

# Texture Transfer

Christopher Gearhart

## Introduction

In the summer of 2017, I developed Rebrickr – an add-on for Blender that converts 3D Meshes into photo-real LEGO brick sculptures. After realizing the tremendous potential of the plugin, I devoted my senior project to developing functionality for transferring textures from the source mesh to the LEGO bricks.

## Rebrickr

The addon works by casting rays from points on a 3D grid to test for intersections with the source mesh. By default, bricks are placed on the inner-side of line segments that intersect with the source mesh.

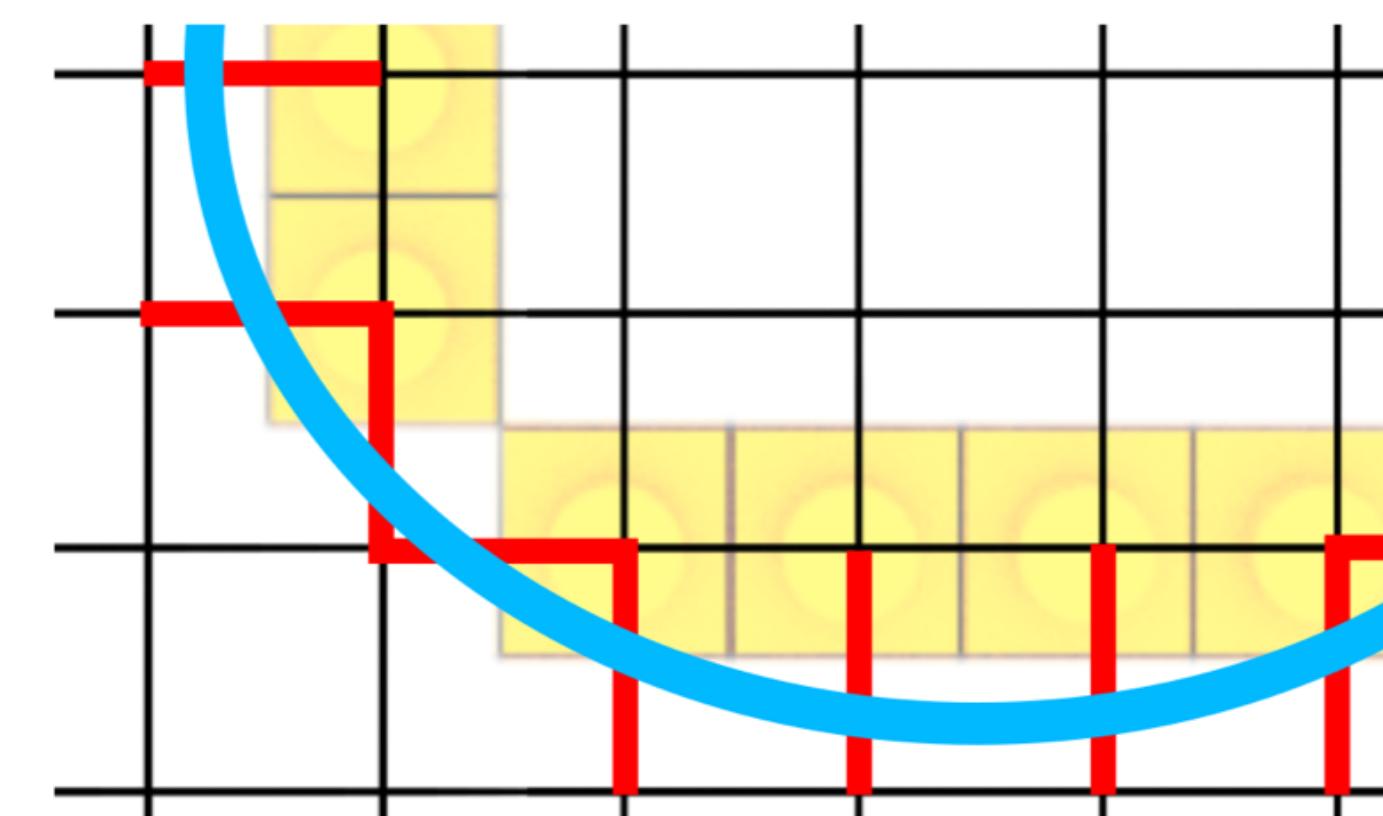


Figure 1

Blue: Source mesh  
Red: Intersecting line segments  
Yellow: Bricks generated by Rebrickr

## UV Texture Lookup

To transfer the UV texture to the bricks, I stored the nearest face intersection point for each brick, calculated the barycentric weights, and calculated the corresponding pixel value in the UV texture image as seen in the figure below.

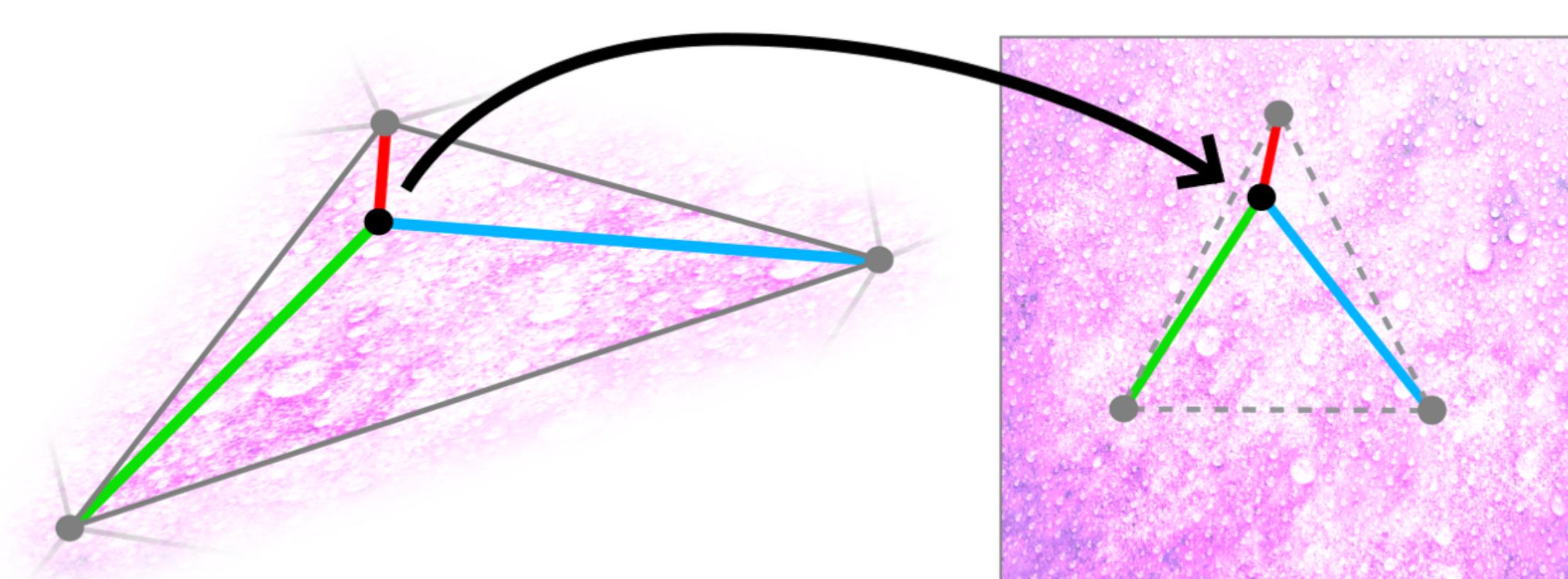


Figure 2

## Color Snapping

With UV texture transfer fully functional, the next step was to snap the color of a brick to the most similar LEGO material. I started off by creating a set of photorealistic LEGO materials based on LEGO's ABS plastic color palette. It was not hard to come up with a simple algorithm that computes the nearest brick material to a given color when both were represented as single RGBA values:

Equation 1:

$$\text{diff} = (r_1 - r_2)^2 + (g_1 - g_2)^2 + (b_1 - b_2)^2 + (a_1 - a_2)^2$$

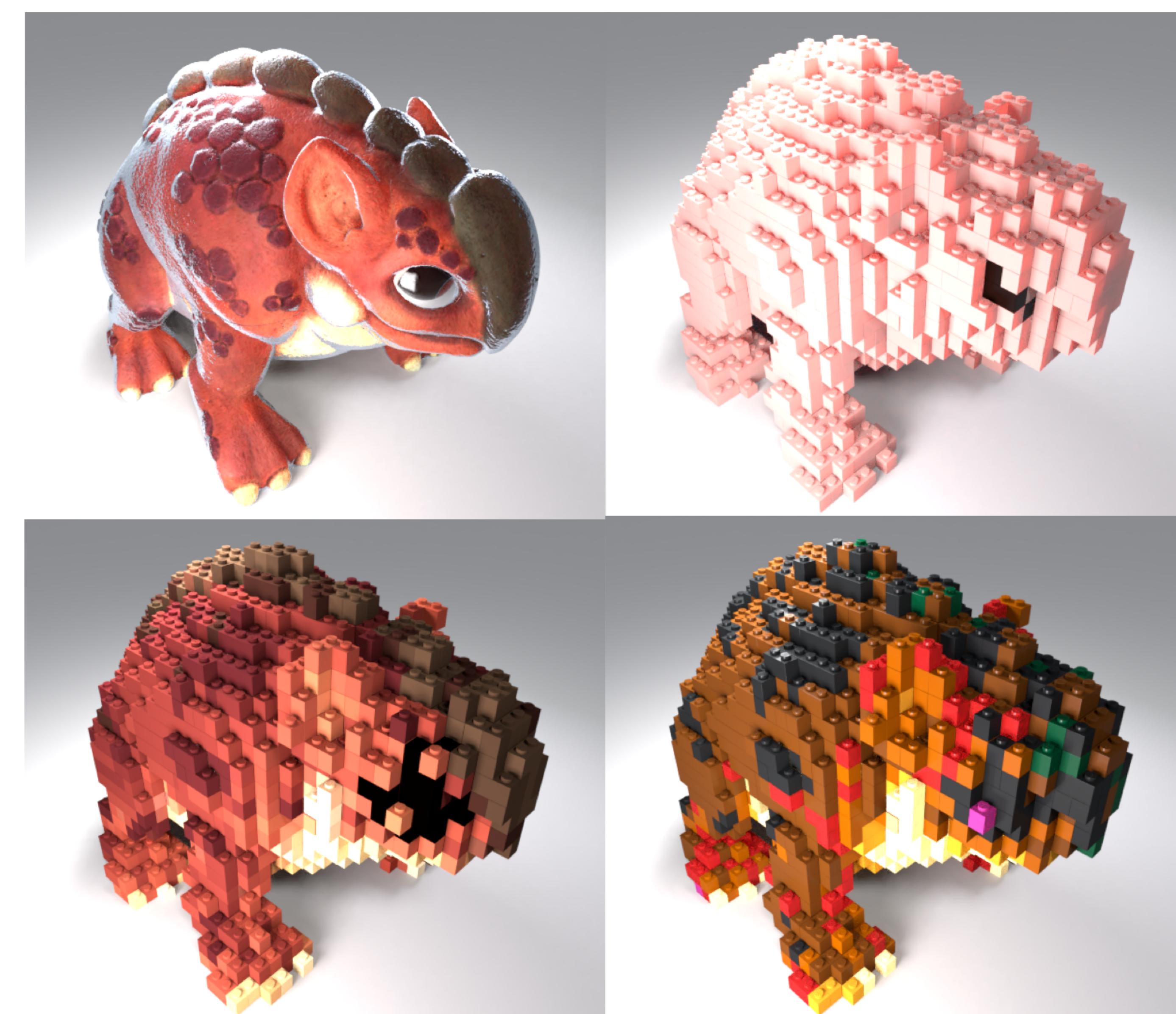
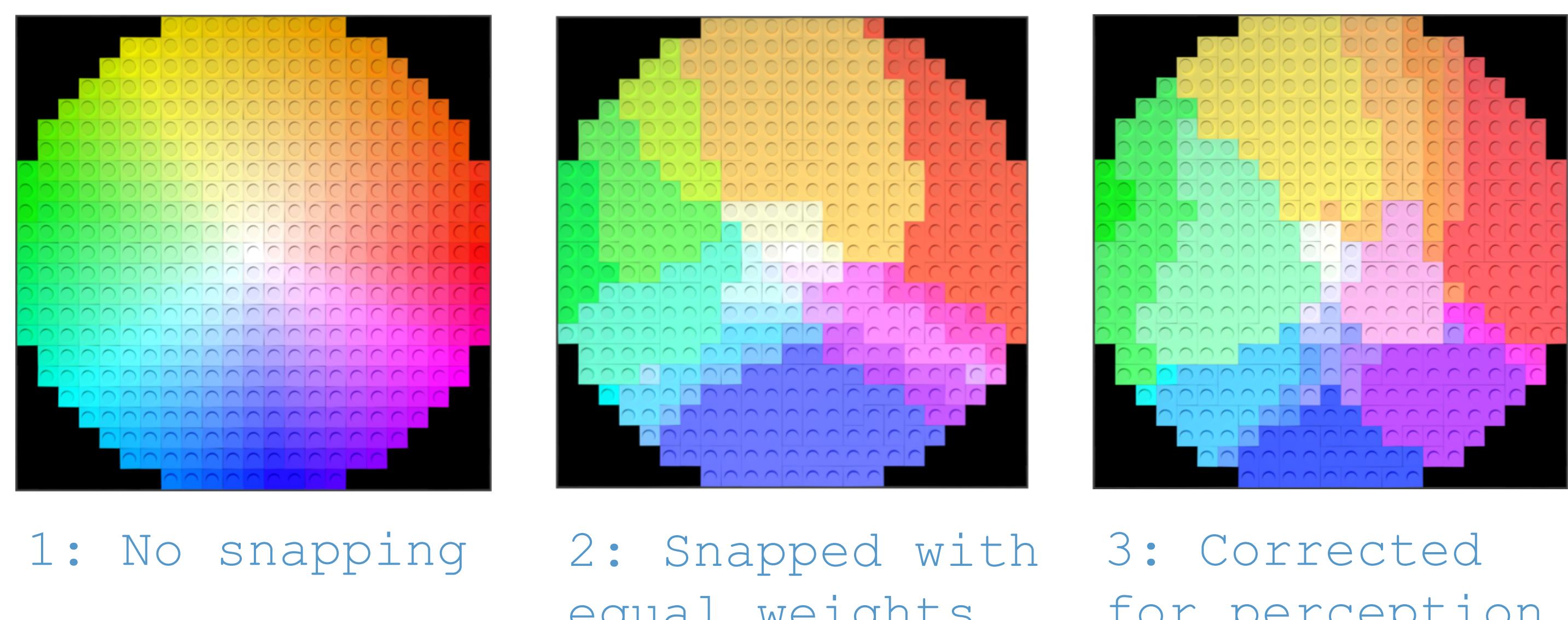


Figure 3  
Top Left: Original model with texture  
Top Right: Standard material transfer  
Bottom Left: Texture lookup  
Bottom Right: Texture lookup snapped to nearest custom material from limited color palette

## Future Work

I tested various alterations to the algorithm on a color wheel, and ended up weighting the RGB values based on the human perception of color (the human eye is most sensitive to the yellow-green range). A future improvement would be to convert the RGB values to LAB color space which more accurately models human color perception.

Figure 4



## Conclusion

In addition to being loads of fun, this project was an excellent exercise in artistic tool development. It helped me to practice developing robust code for artists, which is experience that will be crucial to my résumé.

## Acknowledgements

I would like to thank Dr. Denning for his extensive involvement in this project. He was there to help around the clock, and he was always willing to give as much time as was needed to set milestones, provide direction, and inspire.

## Citations

- 3D Model in Figure 3 from [www.blendernation.com](http://www.blendernation.com)
- Header image texture by Dana Scully