Nick Forester
CMPM 163
3/4/2018

Part C: Interior Mapping

The group that I am working with consists of Sam Barish, Eduardo Gaona, Shawn Edmond, and myself. The subject that we will be working on is Interior Mapping. I had never heard of interior mapping until I saw a post on Stack Exchange which linked me to http://interiormapping.oogst3d.net/. The practice was thought up by Joost van Dongen in the last decade, and the premise is to texture interiors of buildings through shaders alone. In huge open world games like Grand Theft Auto V, lots of city buildings fill up the horizon. Most of these buildings don't have any visible interiors, even when looking closely. Interior mapping is a technique that could allow for the interiors to be rendered in without the need for any geometry.

There is a paper describing the practice written by Joost van Dongen. To render interiors of buildings, the first step is to decide which floor of the building is being drawn. Horizontal planes on the xz axis can be placed on each floor of the building a fixed distance apart. For each pixel, a ray can be drawn from the camera to the pixel, seeing which plane this ray intersects with first. If this ray is angled downwards then this is a floor, and if it is angled upwards it is a ceiling. Then the xz coordinates of the intersection point can be used as uv coordinates for a lookup texture. A similar process can be repeated for the walls using xy and yz planes. The closest intersecting plane is used for the texture lookup. This can be combined with the outside building texture by using a diffuse texture storing window locations with alpha values of 1. This way the outside building will be rendered everywhere except windows, where the interior textures will be rendered.

Complexity can be added to the interior rooms by use of what van Dongen calls the furniture plane. This is a plane parallel to the surface of the building that has been translated slightly into the building such that it is parallel with the back wall from whichever perspective the camera is looking. If the intersection with the furniture plane is closer than the intersection with any other plane, then the pixel describes some part of the middle of the interior, so auxiliary textures like furniture or people can be drawn there. The textures drawn to the furniture plane can be animated to make the rooms seem livelier. Below I will link several pictures showcasing different types of interior mapping.

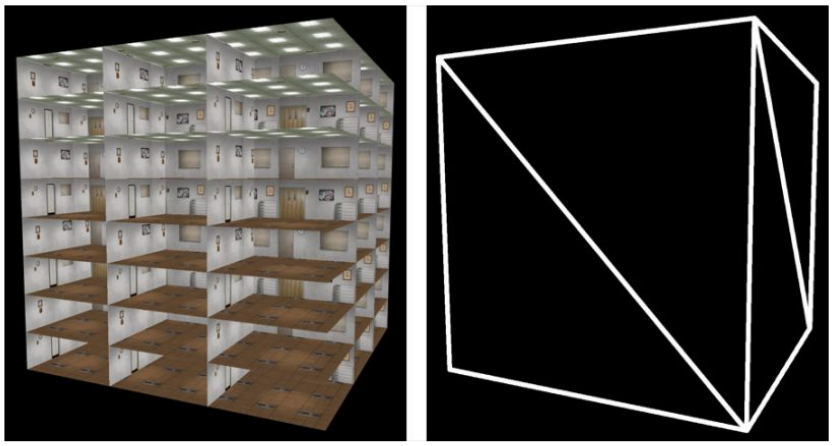

Fig. 3 The result of calculating ceilings, floors and walls with Interior Mapping. The geometry of this building consists of a single cube, as is shown in the wireframe image of the same building to the right.

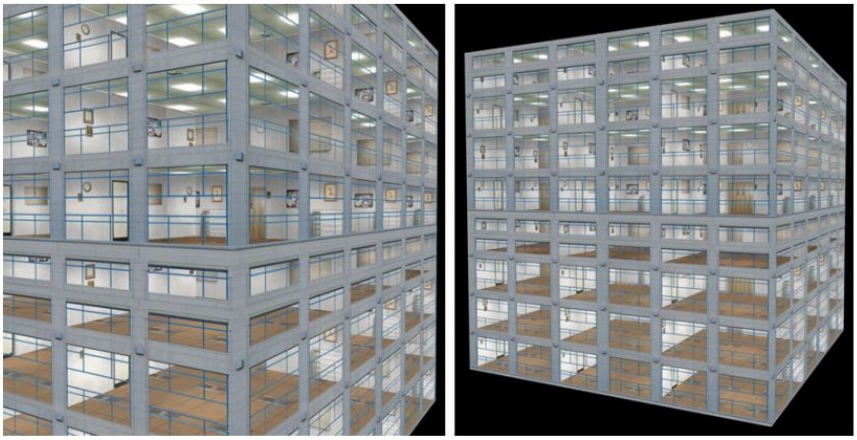

Fig. 5 Interior Mapping combined with an exterior texture and a reflection map. The reflection is made very subtle here to emphasise the effect of the Interior Mapping.

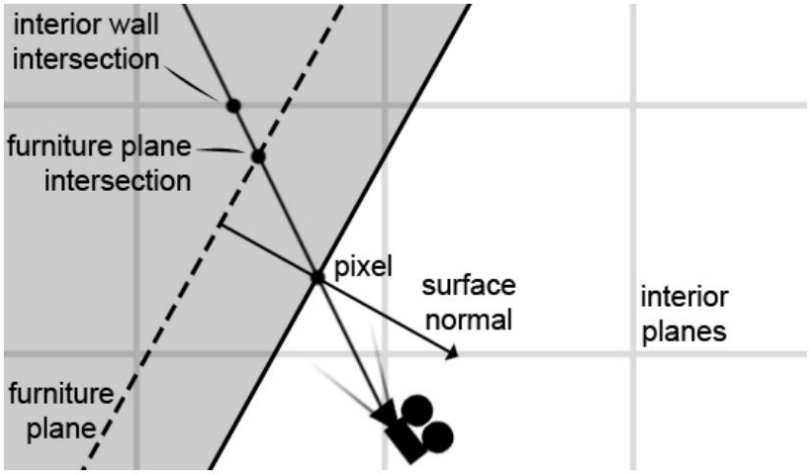

Fig. 6 The furniture plane is parallel to the actual surface of the object. The ray from the camera is intersected with both the furniture plane and the interior planes. In this example, the intersection of the ray with the furniture plane is closer than the intersection of the ray with the interior wall, so the furniture plane is visible.

Fig. 7 An example of characters inside a room, made with a furniture plane.