CS559 Lecture 19-20: More Texture

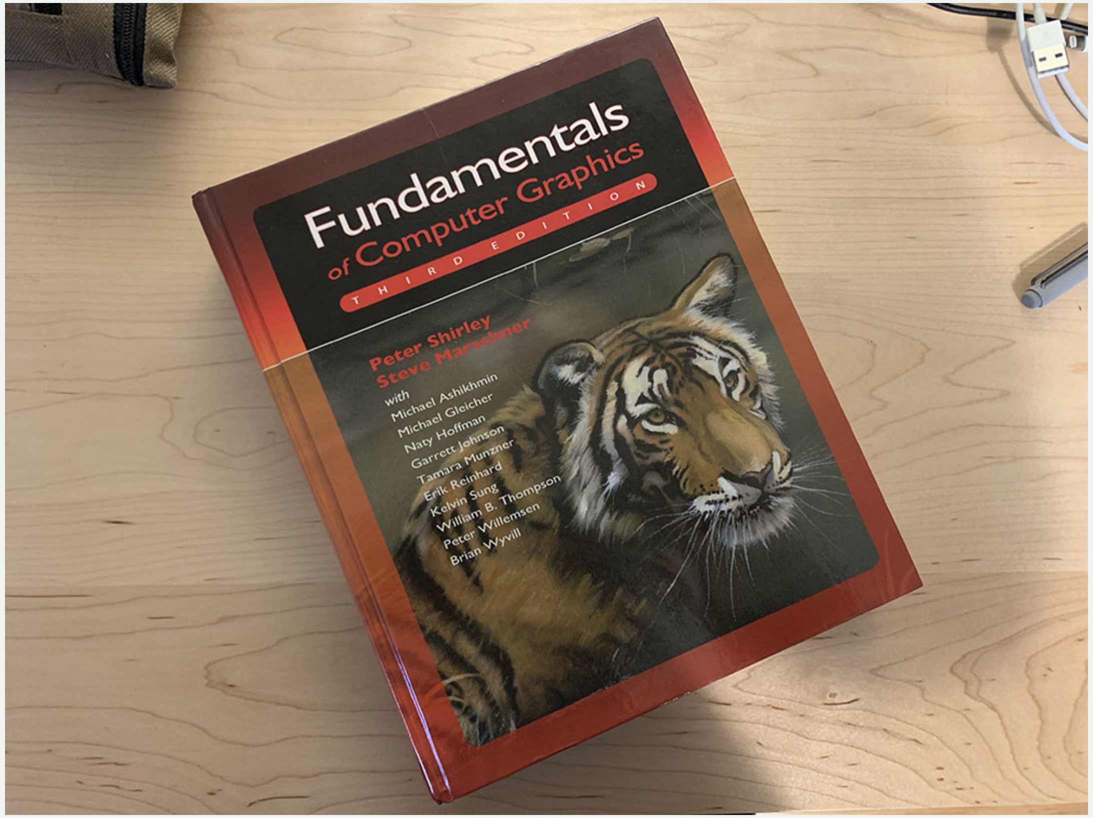
Part 3 - Other Things to Do With Textures

A few smaller topics...

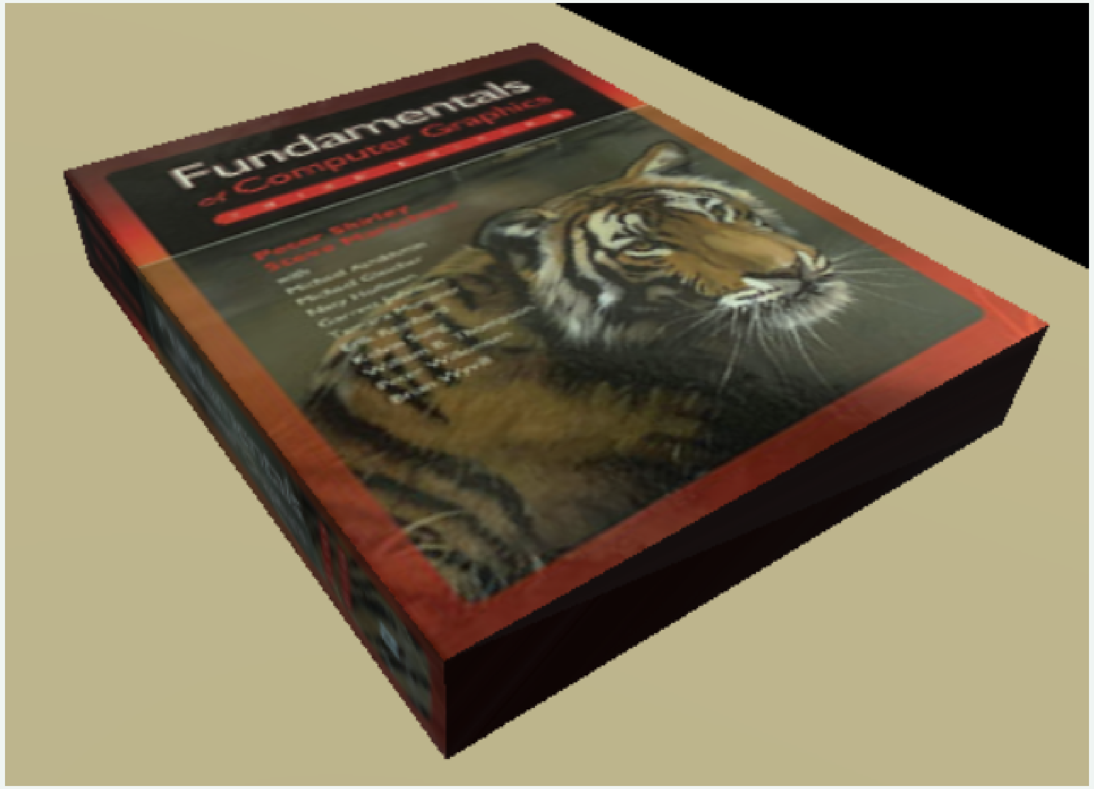
- dealing with patterns
- layering
- "baked in" lighting
- ambient occlusion
- solid tectures

Still more to do...

Real objects are interesting



Still need the wood, the lights, ...



Let's make woodgrain!

Find a texture on the web:

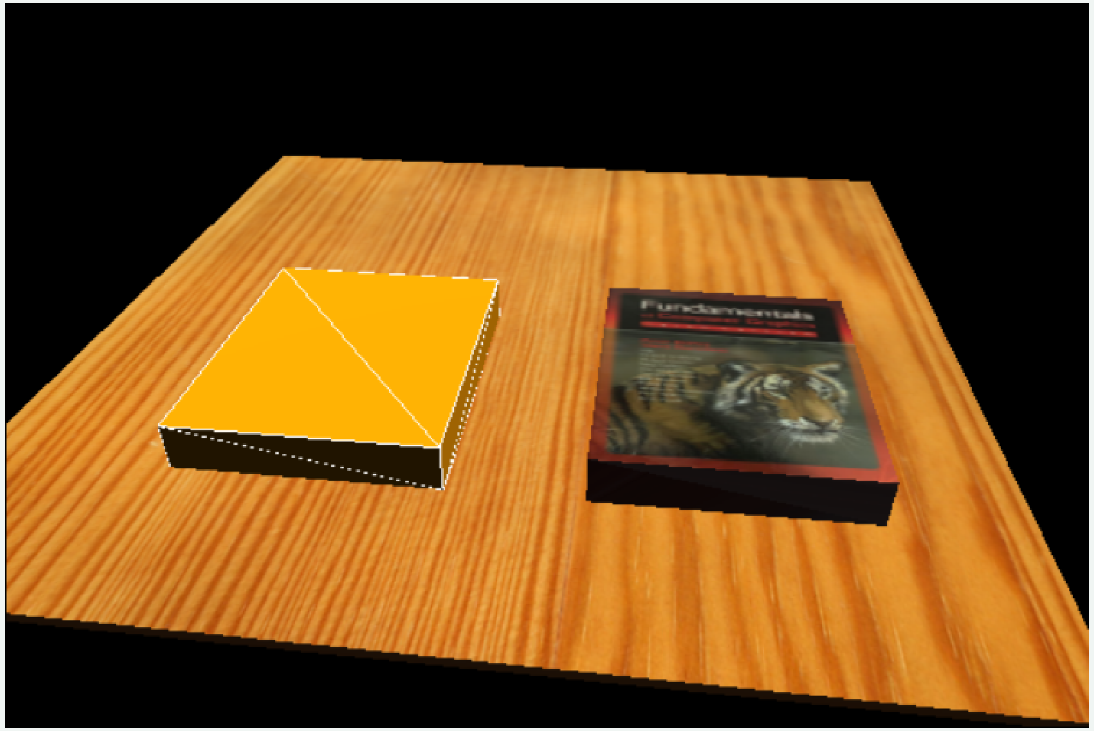
https://freestocktextures.com/texture/wood-board-wood-grain,78.html

A usable texture?

Needs to be a square

Apply it to the table...

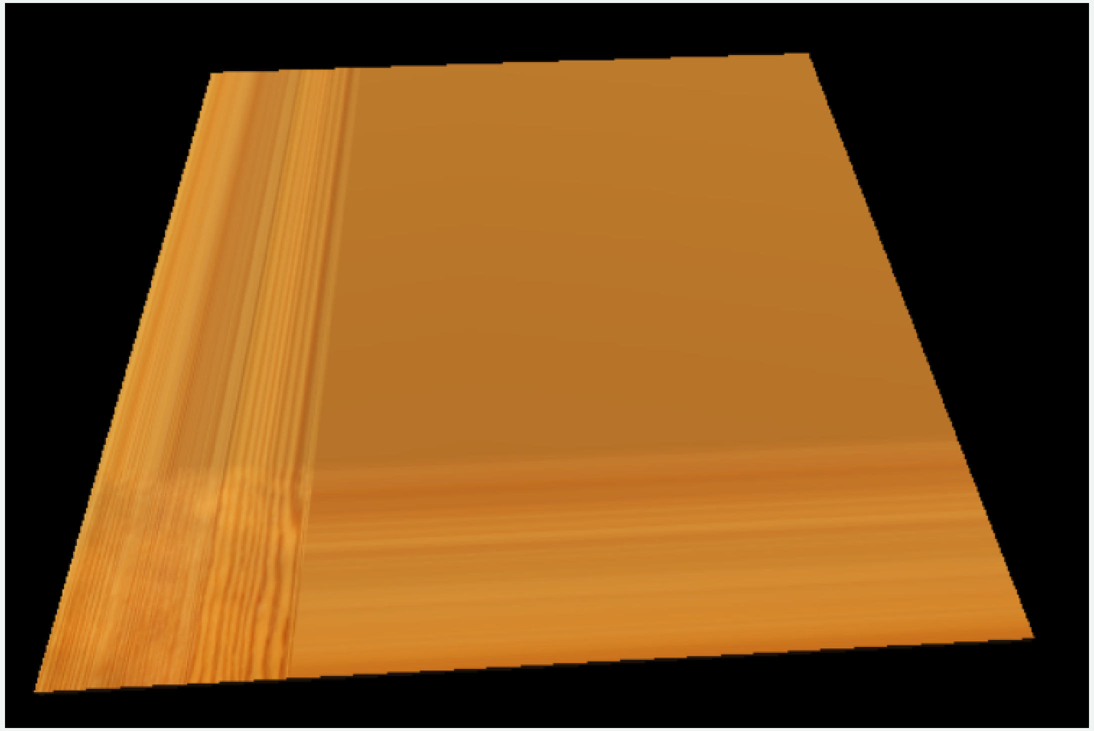
Giant Wood Grain



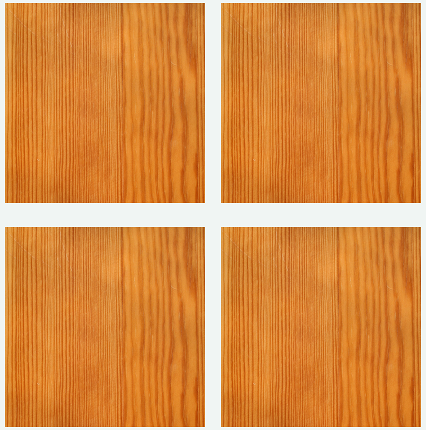
Scaling

U,V values beyond 1

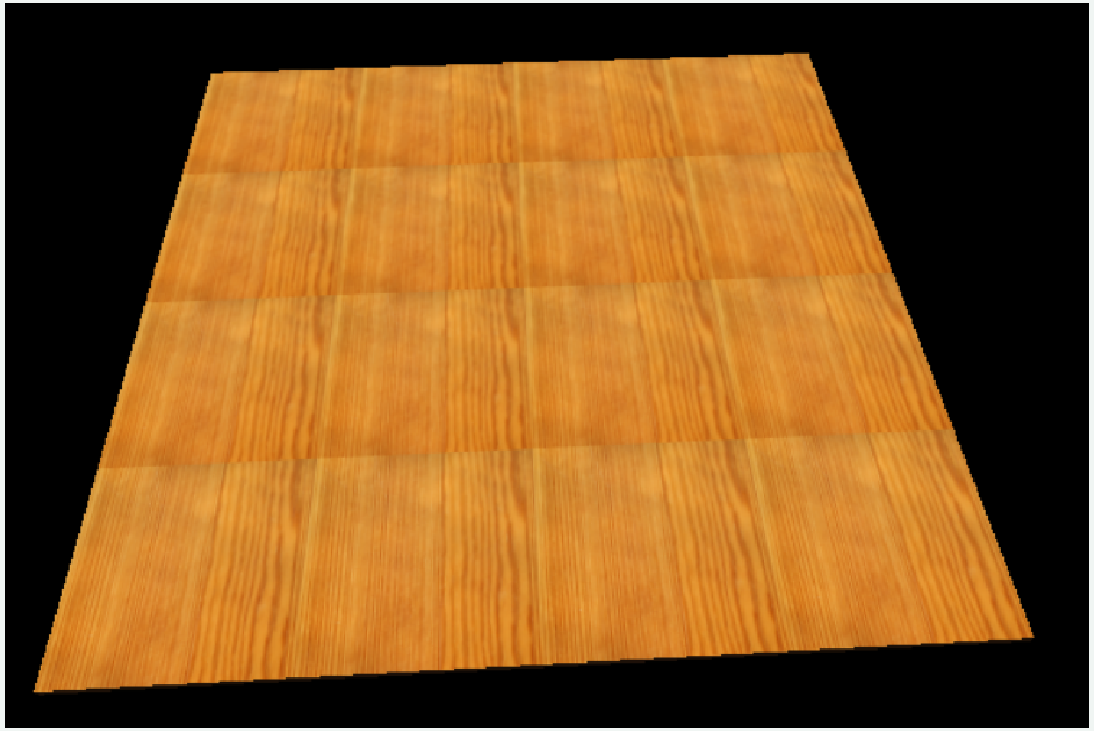
Clamping



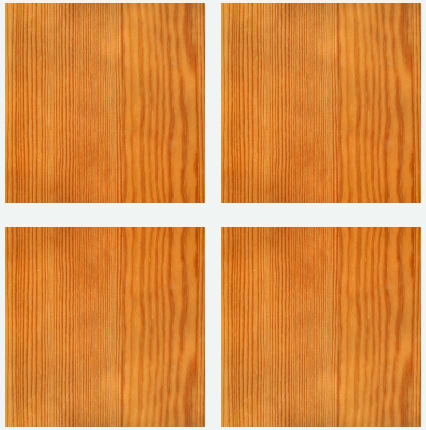
Repeat (tiles)



The edges need to fit together

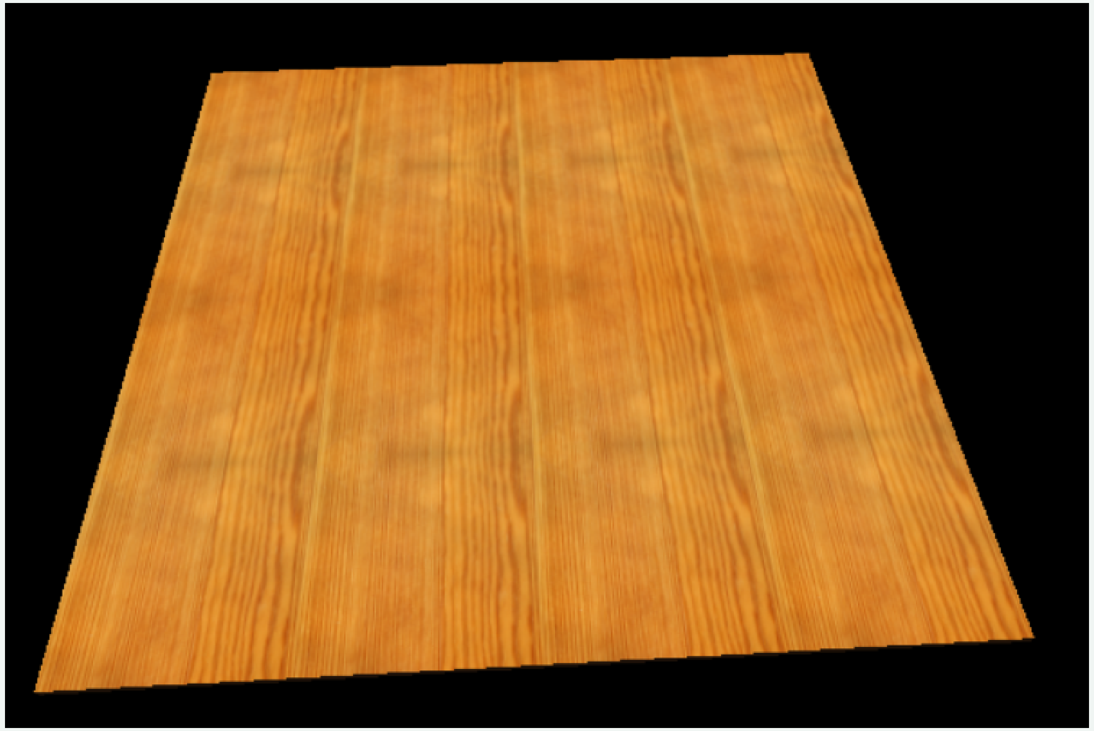


Mirror (tiles)



This only flipped Y

Sometimes called **bookmatching**



In THREE.JS

Of course, they make it easy!

You can specify UV values that you like on objects.

Or (if you are stuck with primitives with U,V in [0,1])

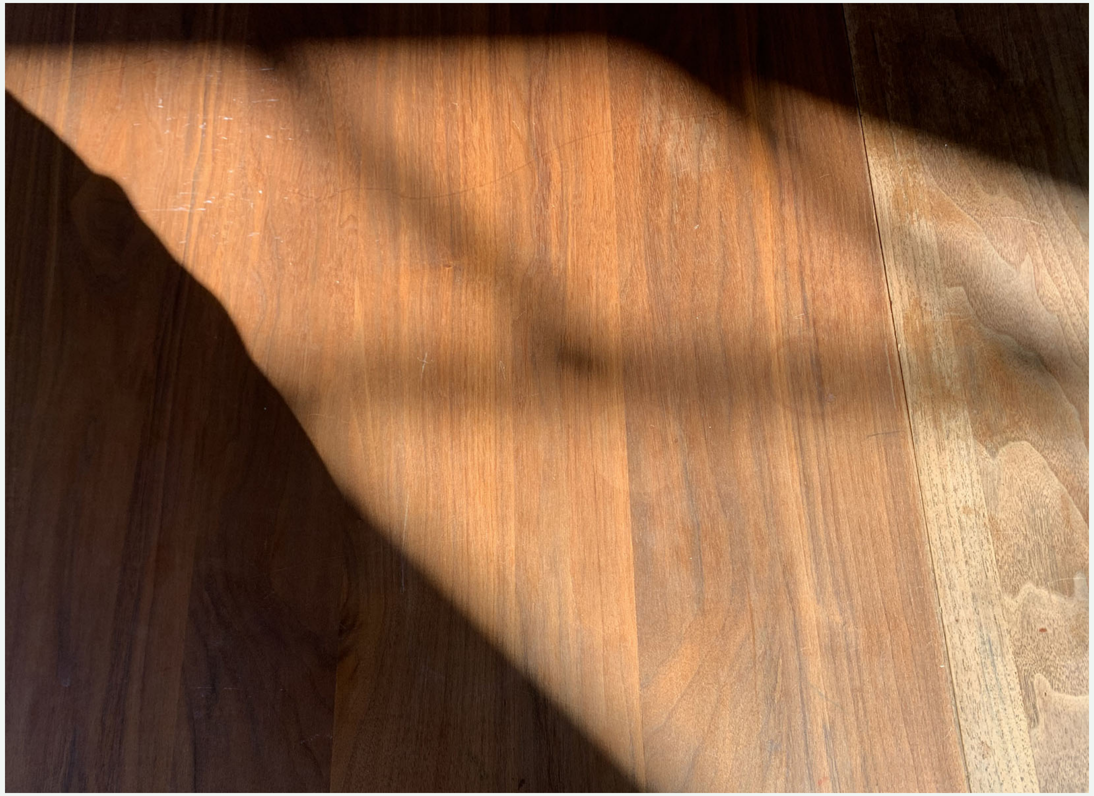
```
texture.repeat.set(x,y);

texture.wrapS = T.RepeatWrapping; // or T.ClampToEdgeWrapping
texture.wrapT = T.MirroredRepeatWrapping;
texture.needsUpdate = true;
```

But I want my walnut table!

A Real Photograph can have:

- Not aligned correctly

- Highlights (lighting)
- Shadows (lighting)
- Dirt / Imperfections



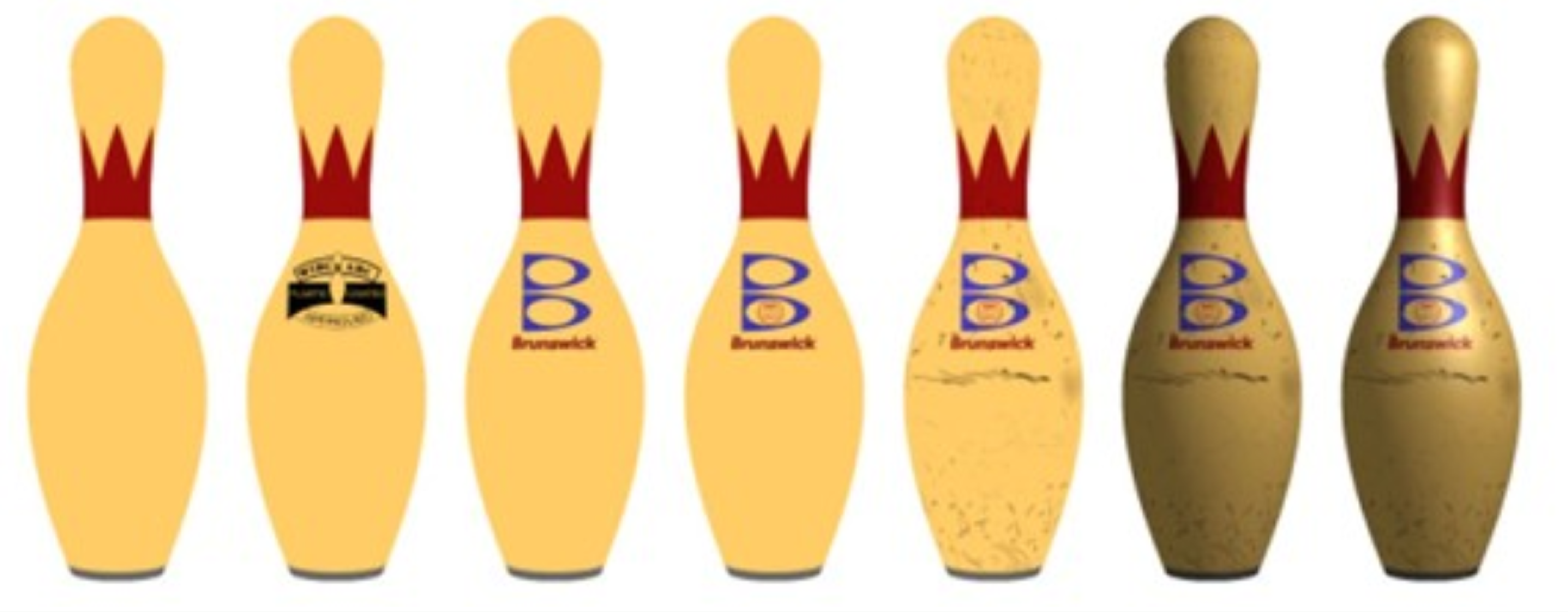
Maybe this is a feature?

Use textures to get the complexity of the world!

- Dirt and small details

- Capture Lighting Effects that we can't easily make

Layered Textures (Multi-Texture)



(old pixar example)

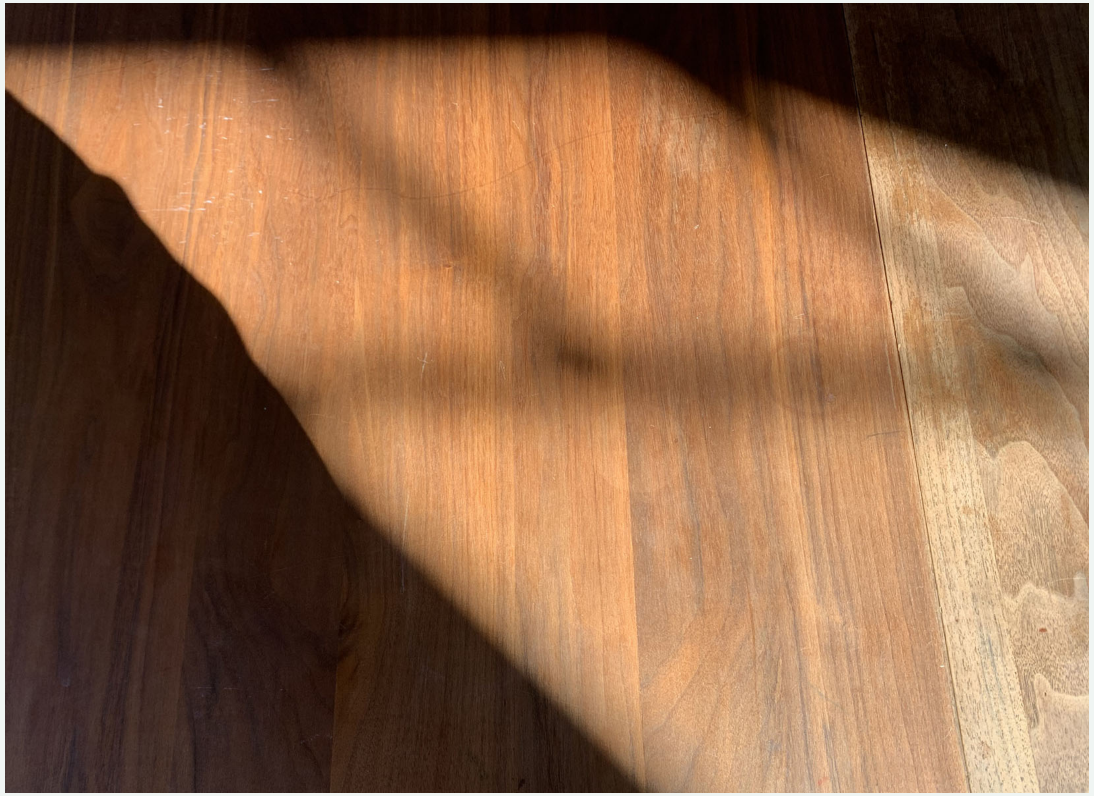
Combine...

Use multiple textures

1. need different U,V values for each one
2. need to blend colors together
3. need to choose textures that work together

In THREE #1 is what layers are for, #2 is not built in

Light Maps



Put lighting into the texture

Good:

- can be as fancy as you like
- pre-computed!

Bad:

- lighting must be known ahead
- can't change
  - camera moves
  - objects move

A Special Kind of Pre-Computed Light

Self shadowing

- important for conveying shape

Pretend light comes from all directions

- like ambient lighting

Amount each point is "visible"

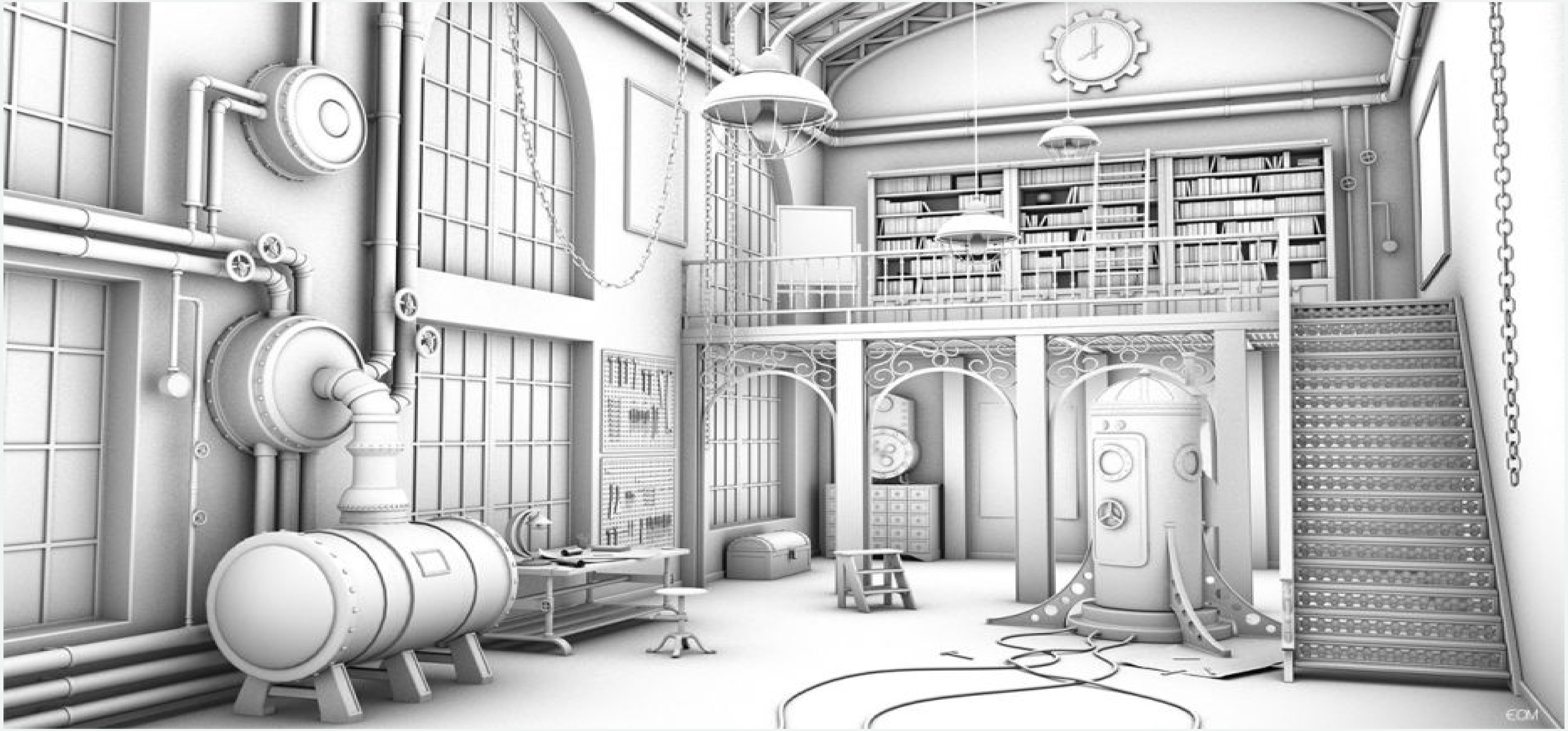
Corners and crevices are dark

Ambient Occlusion Shading

Pre-compute for all points

- use special tools
- or clever hacks

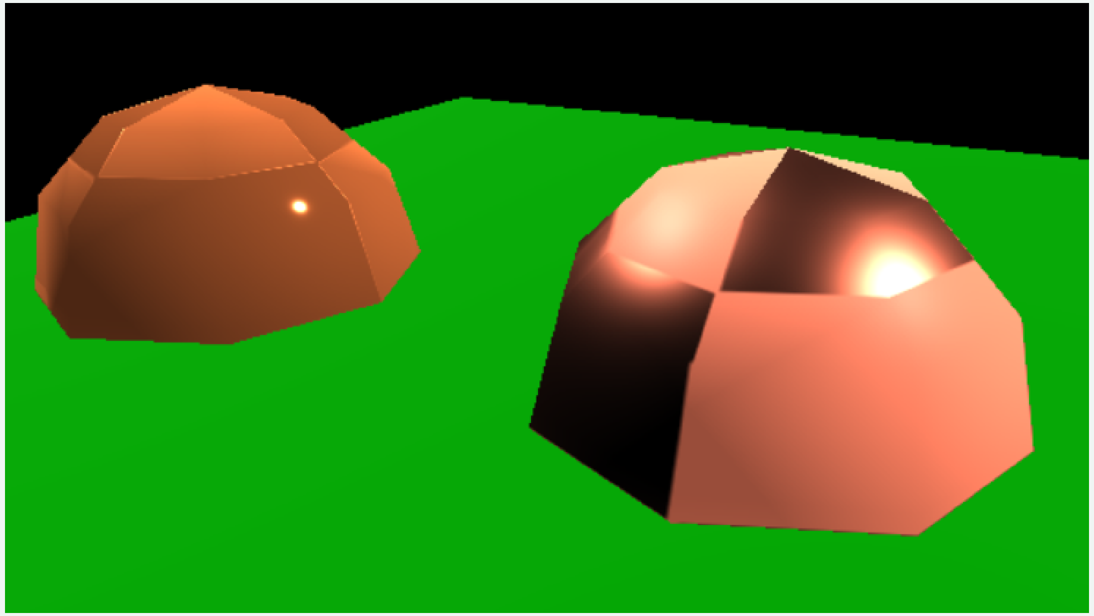
Used like a light-map



https://vr.arvilab.com/blog/ambient-occlusion

What to change with texture?

- Colors
- Normals
- Other Material properties



Thinking about texture...

Each pixel has a (u,v)

Some function

(u,v) -> (r,g,b)

We can write **procedural textures** to define the texture functions

(coming in a few weeks)

Solid Textures

Points have 3D coordinates

Look up values in 3D

Useful for 3D materials

- wood
- stone

Like carving the object out of material

Summary

- Texture Scaling, Wrapping, Wrapping Modes
- Layer Textures for Other Effects
- Light Maps for pre-computed "baked in" lights
- Ambient Occlusion to get cool effects
- Procedural and Solid Textures in the future

Next: using other ways to generate coordinates to get lighting