Texture Lectures 2022

These are taken from 2020

You should watch 19-1 (the first part of the second lecture first)

It was meant as a review - but its a good intro

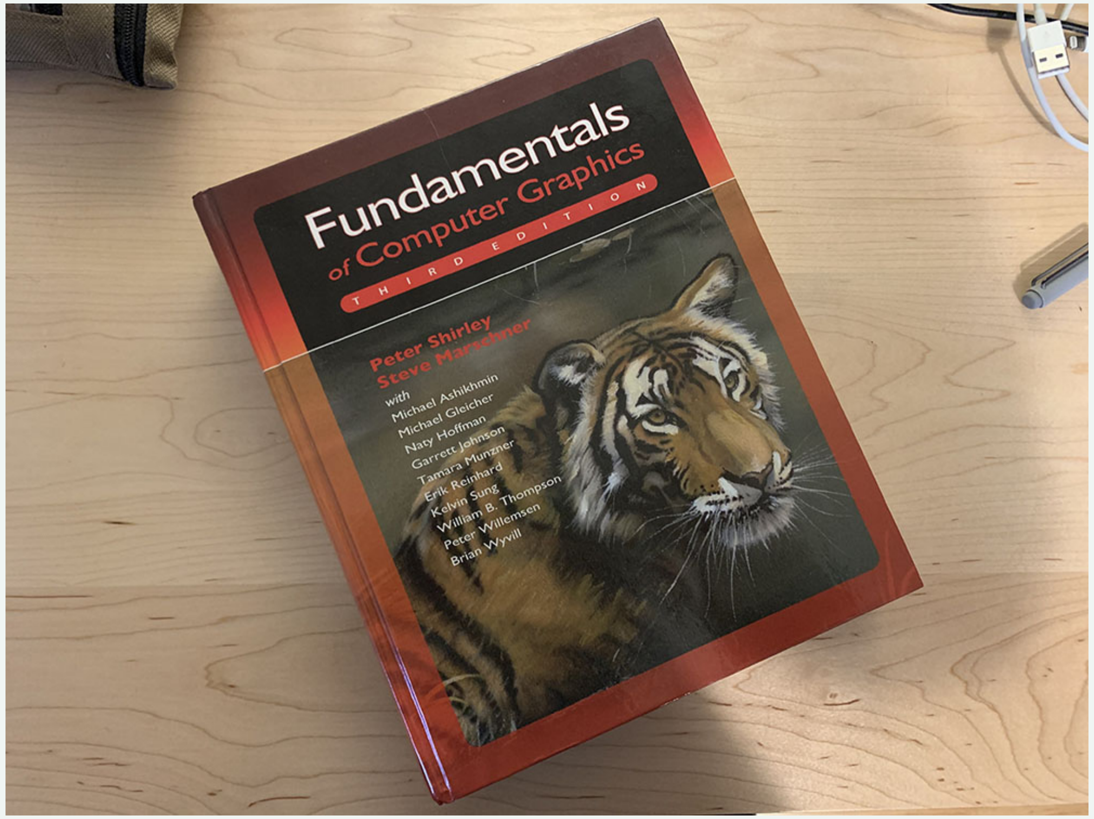
CS559 Lecture 19-20: More Texture

Part 1: Basic Texture Review

Motivation and Review

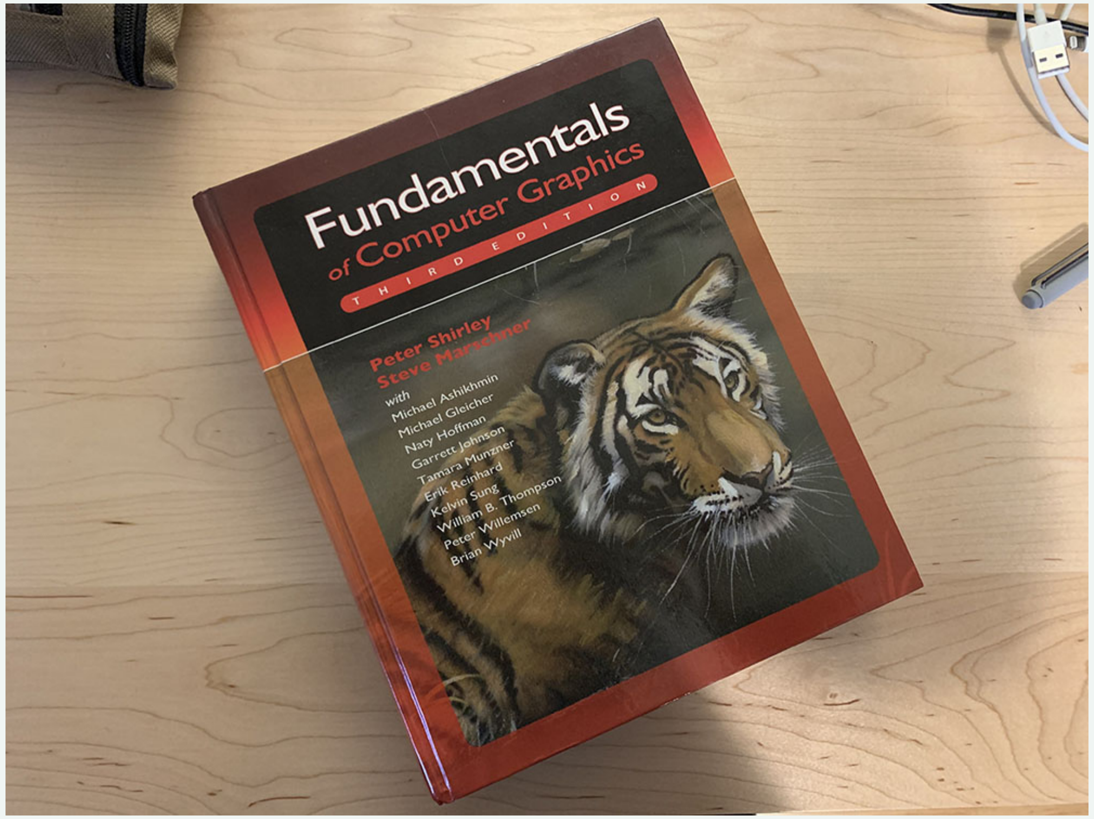
Why Basic Textures?

Because real objects are interesting

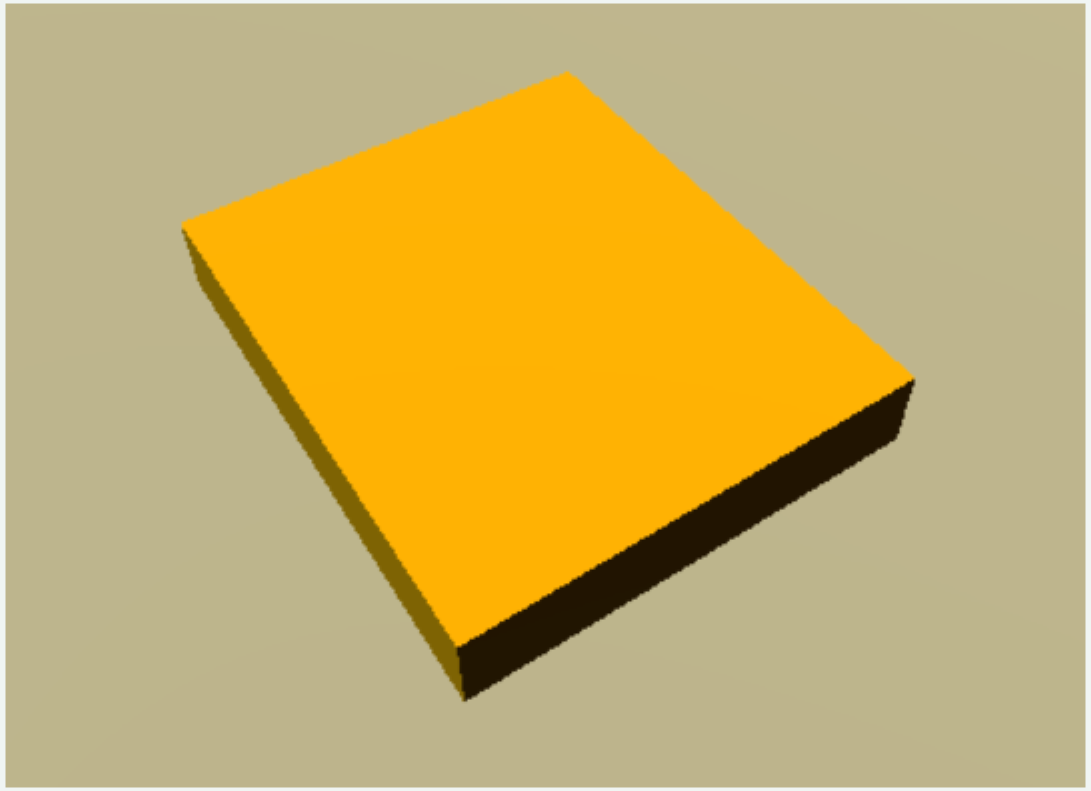


Why Basic Textures?

Real objects are interesting

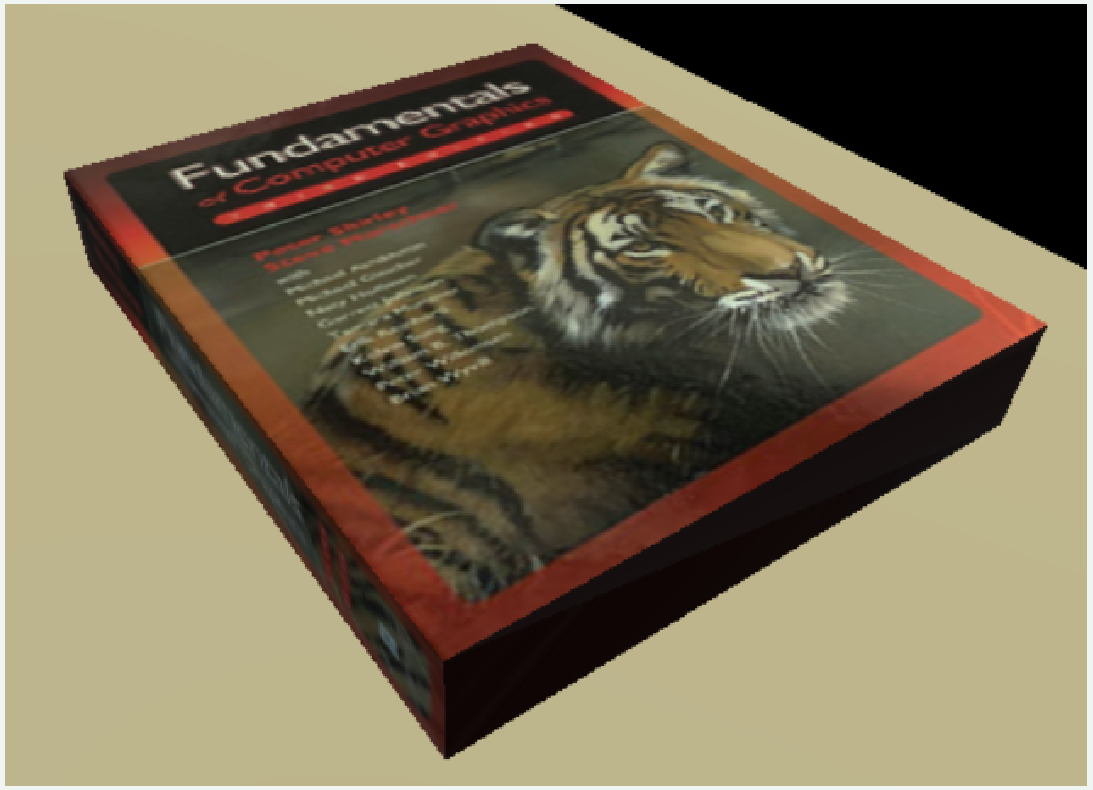


Computer Graphics can be boring...

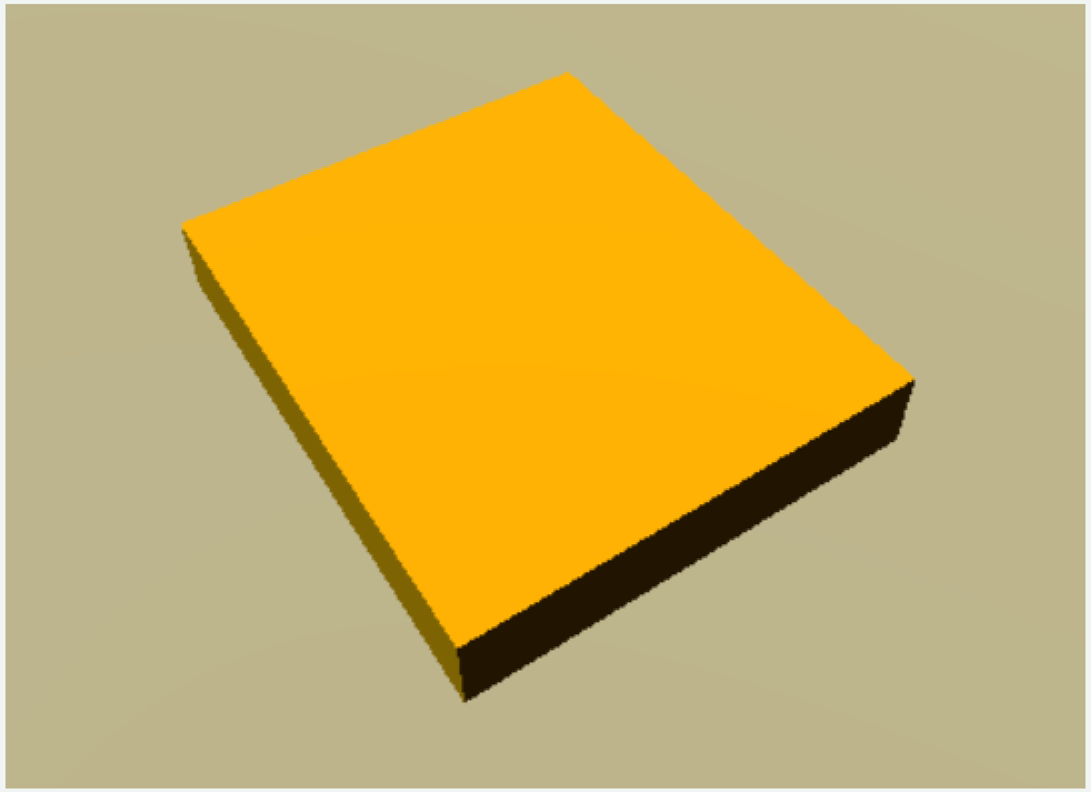


Why Basic Textures?

Even Colors can Help

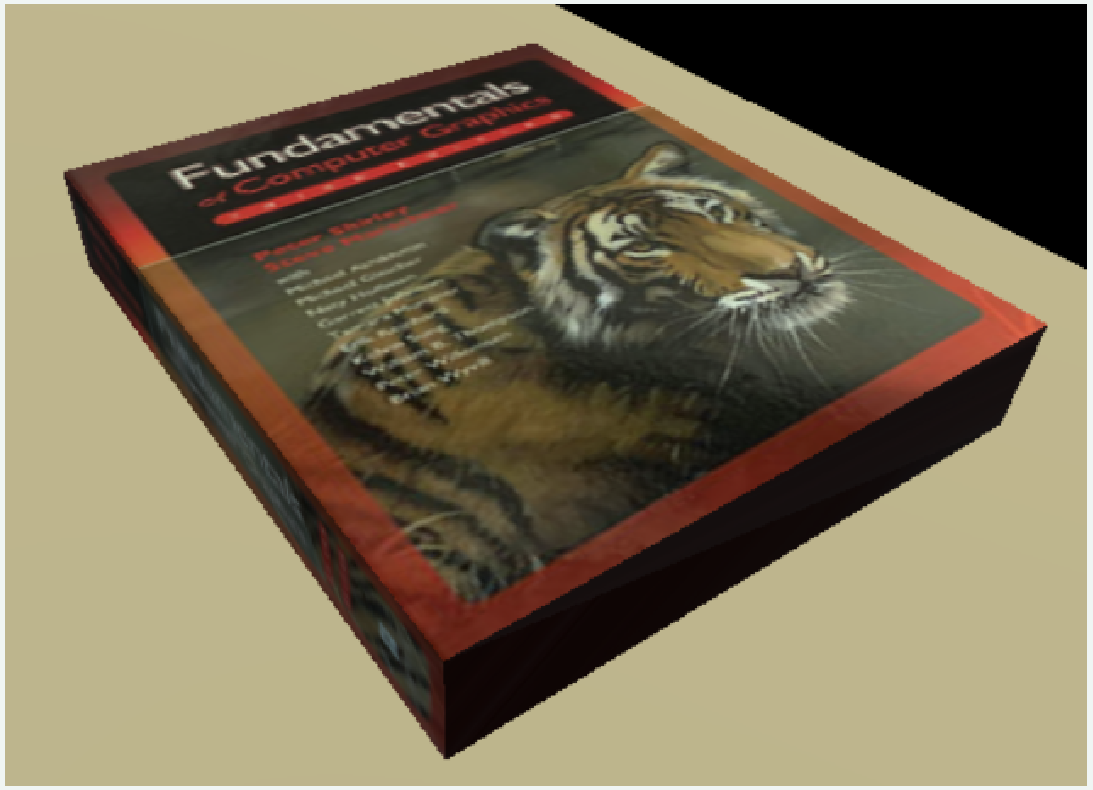


Computer Graphics can be boring...

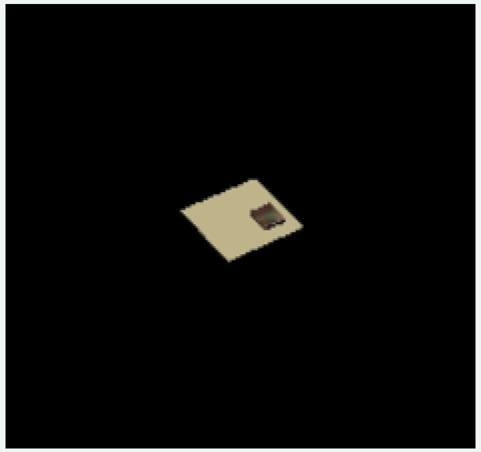


But Why Textures?

Even Colors can Help



- Easy to get image
- Hard to model detals
- Easy to make simple geometry
- Proper sampling

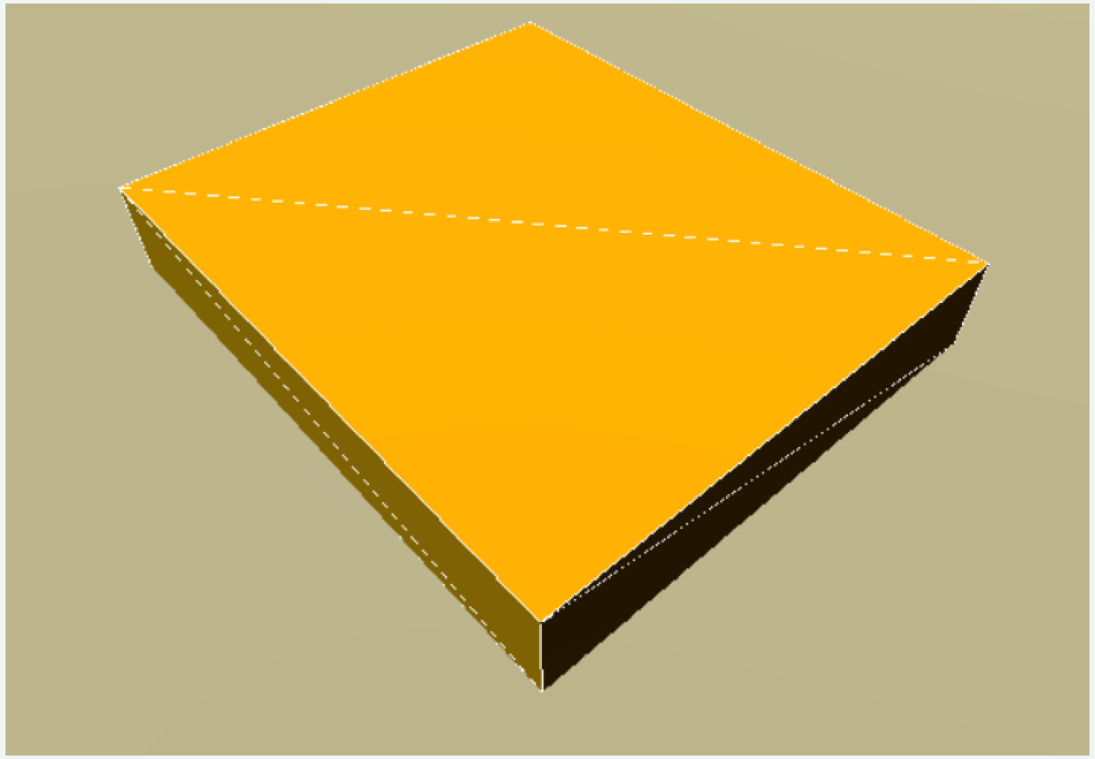


How To Do Basic Textures?

1. Make Some Geometry
2. Get a Picture
3. Get the picture in the right form
4. Assign UV values to vertices
5. Enable Texturing

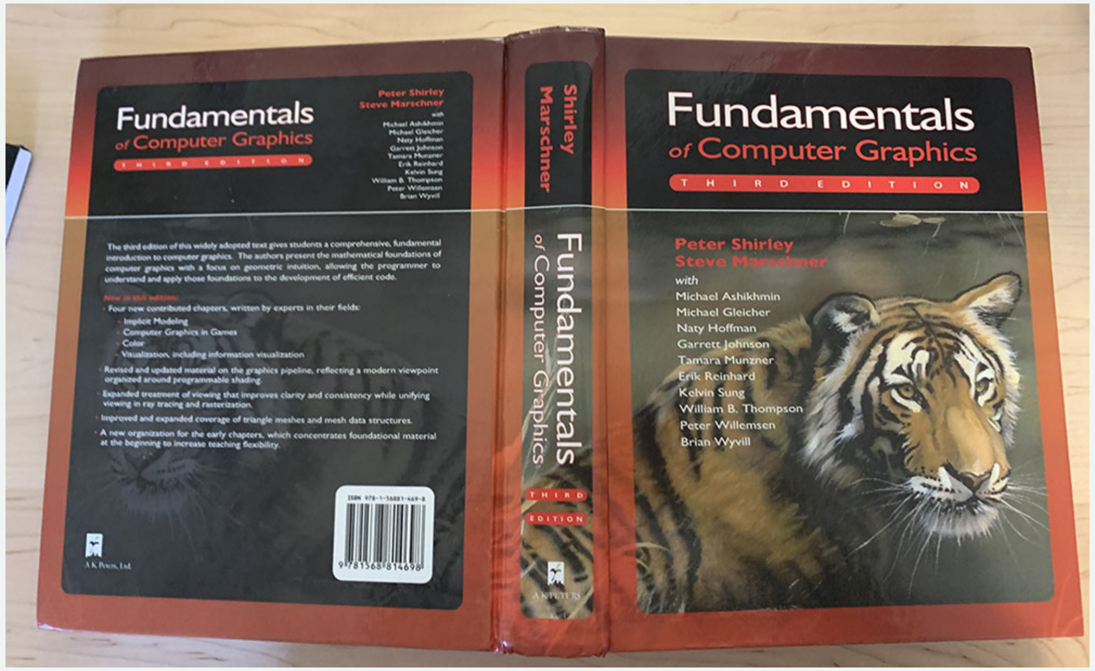
Geometry

1. **Make Some Geometry**
2. Get a Picture
3. Get the picture in the right form
4. Assign UV values to vertices
5. Enable Texturing



A Picture

1. Make Some Geometry
2. **Get a Picture**
3. Get the picture in the right form
4. Assign UV values to vertices
5. Enable Texturing

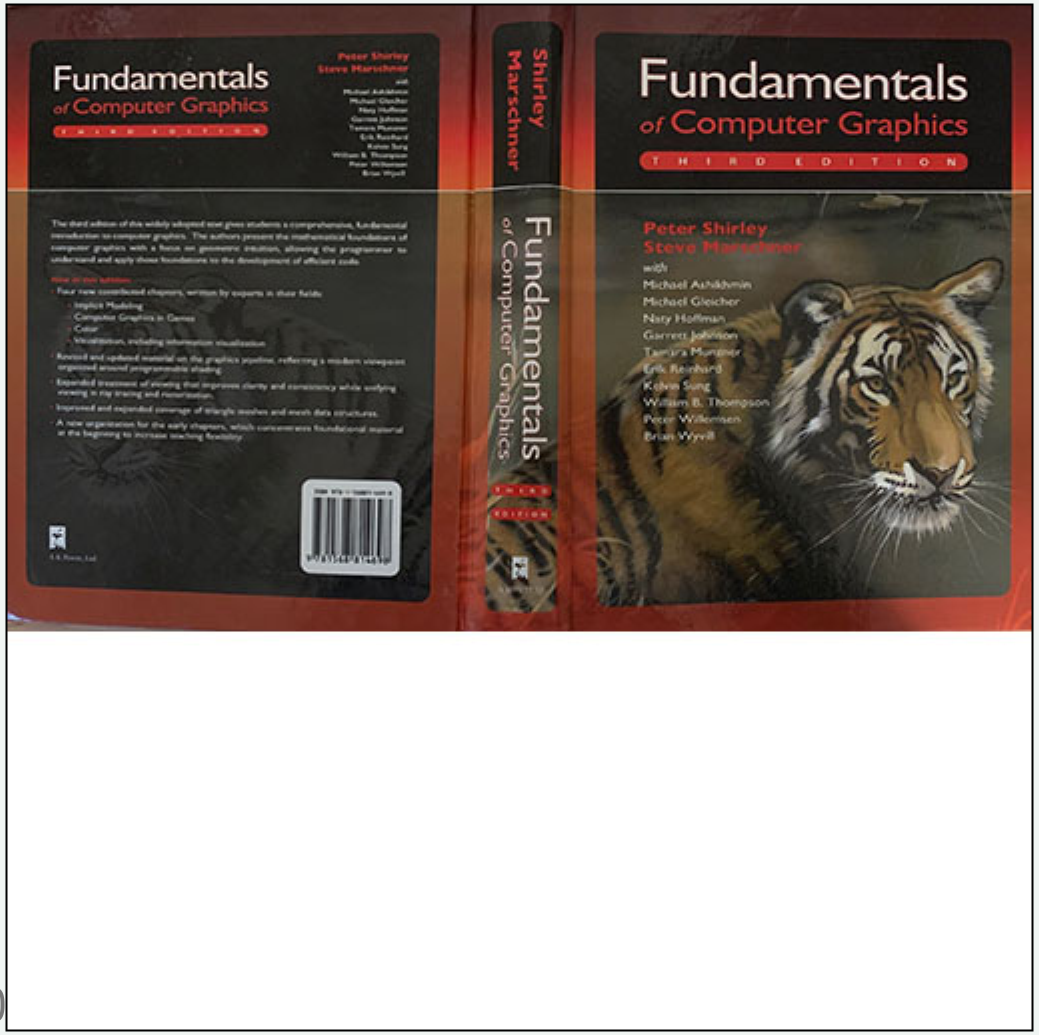


Can paint it yourself

Need to get things to match simple geometry

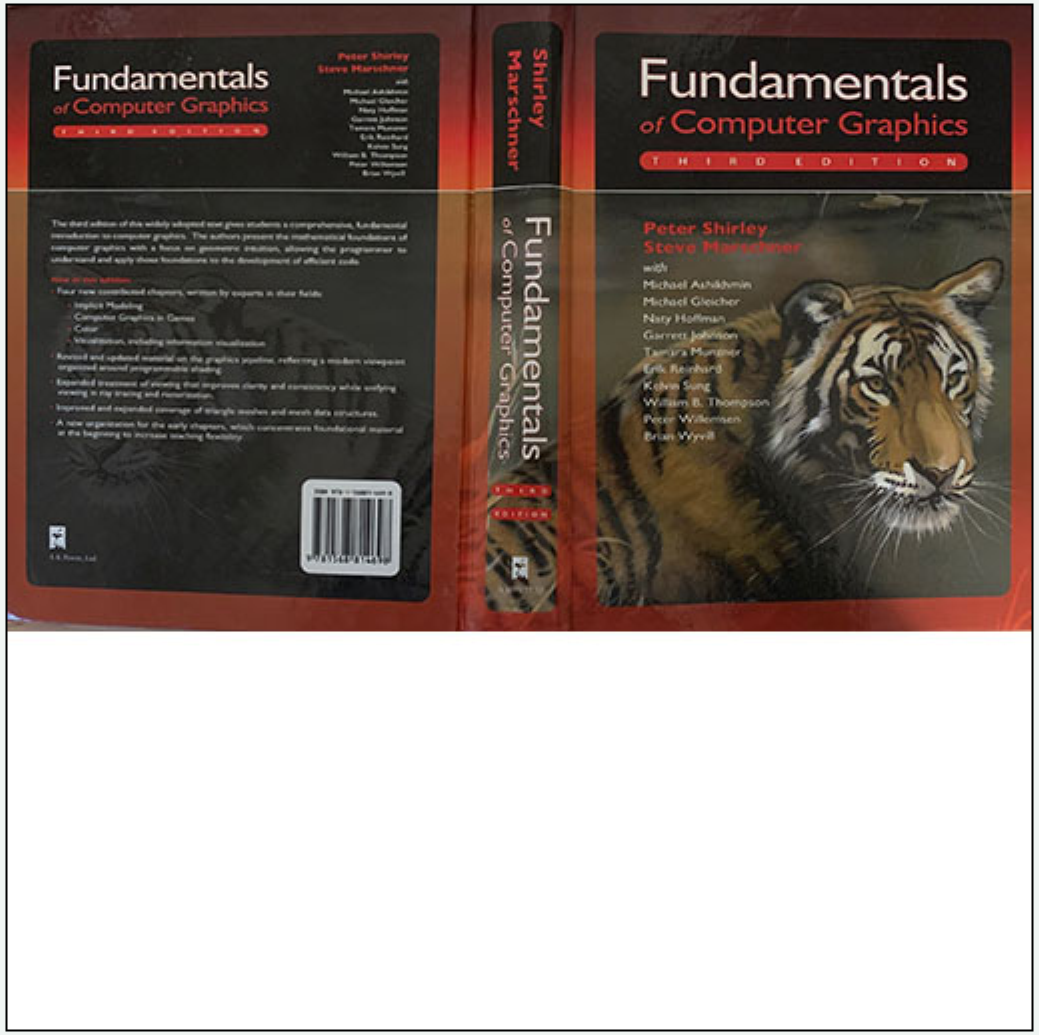
Process the Picture

1. Make Some Geometry
2. Get a Picture
3. **Get the picture in the right form**
4. Assign UV values to vertices
5. Enable Texturing



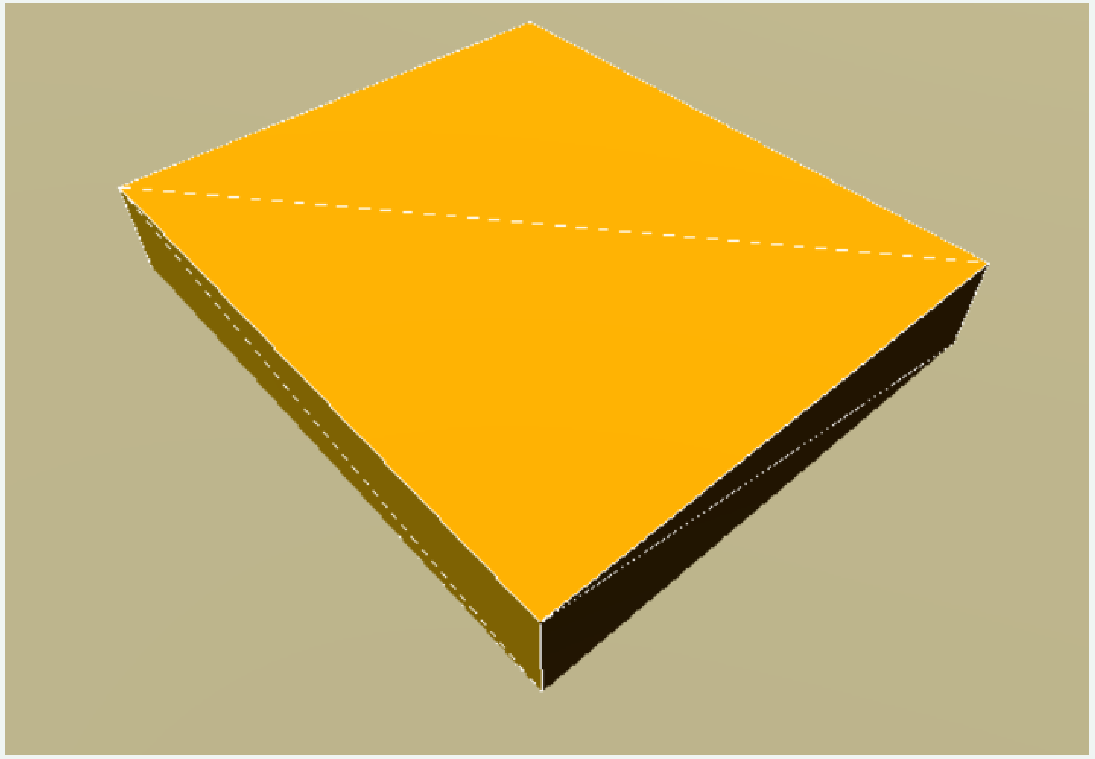
What do we need from a texture?

1. Square
2. Matches Simple Geometry
3. Minimal lighting
4. Put lots of parts in one image

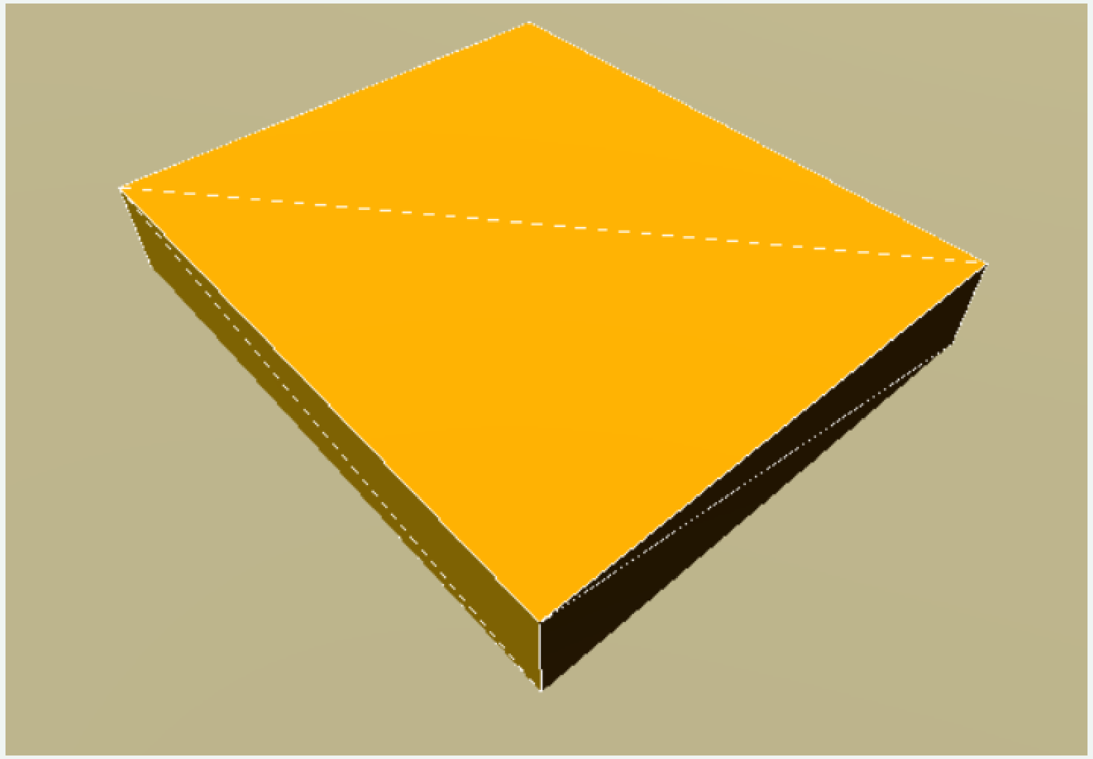


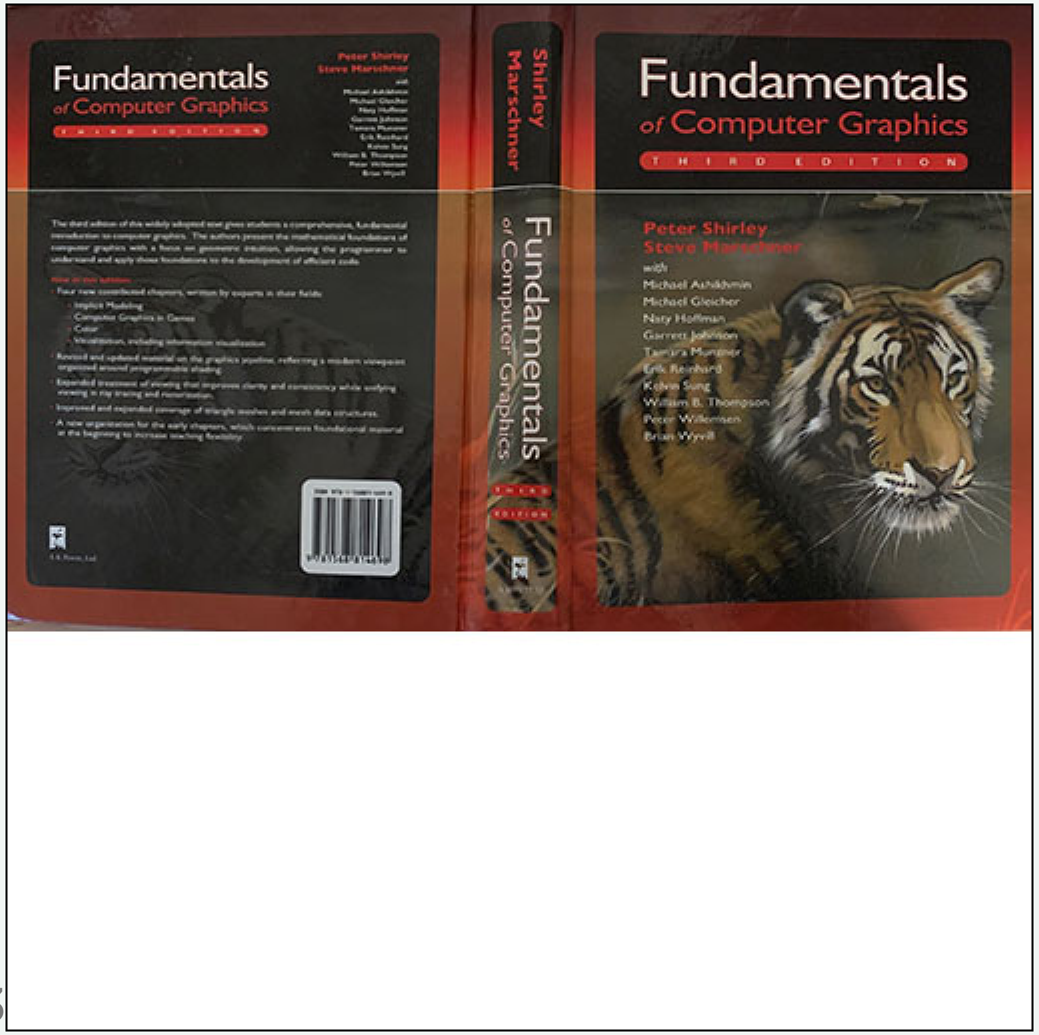
Getting those UV Values…

1. Make Some Geometry
2. Get a Picture
3. Get the picture in the right form
4. **Assign UV values to vertices**
5. Enable Texturing



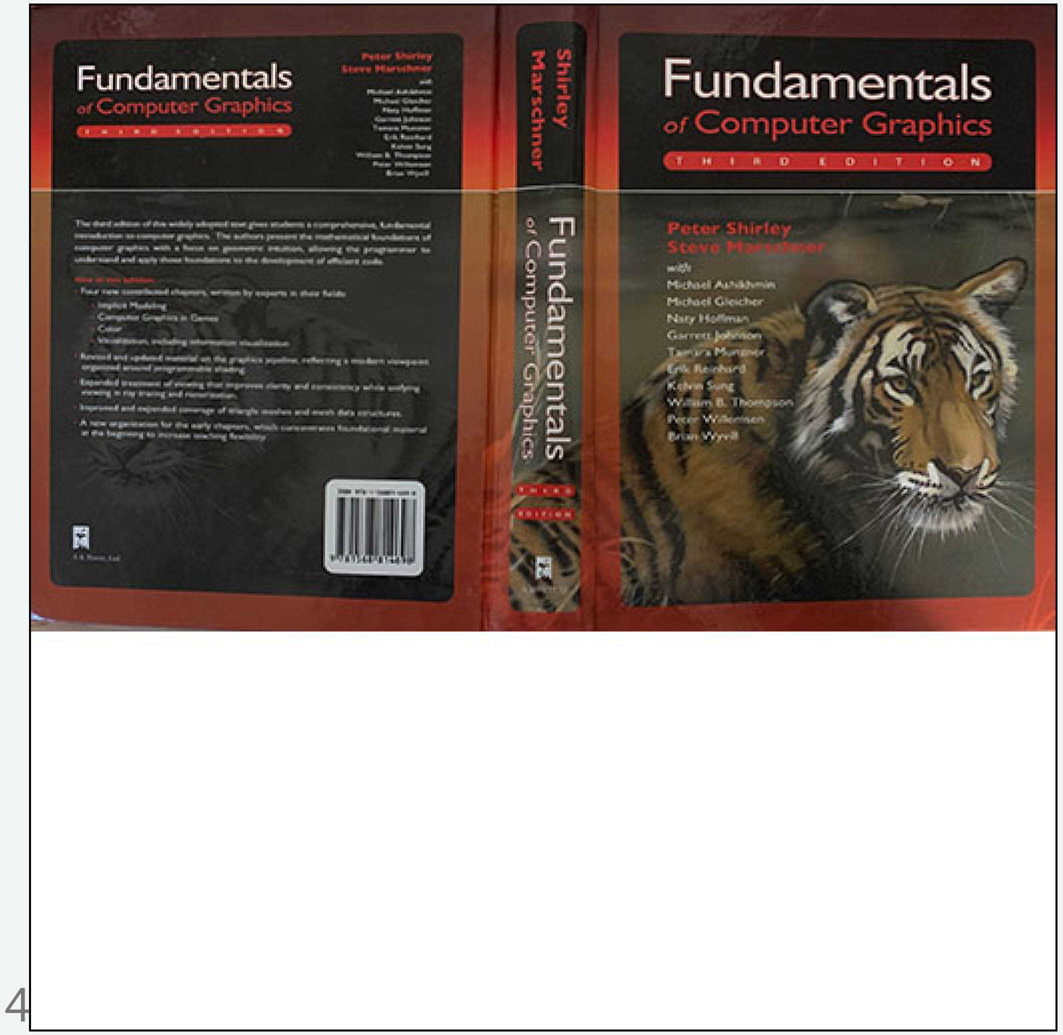
Finding UVs




Fundamentals of Computer Graphics
THIRD EDITION
Peter Shirley
Steve Marschner
with
Michael Ashikhmin
Michael Gleicher
Naty Hoffman
Garrett Johnson
Tamara Munzner
Erik Reinhard
Kelvin Sung
William B. Thompson
Peter Willemsen
Brian Wyvill
Shirley Marschner
Fundamentals of Computer Graphics

Assign UV values to vertices

```
const vertexUVs = [
    // bottom (back of book)
    new T.Vector2(232/512,0),
    new T.Vector2(0      ,0),
    new T.Vector2(0,      311/512),
    new T.Vector2(232/512,311/512),
    // top (front of book)
    new T.Vector2(282/512, 0),
    new T.Vector2(512/512, 0),
    new T.Vector2(512/512,311/512),
    new T.Vector2(282/512,311/512),
]
```



Put into the (weird) THREE structures

```
const vertexUVs = [
    // bottom (back of book)
    new T.Vector2(232/512,0),
    new T.Vector2(0      ,0),
    new T.Vector2(0,      311/512),
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    // top (front of book)
    new T.Vector2(282/512, 0),
    new T.Vector2(512/512, 0),
    new T.Vector2(512/512,311/512),
    new T.Vector2(282/512,311/512),
]
```
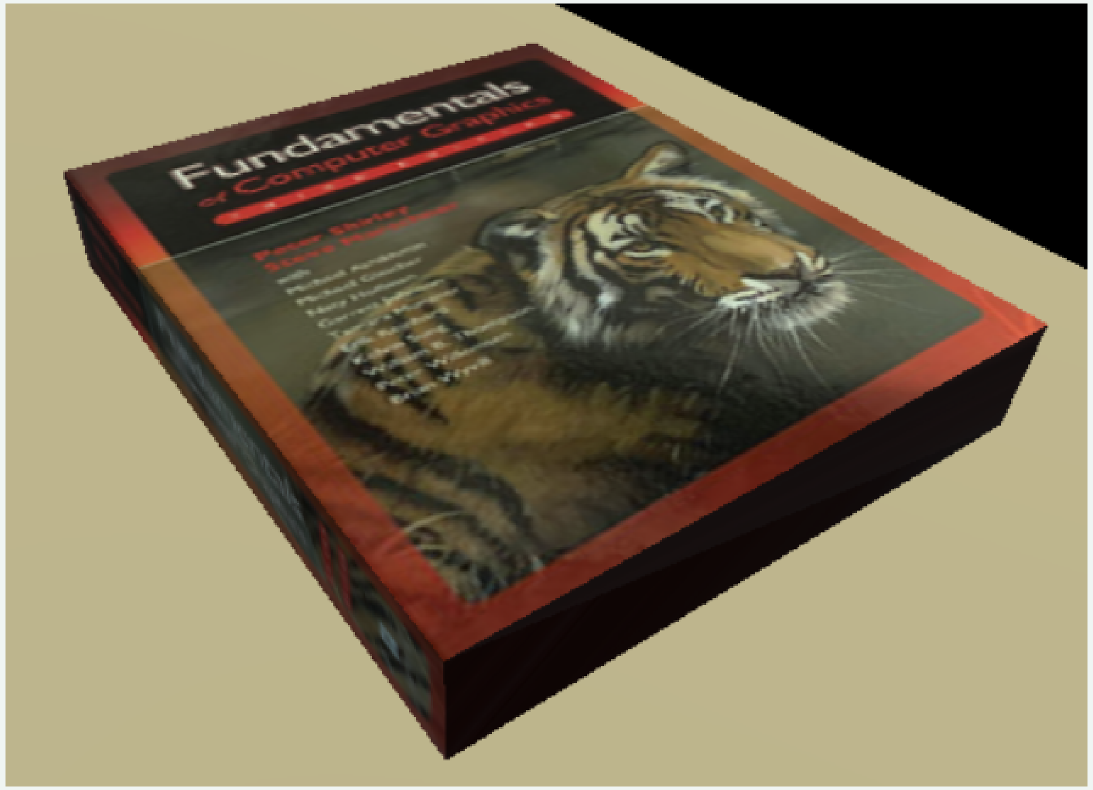
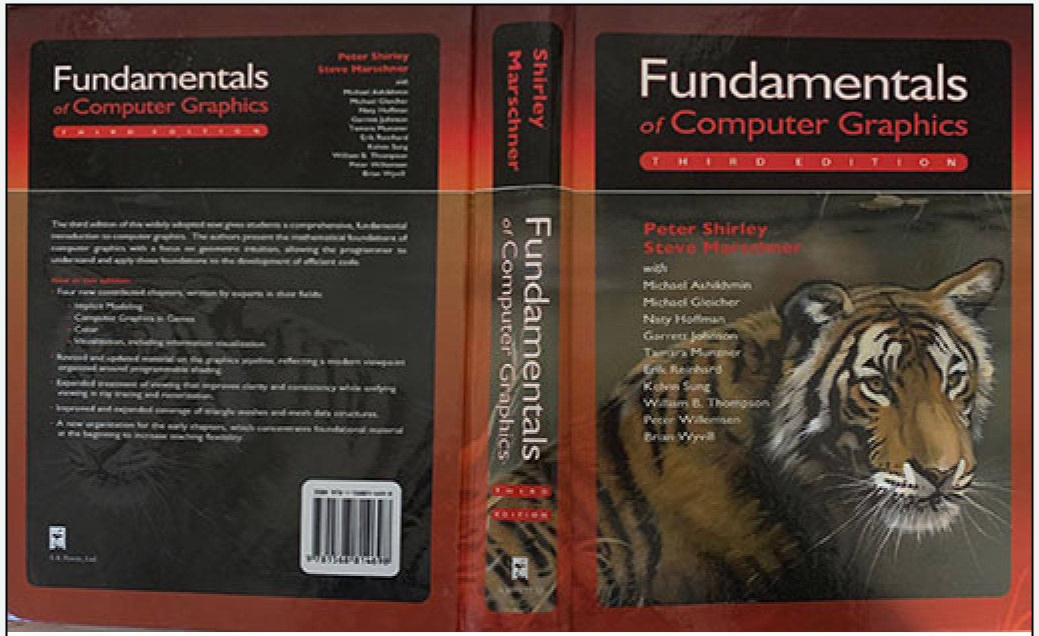

```
let face1V = [vertexUVs[0],
              vertexUVs[1],
              vertexUVs[2]
             ];
// ...
let faceVs = [face1V, face2V, ...];

//
geom.faceVertexUvs = [faceVs];
```

Why Per Face? - Vertex Splitting!





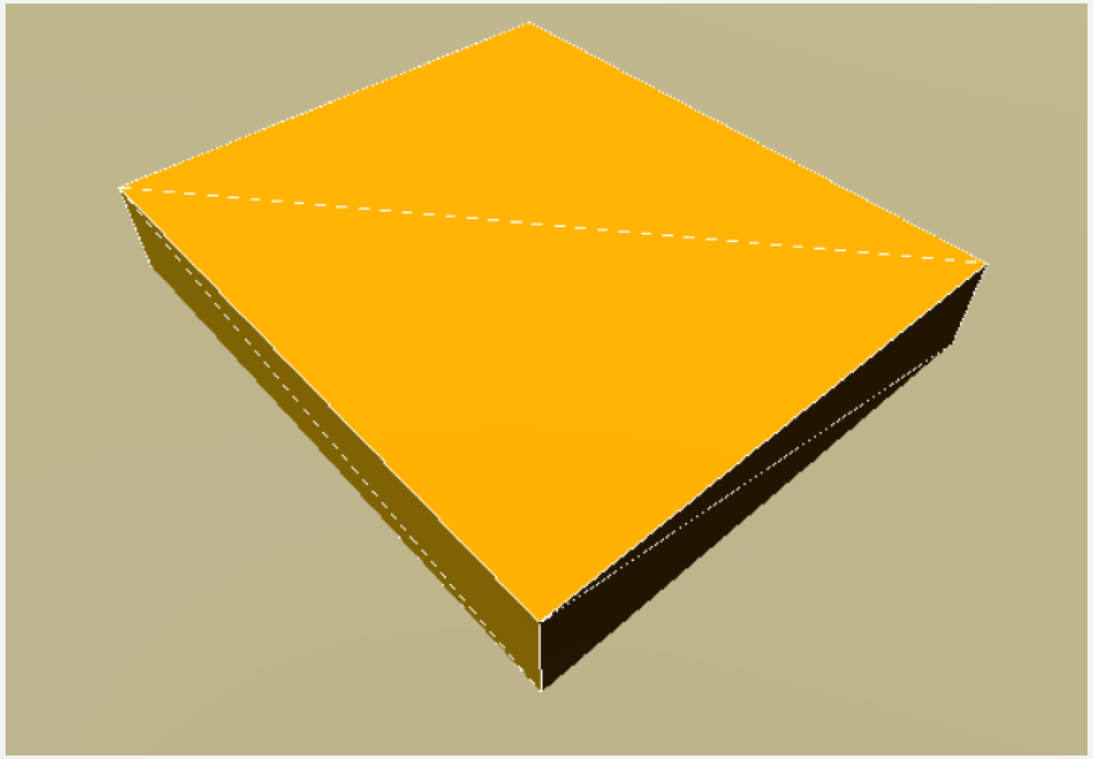
Put it together...

1. Make Some Geometry
2. Get a Picture
3. Get the picture in the right form
4. Assign UV values to vertices
5. **Enable Texturing**

```
// load in the cover texture
let fcg = new T.TextureLoader().load("fcg-texture.jpg");
fcg.flipY = false;
```

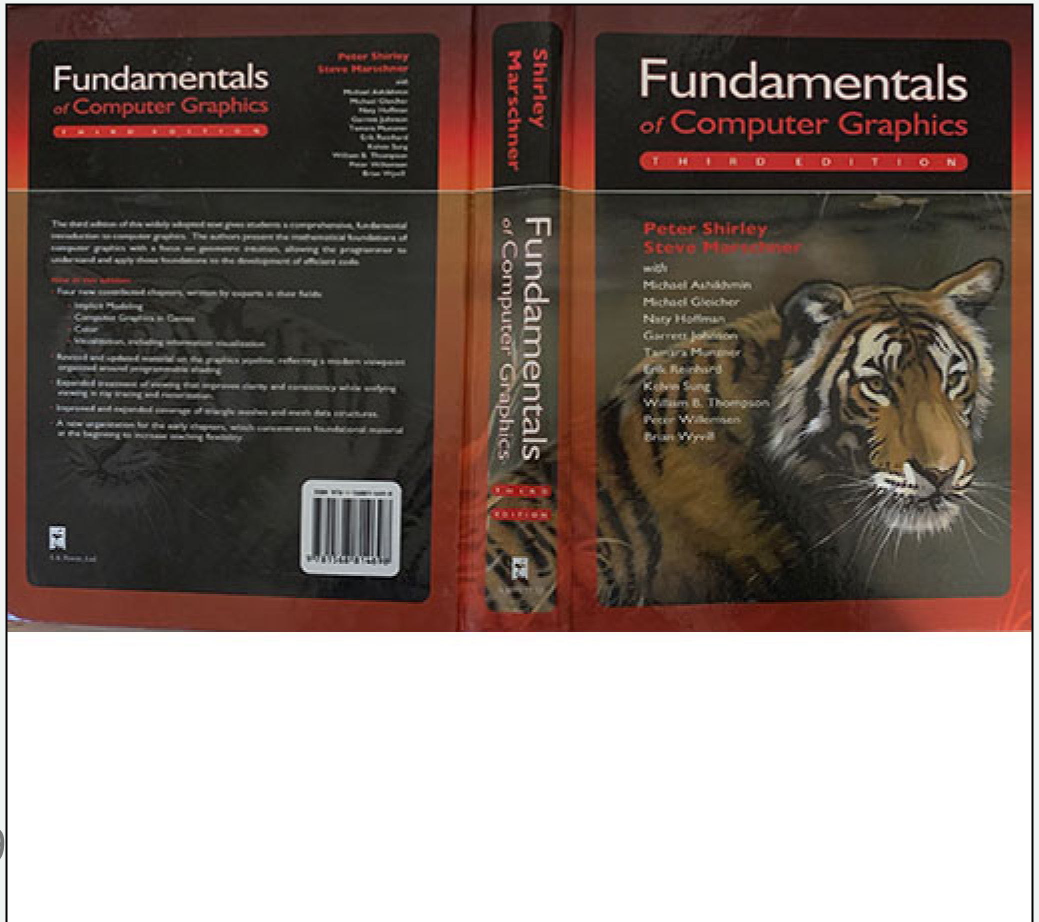
```
let mat = new T.MeshStandardMaterial(
    {color:"white", map:fcg}
);
```

What the hardware does...
1. UV coordinates per pixel



Barycentric Coordinates

What the hardware does…
2. Texture Lookup

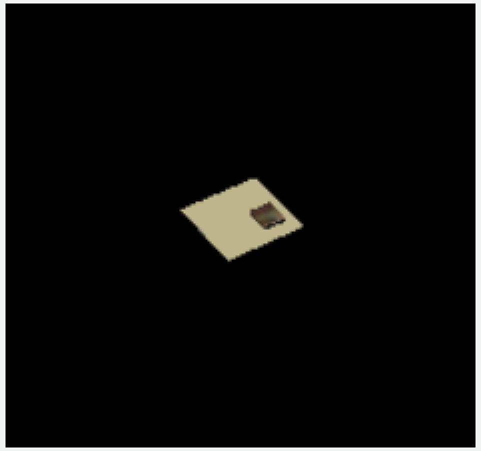


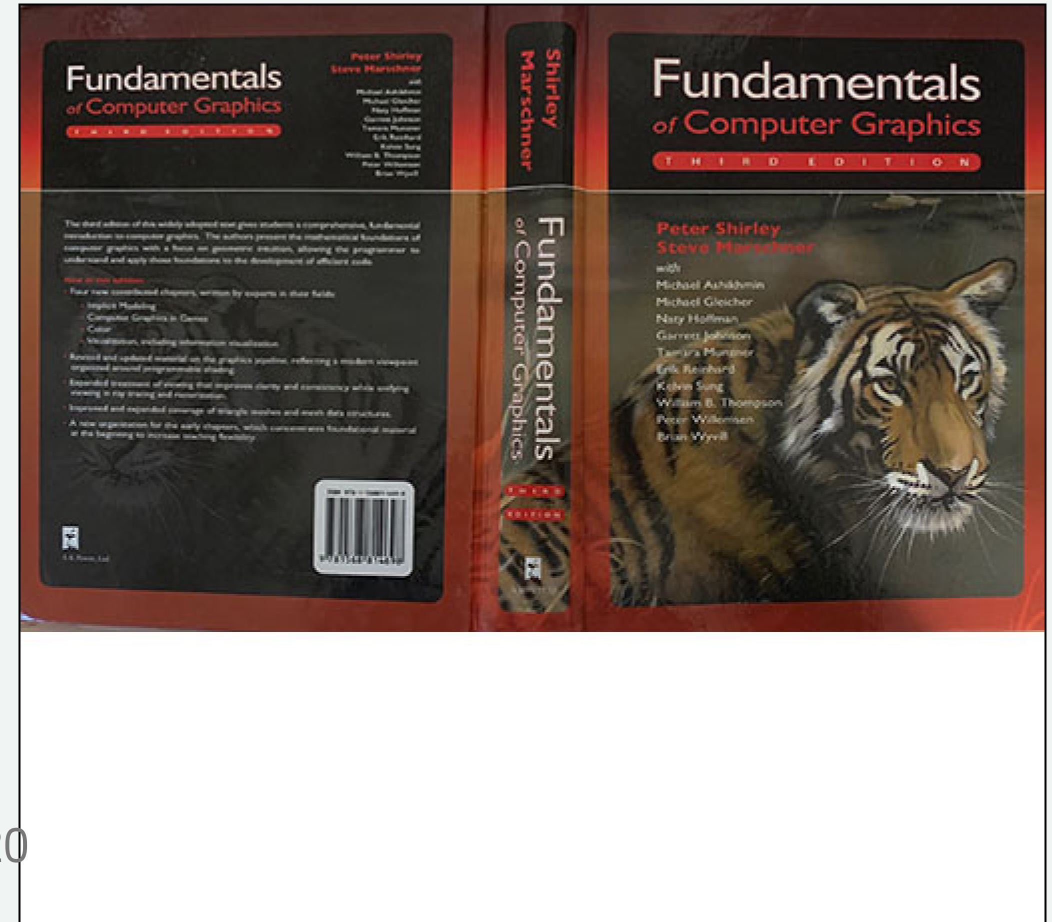
What the hardware does...
3. Texture Filtering

Each pixel maps to many texels

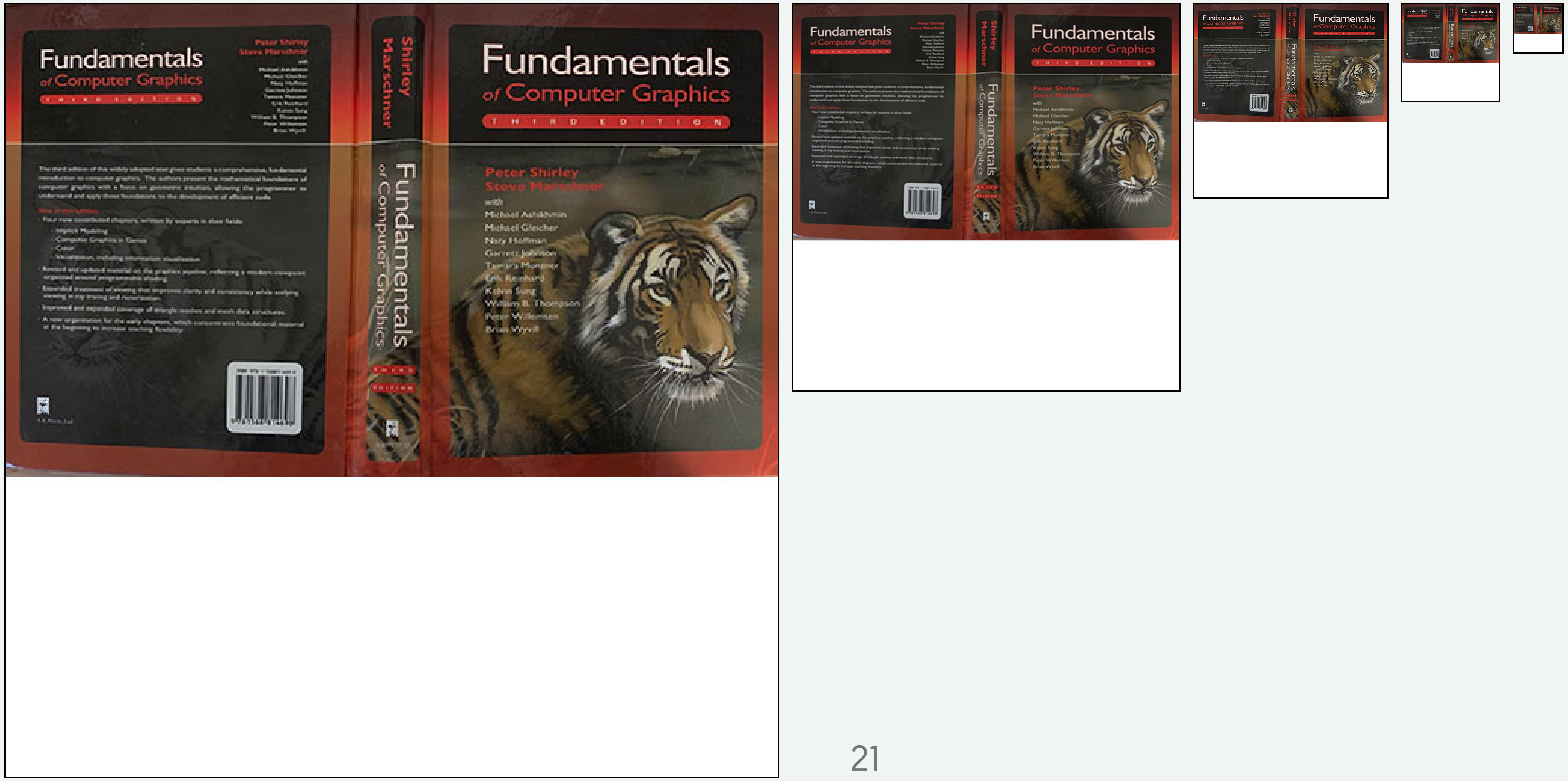
Can't pick one!

Average region together!





Filtering Fast... Mip Maps



Once you have the color...

Use as the material color (for lighting)