# NPR: 3D Window grilles

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**Figure 1: A traditional Chinese Spring festival paper window grill styles of a girl and a tiger**


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## ABSTRACT

This project is an exploration of the possibility using 3D NPR style to express traditional Chinese Spring festival paper grilles in a modern way.

## KEYWORDS

WebGL, ThreeJS, Visualization, NPR, blender, paper cut

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# 1 INTRODUCTION

Spring festival paper window grill is an important traditional art format of Chinese culture. Nowadays, people are giving less appreciation to it. One of the reasons is that traditional window grill is usually the 2D form, which is less attractive comparing to other Varying art. This project is a after class study of 3D NPR style, and also a try on expression the traditional art.

# 2 RELATED WORK

Three.js [1] , XTK [2] .

# 3 METHOD

This project have two main challenges to deal with. 1 Make the 3D object looks always plain. To solve this, we have to make object or the scene not sensitive to the light and shows the deep. After giving some tries on basic material, tool materials and other, which receive wrong or not good effect, the best and easiest way found out to achieve this is to use only ambient Light. 2 Get Stroke effect on the 3D model. In this project, I figure out 2 ways to achieve this. The first one is directly rewrite material shader, this method works well when I test on low-poly objects, like knots, but have limitation on more complicated objects. The other ways is to finish the stroke effect in blender with Backside culling. The essential is similar on changing the shading of backside effect.

## 3.1 Implementation

We can rewrite the shader to get a outline material directly. As shown in the code, rewrite the material on before compile, we can change the shader and make it always shows the backside and above the object outline, which helps reducing the z-fighting. To use it, we just need to load the original object geometry twice as a group, and apply this material to one of the geometry. It is a quick way and can solve many basic object.

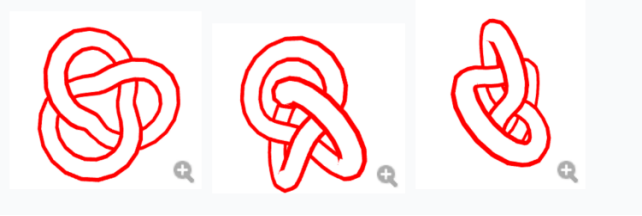

**Figure 2: hading effect on knots.**

```
const material1  = new THREE.MeshToonMaterial({
  color: 0xff0000,
  side: THREE.BackSide
 });
material1.onBeforeCompile = (shader) => {
  const token = '#include <begin_vertex>'
  const customTransform =
  ` vec3 transformed = position + objectNormal*0.8; `
    shader.vertexShader =
    shader.vertexShader.replace(token,customTransform)
}
```

## 3.2 Milestones

*3.2.1 Milestone 1.* Find out how to achieve a stable outline effect

*3.2.2 Milestone 2.* Find out how to achieve the flat effect.

*3.2.3 Milestone 3.* Making a proper model which is related to tiger spring festival, and also have good outline works with the outline requirement.

## 3.3 Challenges

Describe the challenges you faced.

- Challenge 1: The most challenging part for me is the how to achieve the outline effect. At first I am not sure how to make this. I had some tried on others' Ready-to-use vertex Shader for animation NPR or outline demo, and most of them turns out either not the effect I need for the window grilles(and also too complicated for me at present), or only behave well on typical outline like circle and straight lines. And there was also another issue is that the 3d effect would shows different on diff erect platform as they might have different renderer, and I am not sure which could be also shows on three js. My windows original 3d viewer made me almost miss the present final solution, because it shows the outline turns into transparent.
- Challenge 2: Getting the model is also a challenge, as I need to make it myself, I am not expert on making model, and the model need to have some festival element(I choose tiger as the tiger new year is coming). And we have pay attention to the outline during modeling, because the outline still effect how the Stroke effect works, we still need to avoid the complicate outline, and the stroke effect might lose some feature of the ordinal model: as in this project, the tiger in fixed model still looks like a pig.

# 4 RESULTS

Finally we can get the 3D shape window grill view on website format. Comparing to the traditional paper window grilles, this 3D experiment show that we can achieve the decoration art format, while show more shape. From any angle, the model always looks like a plain paper cut. As show below,We can even get the FU(lucky) and the SHOU(long live) Chinese words on one paper cut while assert on different side getting different pattern.

# 5 CONCLUSIONS

To conclude this project, I have to admit it does not process successfully, as I pick the project wrongly, getting too many technique which I am not very familiar with involve in it. Many things I got to learnt at once while making the project. If I start over this, I would probably choose a project that mix what we learnt on class and practice them. But it is still fun and I learnt a lot during the dash of finishing project. I learnt some about NPR, which I have been interested in; and learnt that to handle the graphic issue, I got to

**Figure 3: Paper cut effect from any angle.**

learnt deep into the shading, renderer and other math part. I also level up my blender skill in a short time. Glad to have this class and the final project!

## REFERENCES

[1] Ricardo Cabello et al. 2010. Three.js. *URL: https://github. com/mrdoob/three.js* (2010).

[2] Daniel Haehn, Nicolas Rannou, Banu Ahtam, P. Ellen Grant, and Rudolph Pienaar. 2012. Neuroimaging in the Browser using the X Toolkit. *Frontiers in Neuroinformatics* (2012).