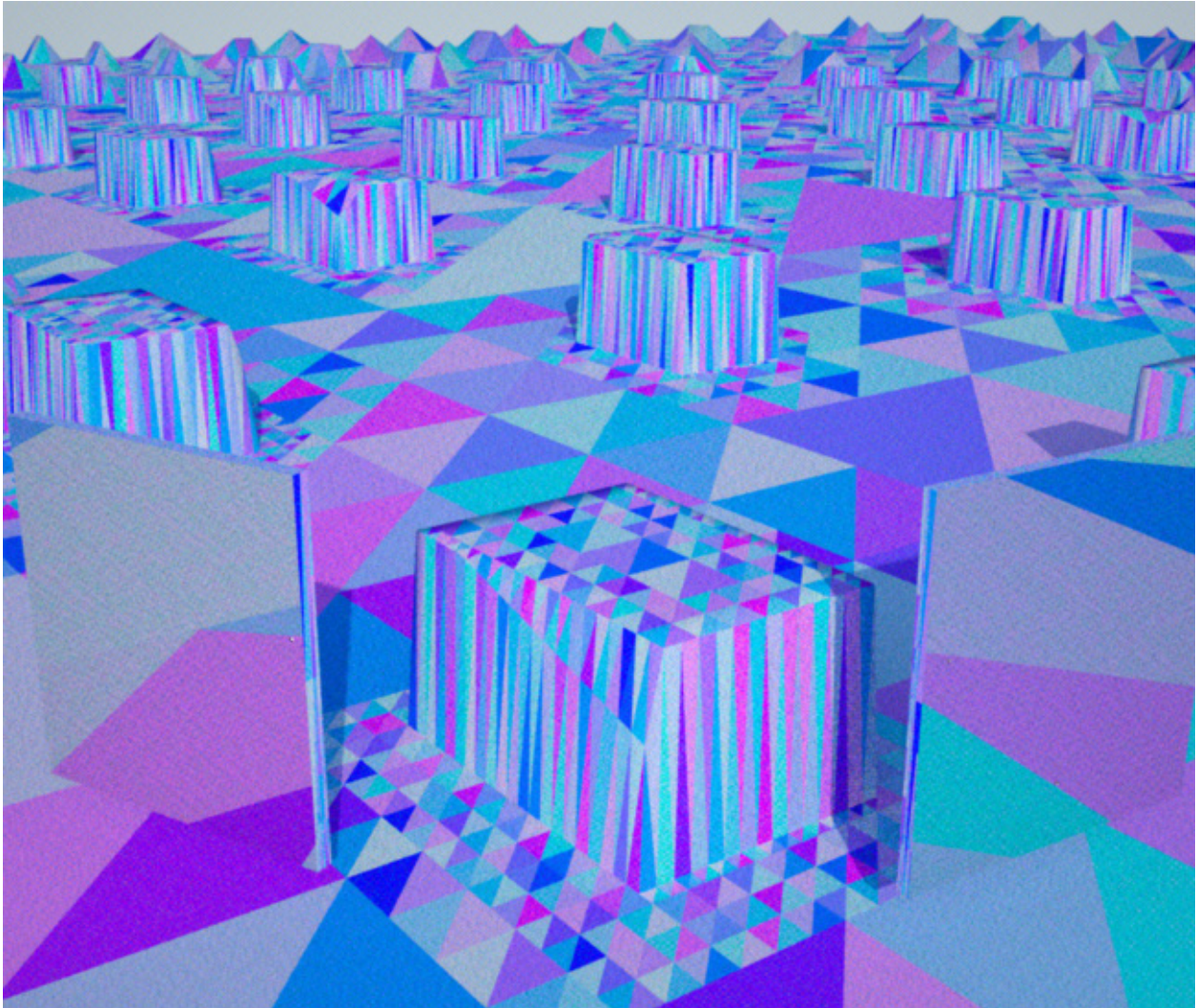


Figure 4 - Increasing the Pixel Threshold

Parameters:

- Max Number of Subdivision: 10
- View Dependent Subdivision: On
- **Pixel Threshold: 20px**
- Curvature Threshold: 0.1 radians
- Displacement Error Threshold: 0.001m
- Displacement Map Strength (B): 0.5m

Now we have increased the pixel threshold to 20px. The effect is most noticeable in the background of the image as the subdivision resolution is decreased further away from the camera. Any triangles smaller than 20px in screen space are not getting subdivided.

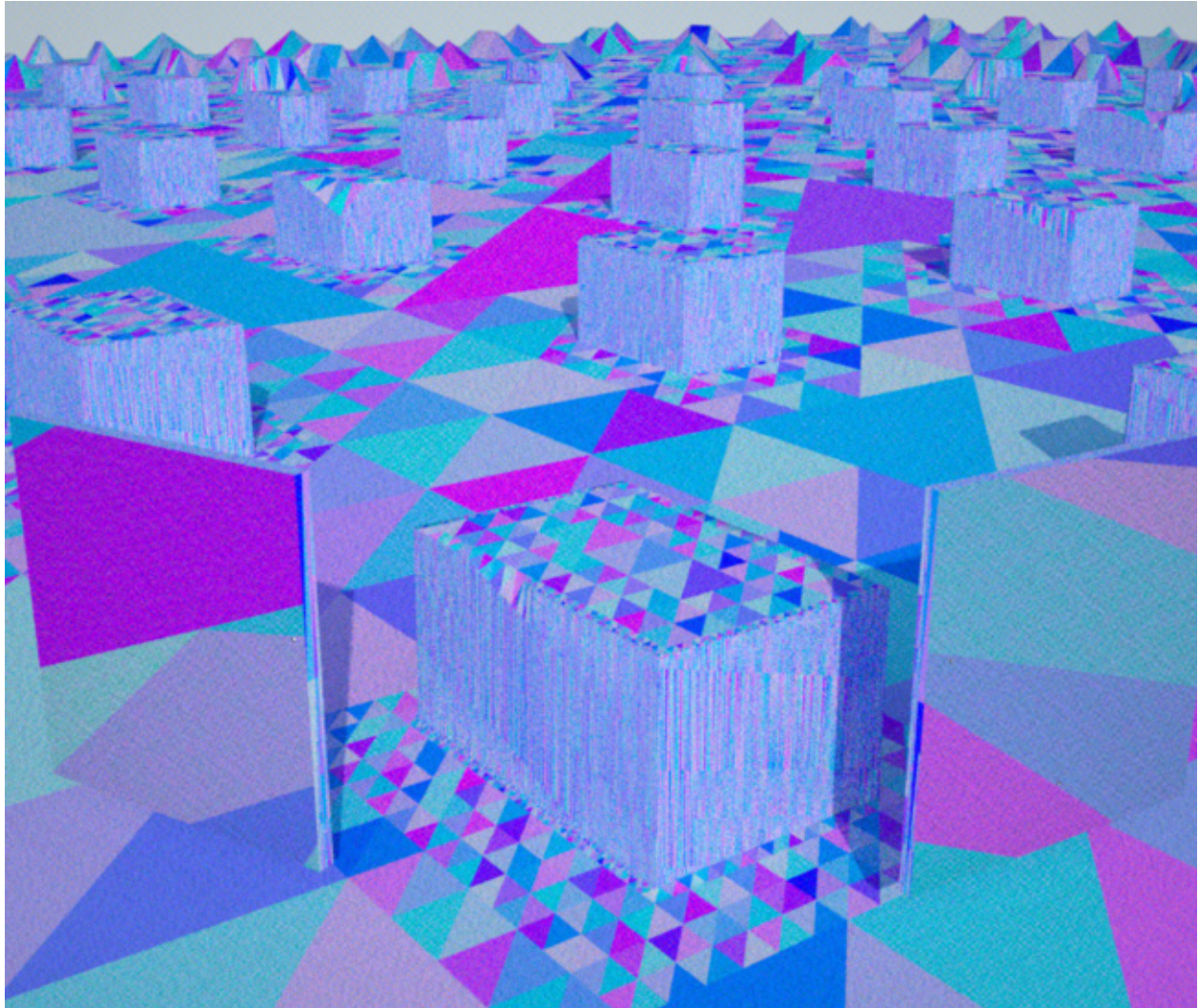


Figure 5 - Increasing Max Subdivisions to 15

Parameters:

- **Max Number of Subdivision: 15**
- View Dependent Subdivision: On
- Pixel Threshold: 20px
- Curvature Threshold: 0.1 radians
- Displacement Error Threshold: 0.001m
- Displacement Map Strength (B): 0.5m

Now we increase the max number of subdivisions to 15. Because we still have a pixel threshold of 20px, the background displacement is still low resolution. To fix this, we could simply turn view dependent subdivision off or lower the pixel threshold.

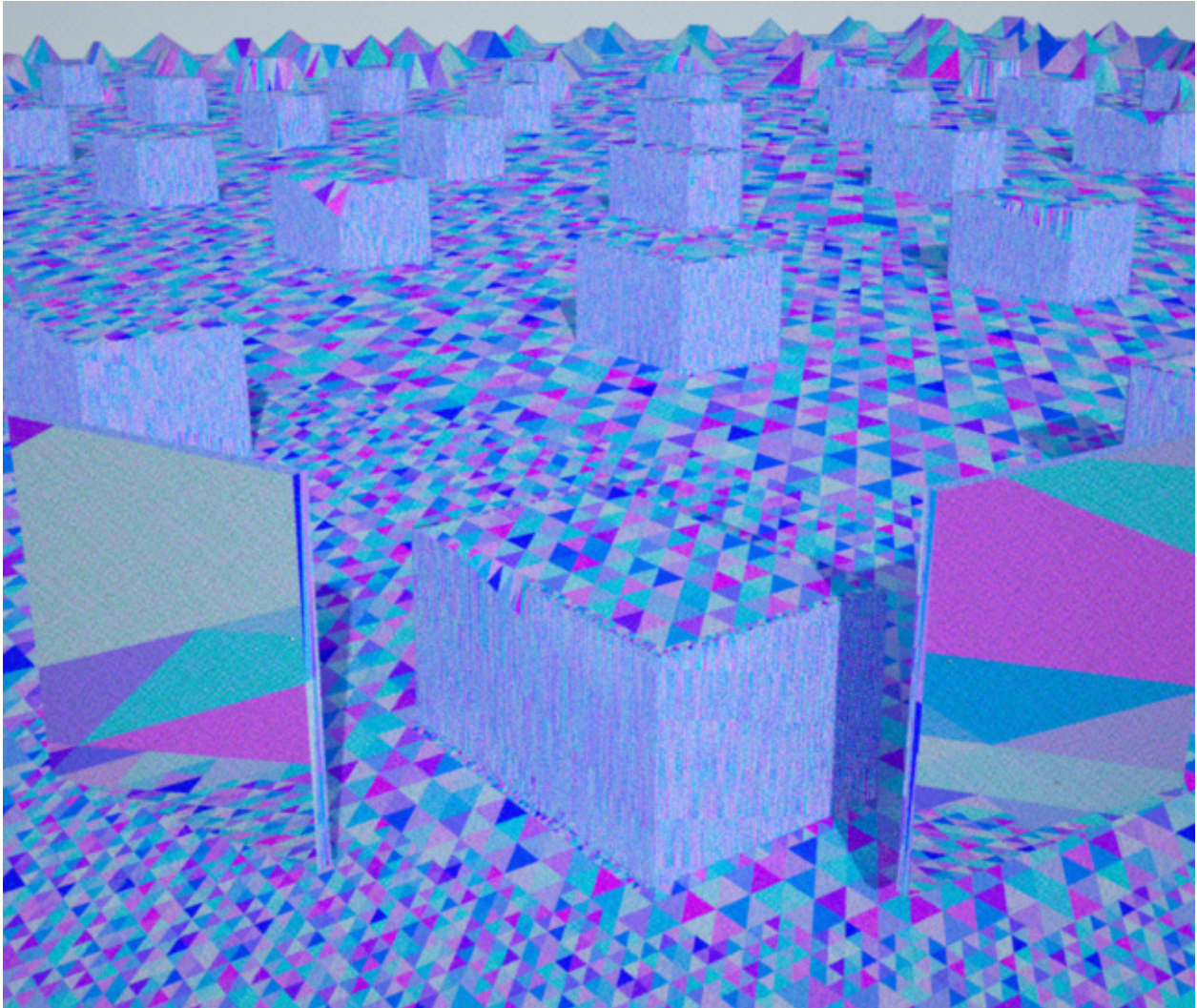


Figure 6 - Dropping the curvature threshold to 0

Parameters:

- Max Number of Subdivision: 15
- View Dependent Subdivision: On
- Pixel Threshold: 20px
- **Curvature Threshold: 0.0 radians**
- Displacement Error Threshold: 0.001m (Note: Indigo default is actually 0.1m)
- Displacement Map Strength (B): 0.5m

Now we have lowered the curvature threshold to 0. This means that triangles even with no curvature (flat areas) will still get subdivided. The effect is clear in the image. However, notice the reflection in the mirror. Because view dependent subdivision is enabled, the triangles outside of view are still not being subdivided.

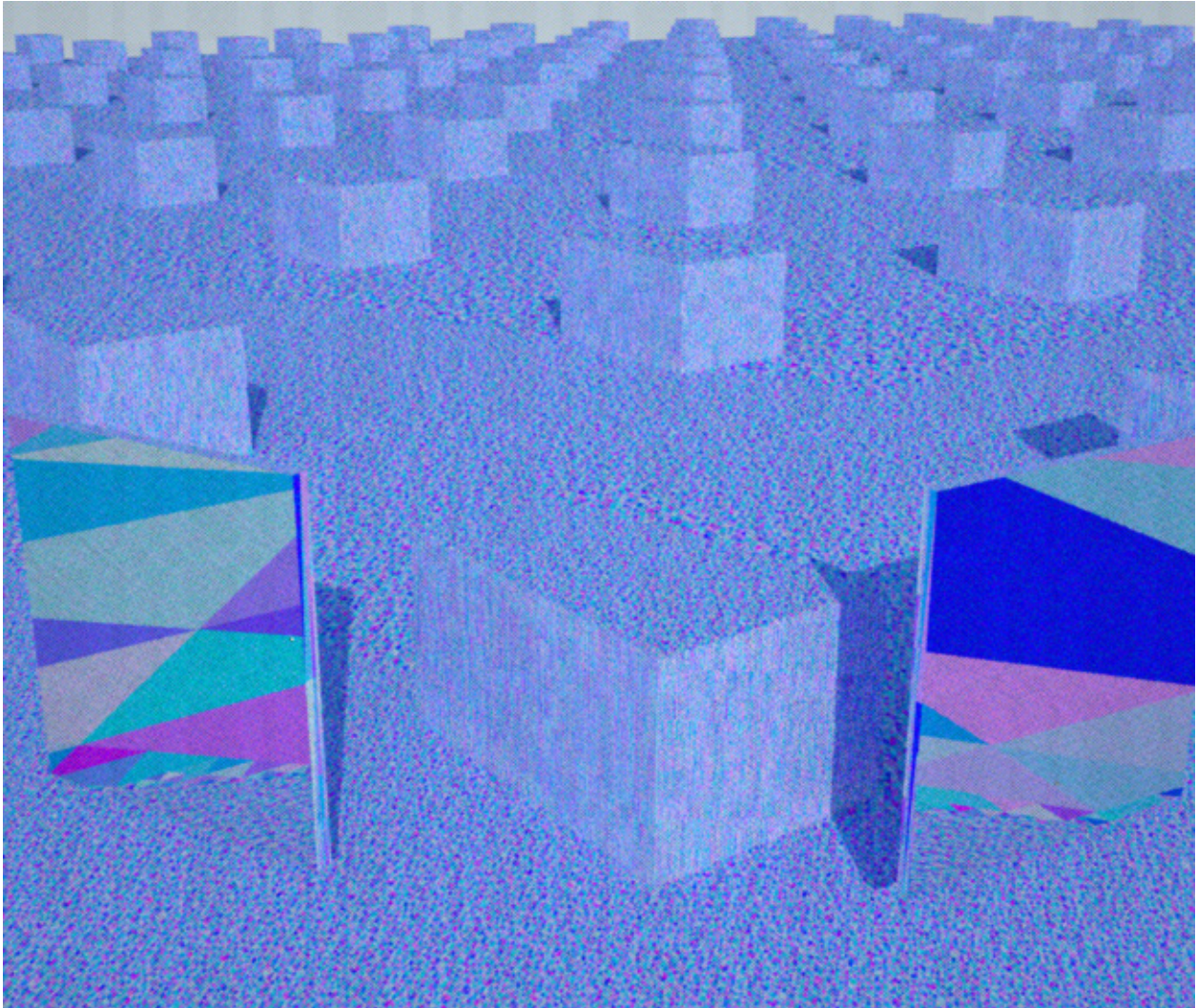


Figure 7 - Dropping the pixel threshold to 4px

Parameters:

- Max Number of Subdivision: 15
- View Dependent Subdivision: On
- **Pixel Threshold: 4px**
- Curvature Threshold: 0.0 radians
- Displacement Error Threshold: 0.001m (Note: Indigo default is actually 0.1m)
- Displacement Map Strength (B): 0.5m

Here, we lower the pixel threshold back down to 4px. We now have very high subdivision resolution throughout the geometry **except for the triangles that are not in front of the camera** as we can see from the reflections in the mirror.

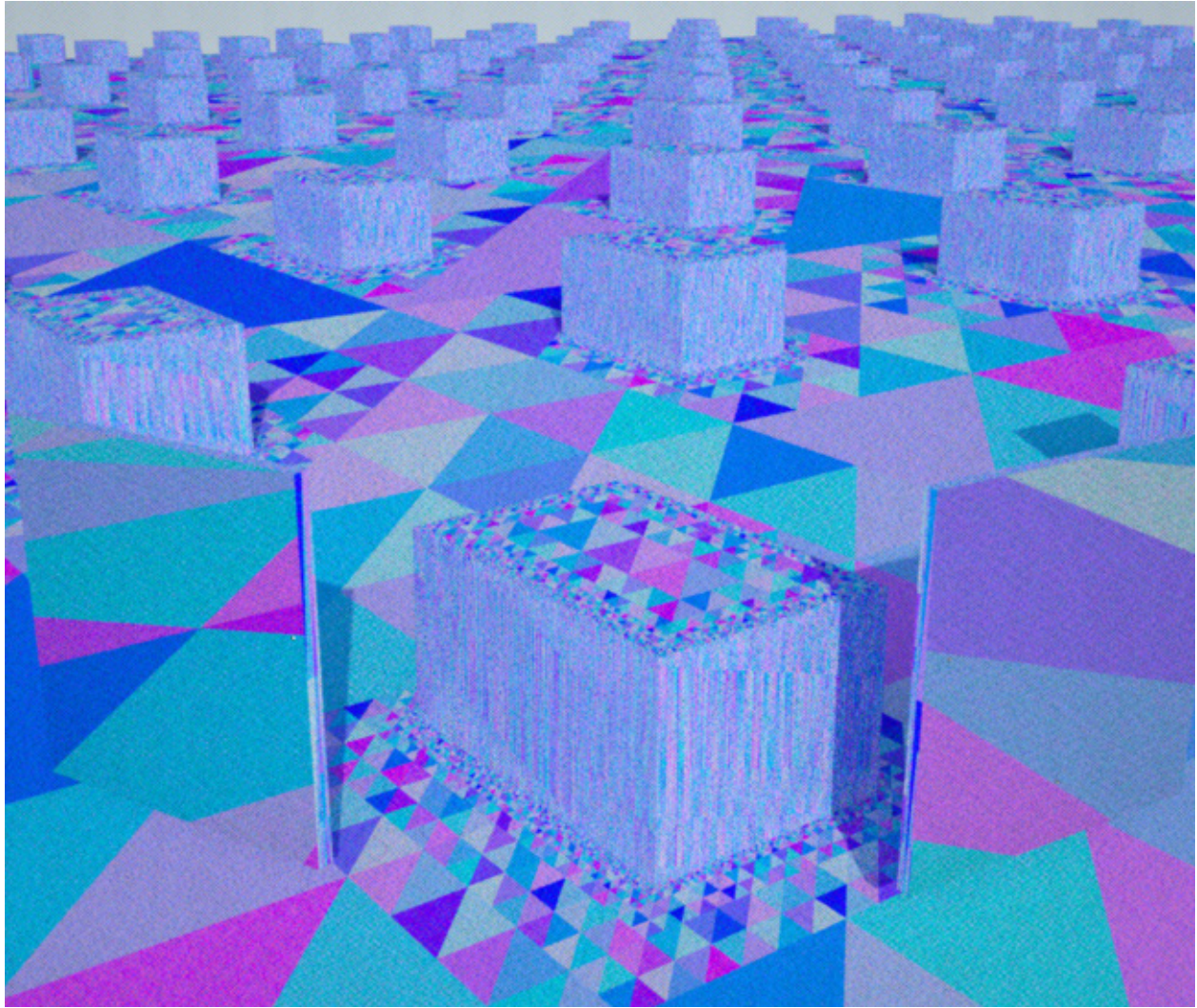


Figure 8 - Increasing the Curvature Threshold to 0.1

Parameters:

- Max Number of Subdivision: 15
- View Dependent Subdivision: On
- Pixel Threshold: 4px
- **Curvature Threshold: 0.1 radians**
- Displacement Error Threshold: 0.001m (Note: Indigo default is actually 0.1m)
- Displacement Map Strength (B): 0.5m

As we now bring the curvature threshold back up to 0.1, the unnecessary subdivision in the flat areas is gone again. We have a nice resolution displacement in the foreground and background. The pixel threshold of 4px still prevents a lot of excessive subdivision from happening and helps save RAM. These settings seem to be ideal for this particular scene.

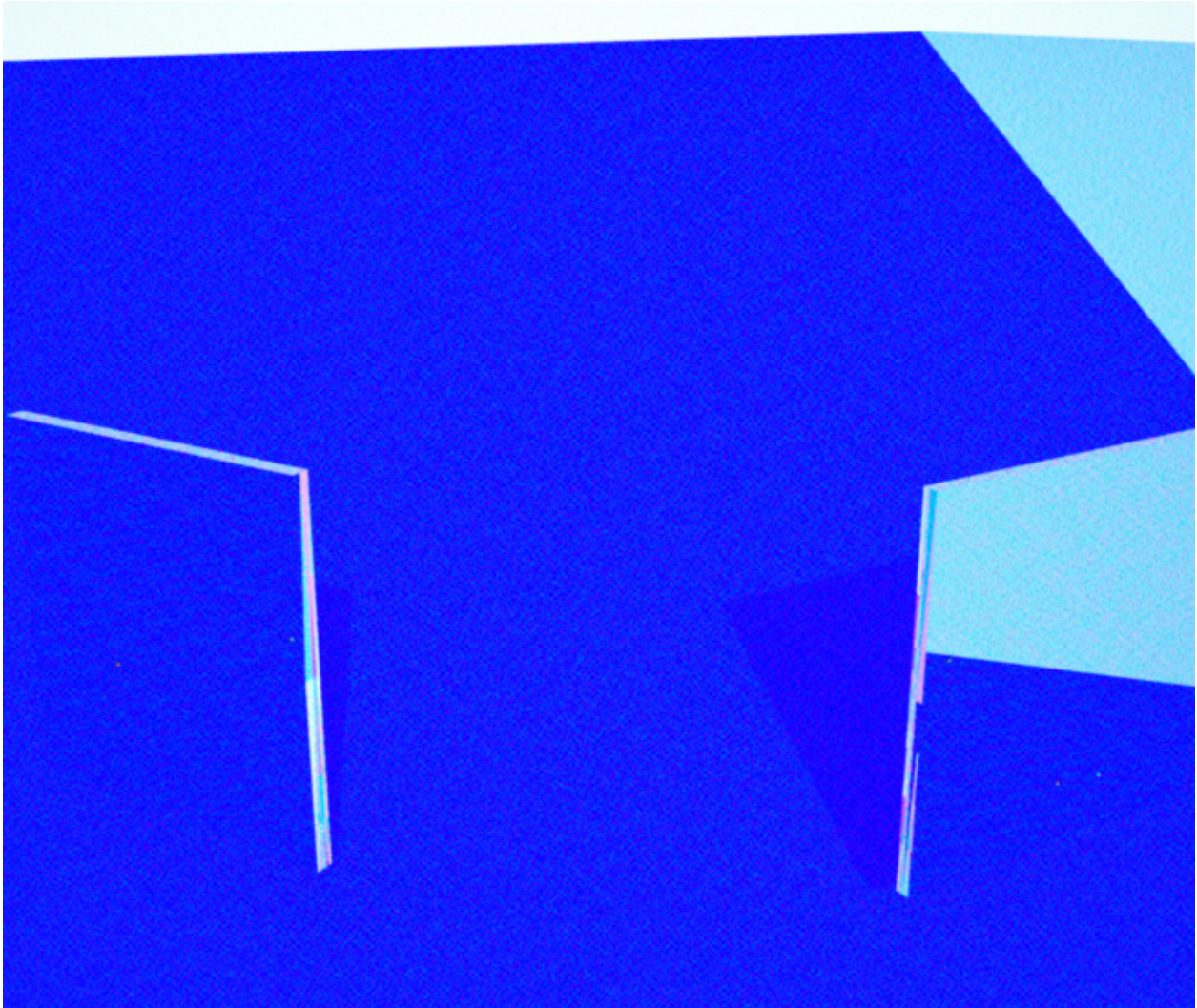


Figure 9 - Displacement Strength lowered below Error Threshold

Parameters:

- Max Number of Subdivision: 15
- View Dependent Subdivision: On
- Pixel Threshold: 4px
- Curvature Threshold: 0.1 radians
- Displacement Error Threshold: 0.001m
- **Displacement Map Strength (B): 0.0m**

Now we have only changed the displacement map strength. The displacement map is still applied to the material but the B parameter has been set to 0.0. If the value of the displacement is lower than the Displacement Error Threshold, the mesh is not being subdivided. If the Displacement Error Threshold value is set too high, you may get unexpected results when using a displacement map. If you want to conserve RAM, this value should be set to the minimum amount of displacement that will result from your displacement map. For example, if you have a brick displacement map, you might set this value to a very low value (say 0.001m). If you have a displacement map that creates a mountain range, you might set this value much higher (say 0.5m) because you are not concerned with displacement map

values that are less than 0.5m high.

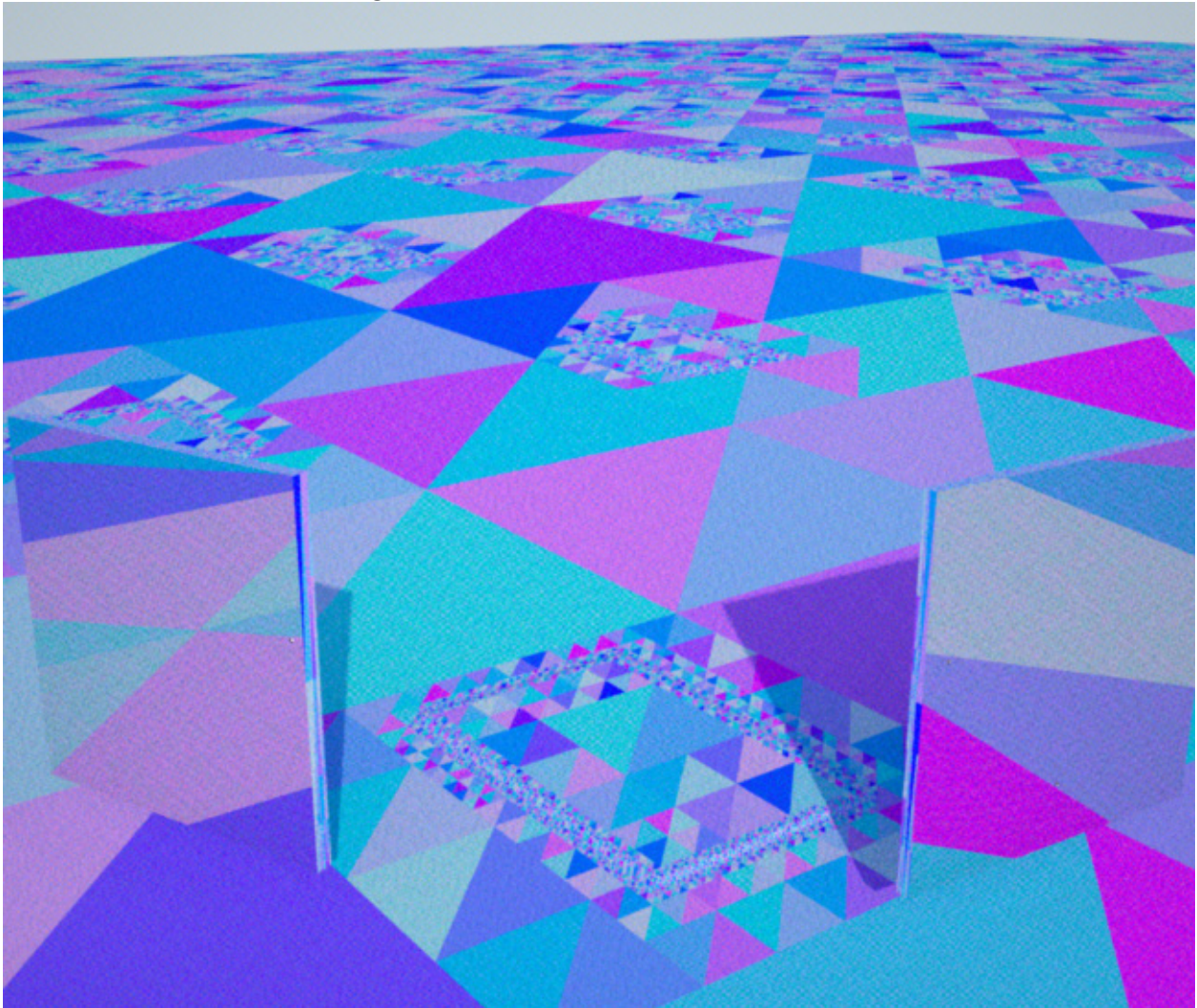


Figure 10 - Increasing the Displacement value above the Error Threshold

Parameters:

- Max Number of Subdivision: 15
- View Dependent Subdivision: On
- Pixel Threshold: 4px
- Curvature Threshold: 0.1 radians
- Displacement Error Threshold: 0.001m
- **Displacement Map Strength (B): 0.01m**

Here, we increase the displacement map strength just higher than the Displacement Error Threshold. Now, the mesh is being subdivided again.

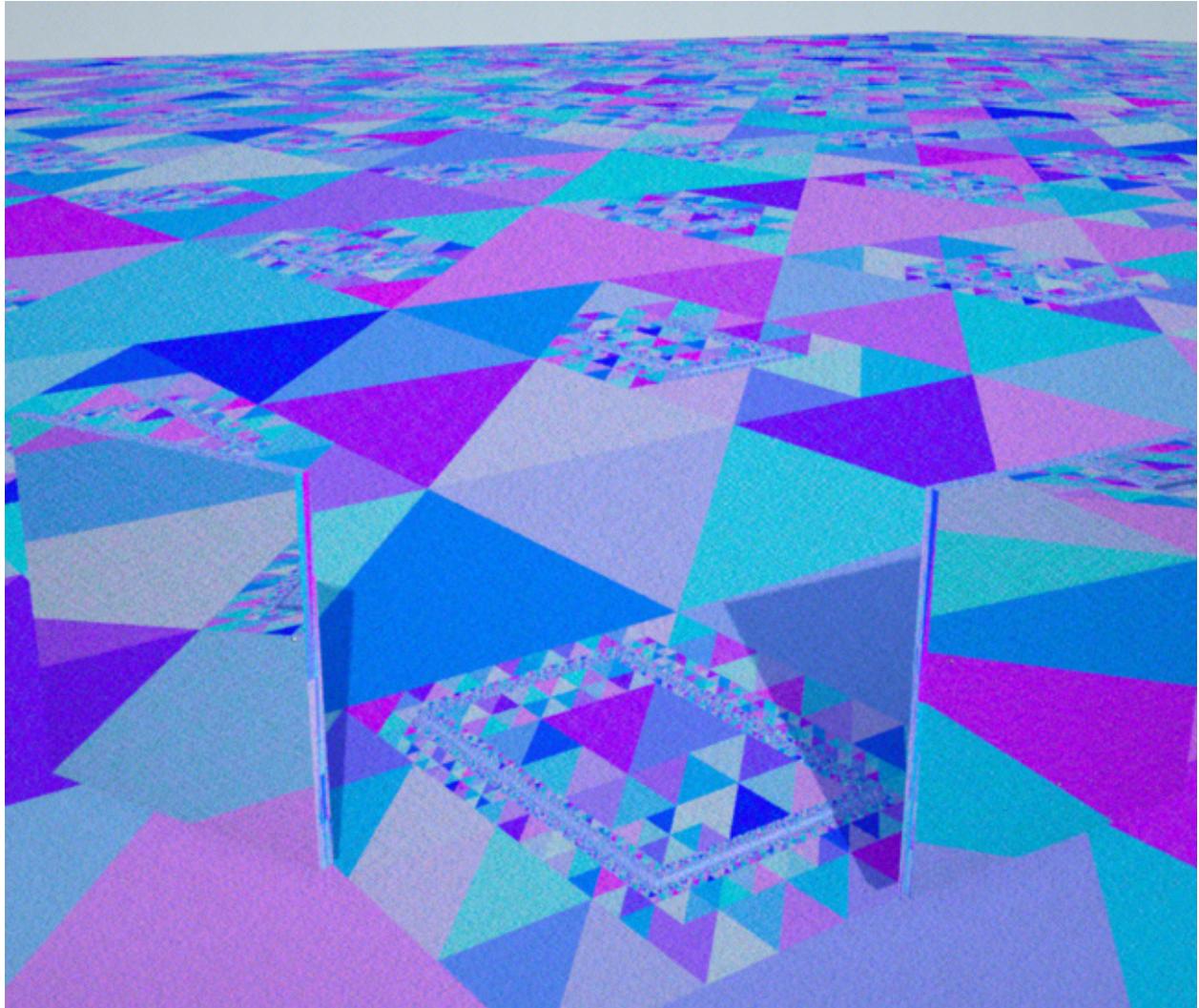


Figure 11 - View dependent turned off

Parameters:

- Max Number of Subdivision: 15
- **View Dependent Subdivision: Off**
- Pixel Threshold: 4px
- Curvature Threshold: 0.1 radians
- Displacement Error Threshold: 0.001m
- Displacement Map Strength (B): 0.01m

Now we look briefly at what happens when we turn off View Dependent Subdivision. Two things should be evident: Looking in the mirrors, we can now see that there are areas behind the camera that are being subdivided heavily. Also, the pixel threshold value is ignored. The areas of higher curvature have extremely high subdivision density regardless of the distance to the camera.

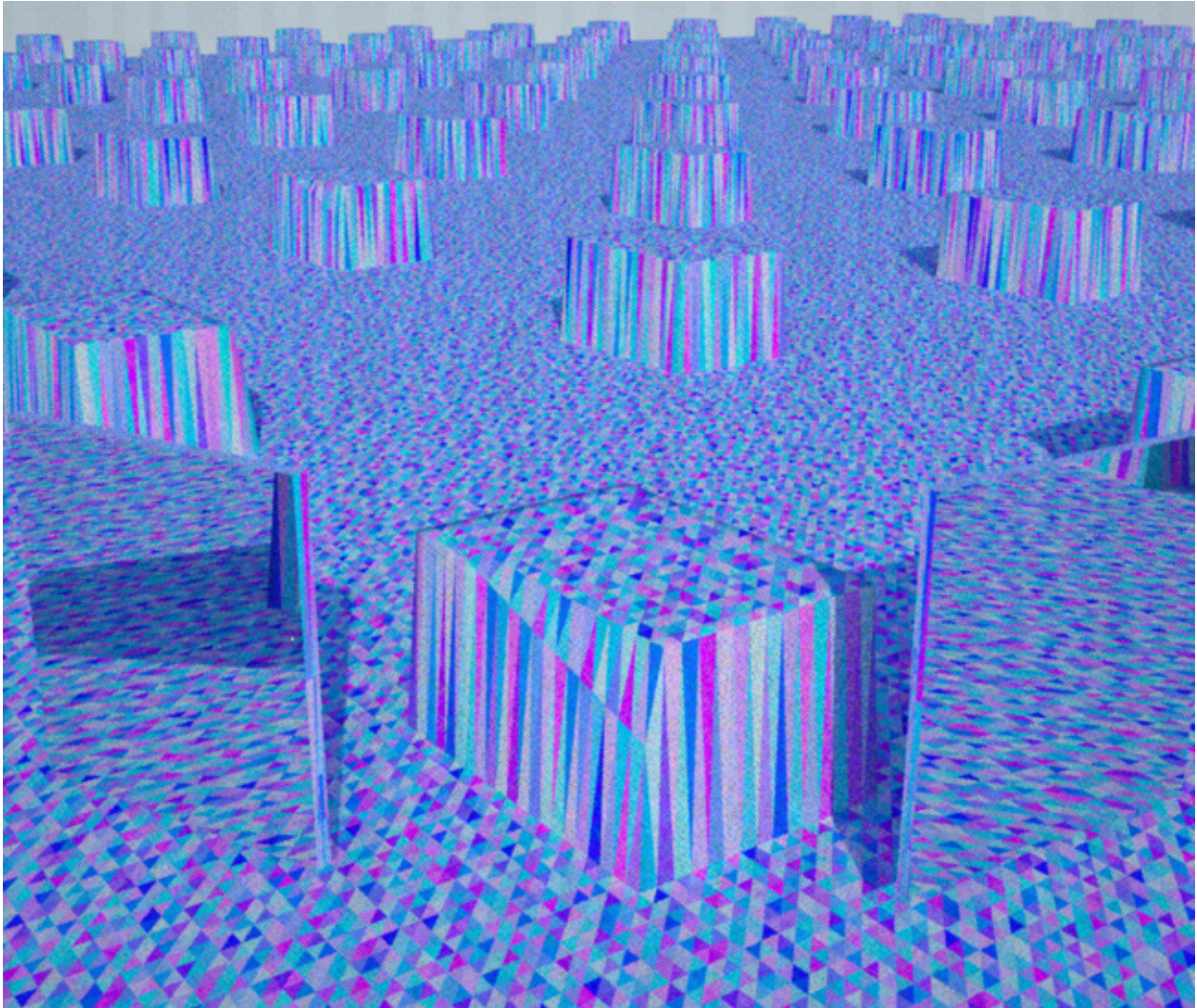


Figure 12 - Lowering the number of subdivisions and removing the curvature threshold

Parameters:

- **Max Number of Subdivision: 10**
- **View Dependent Subdivision: Off**
- Pixel Threshold: 4px
- **Curvature Threshold: 0.0 radians**
- Displacement Error Threshold: 0.001m
- **Displacement Map Strength (B): 0.5m**

Now we lower the max number of subdivisions to 10 and remove the curvature threshold. We have uniform subdivision throughout the entire mesh (regardless of curvature and distance to camera). The pixel threshold is ignored because view dependency is turned off. We can also see that the mesh is being subdivided behind the camera as well. These settings are highly inefficient and result in long scene build times and excessive RAM usage. Try to avoid this.

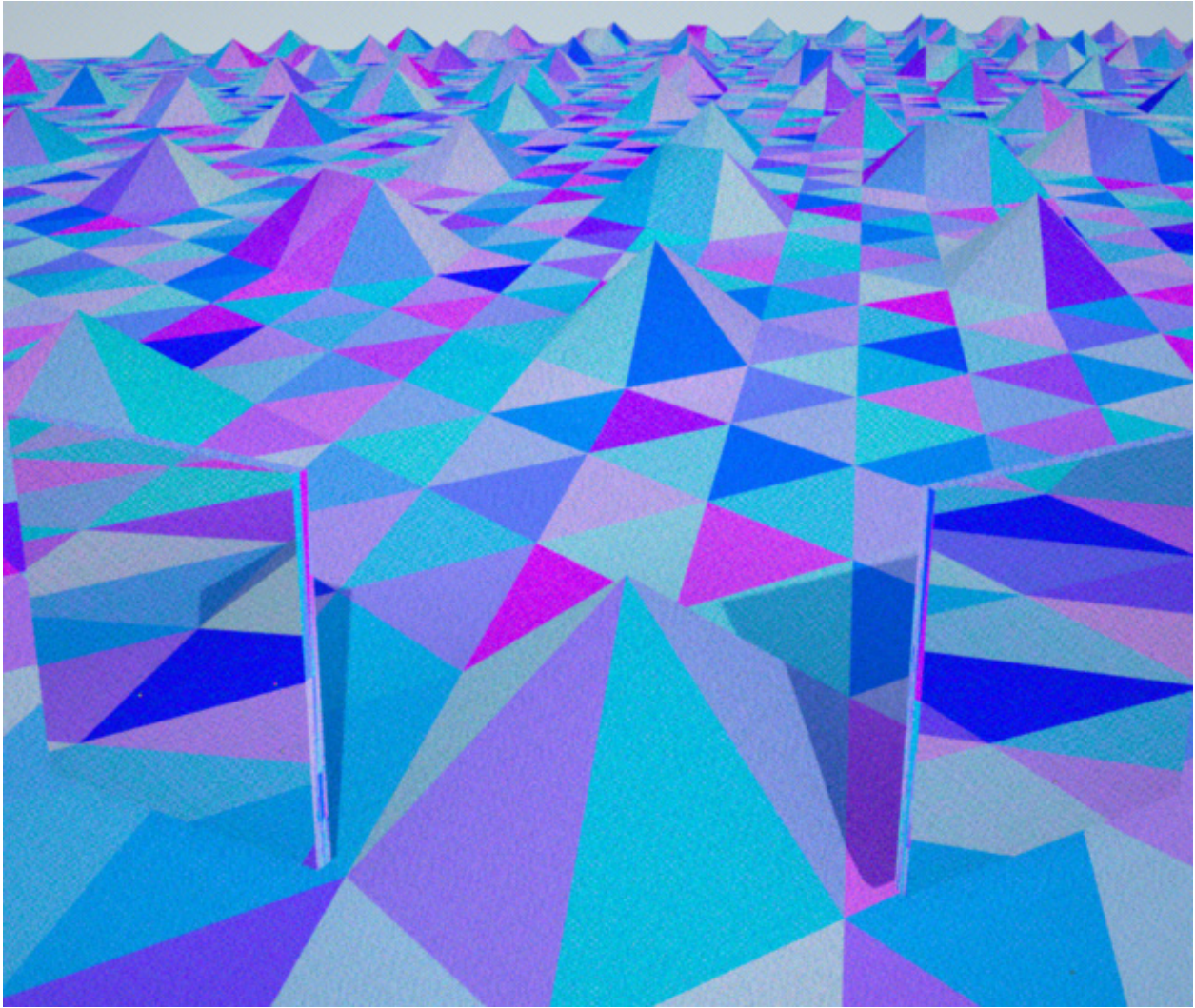


Figure 13 - Max subdivisions lowered to 6

Parameters:

- **Max Number of Subdivision: 6**
- View Dependent Subdivision: Off
- Pixel Threshold: 4px
- Curvature Threshold: 0.0 radians
- Displacement Error Threshold: 0.001m
- Displacement Map Strength (B): 0.5m

Finally, we look at the effect of having the max number of subdivisions set far too low. There is just not enough subdivision resolution to produce a proper displaced surface. The max number of subdivisions is the most important parameter for producing nice-looking displaced surfaces.