

CS559 Lecture 19-20: More Texture

Idea - break the "week's" material into smaller chunks
[rather than 2 big ones]

Outline:

1. Texture Basics Review
2. Fake Normals, Normal Maps, Bump Maps
3. Multi-Texture, Light Maps, AO Maps
4. Environment Maps
5. Shadow Maps

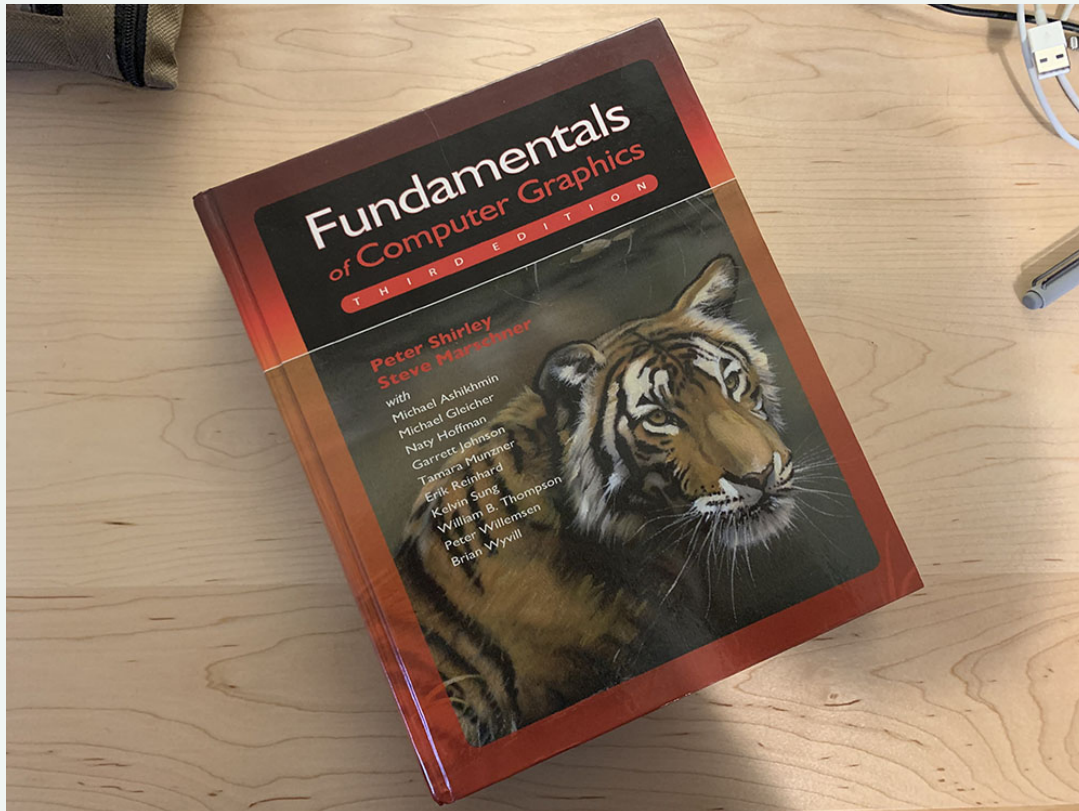
CS559 Lecture 19-20: More Texture

Part 1: Basic Texture Review

Motivation and Review

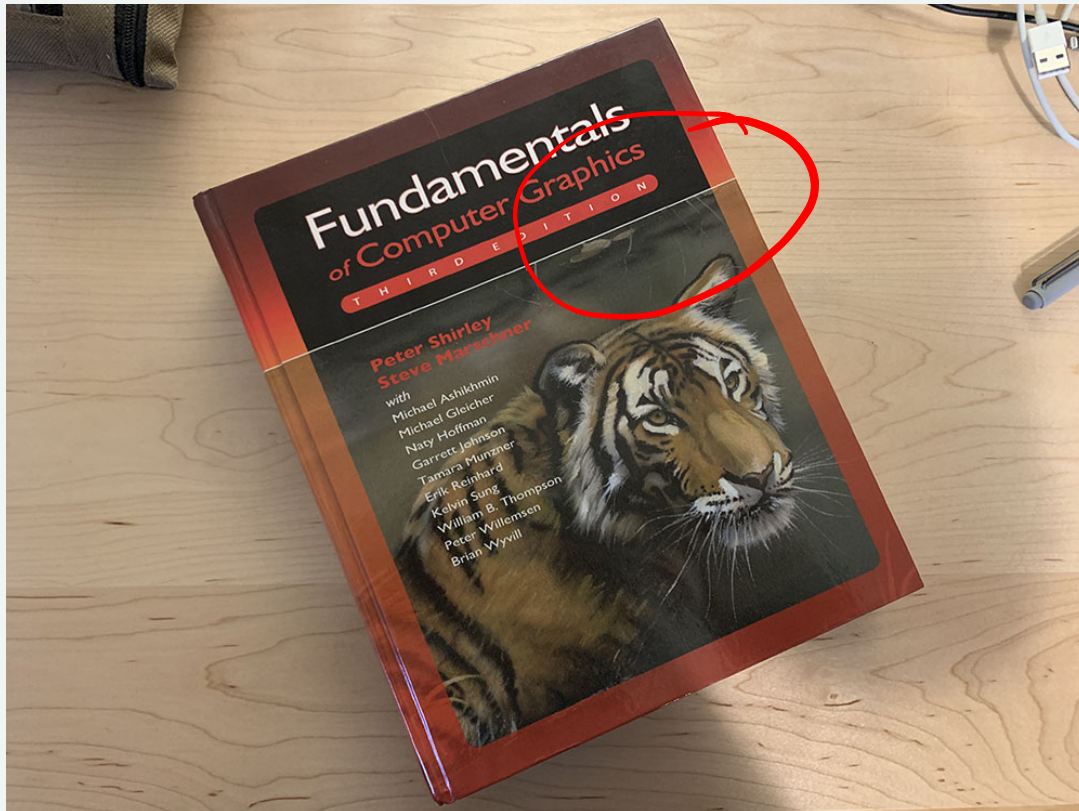
Why Basic Textures?

Because real objects are interesting

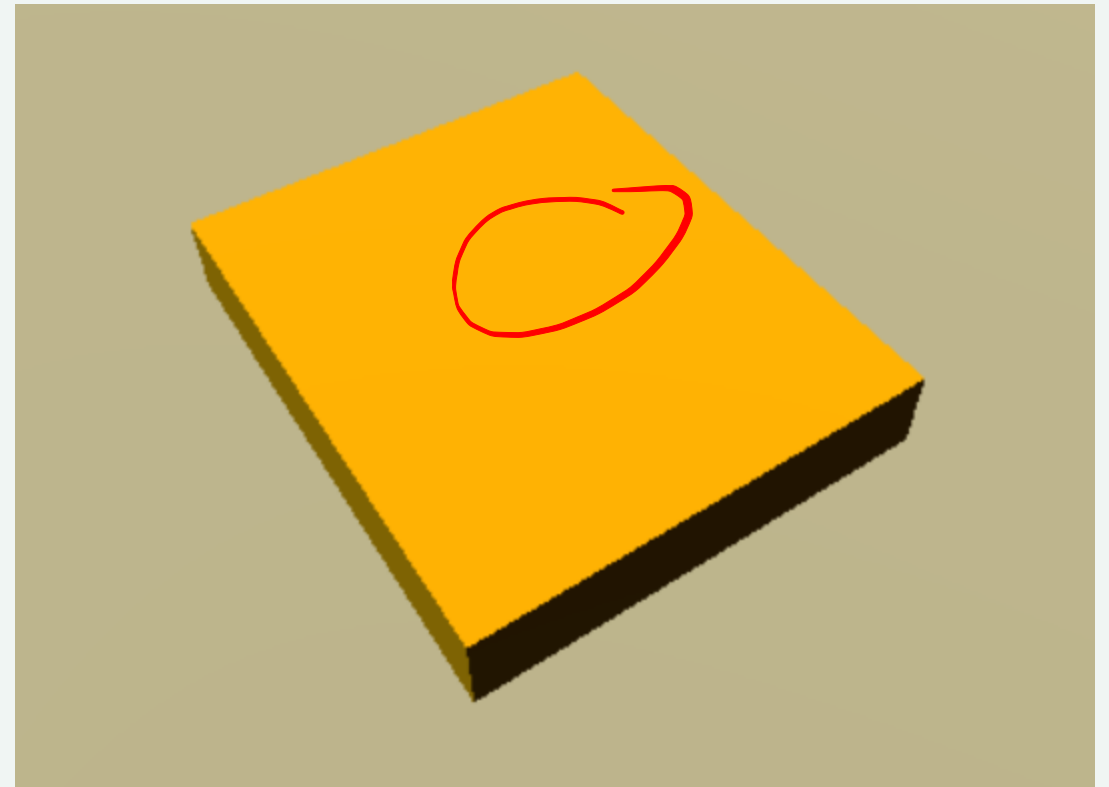


Why Basic Textures?

Real objects are interesting



Computer Graphics can be boring...



Why Basic Textures?

Even Colors can Help



Computer Graphics can be boring...

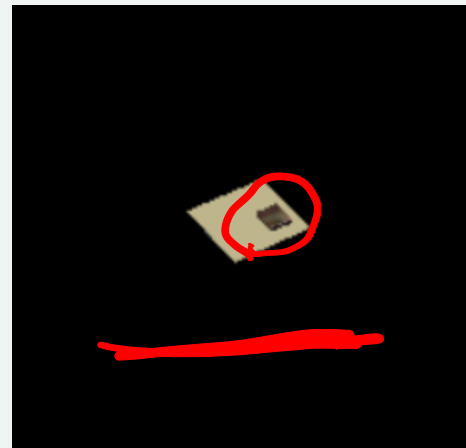


But Why Textures?

Even Colors can Help



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

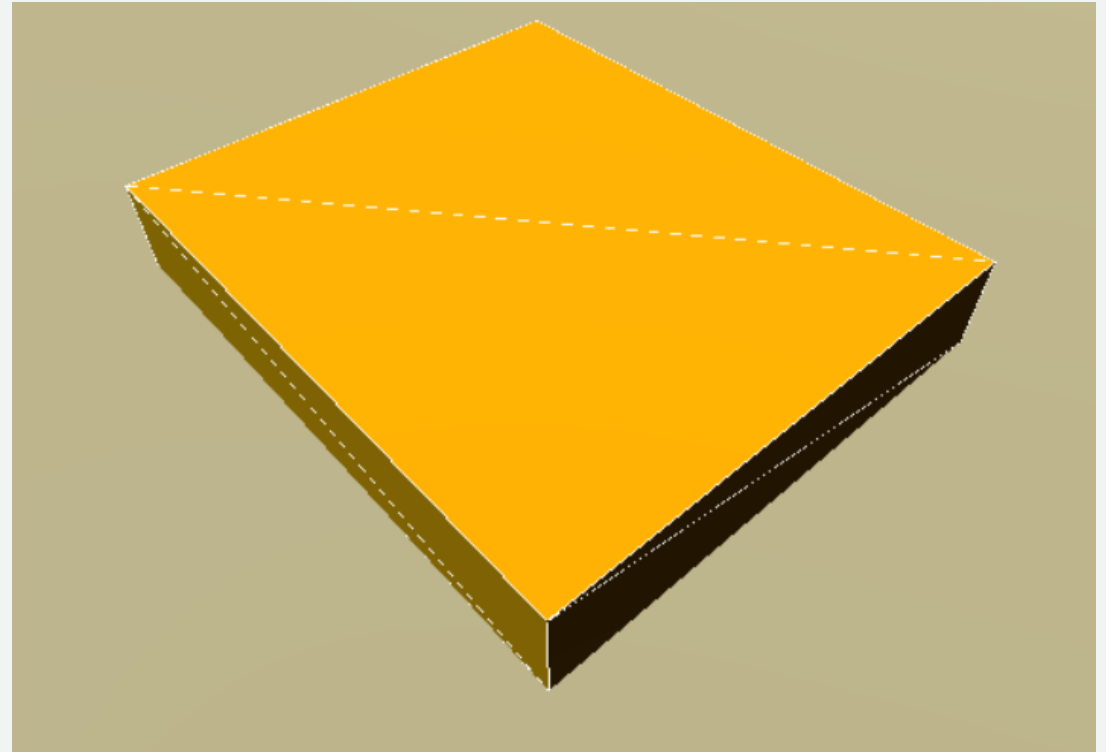


How To Do Basic Textures?

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

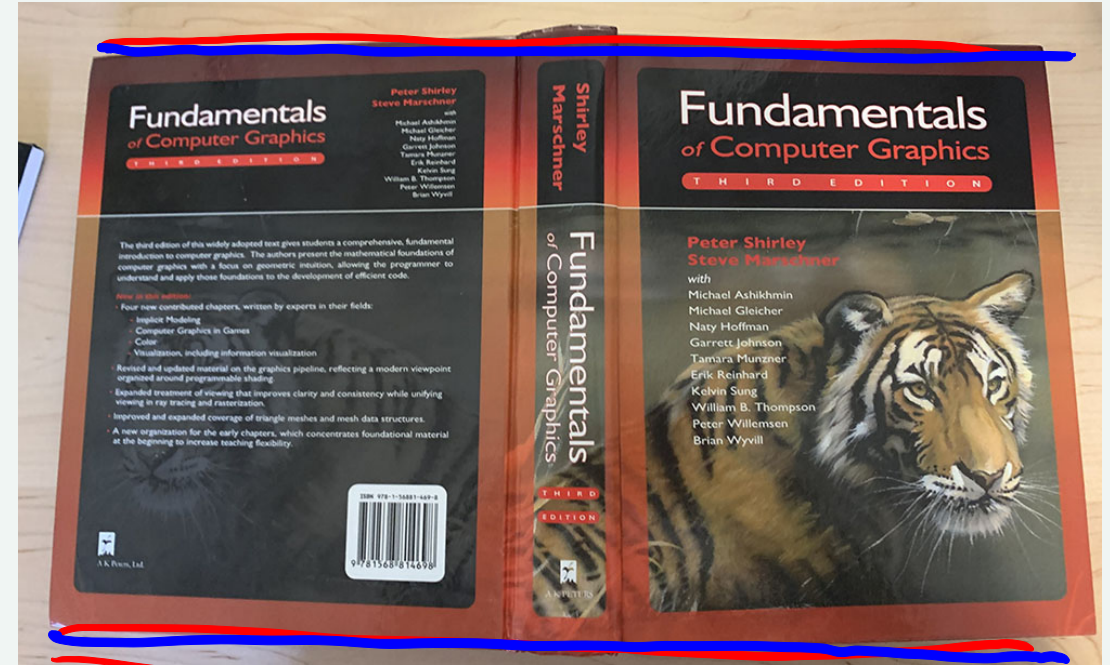
Geometry

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

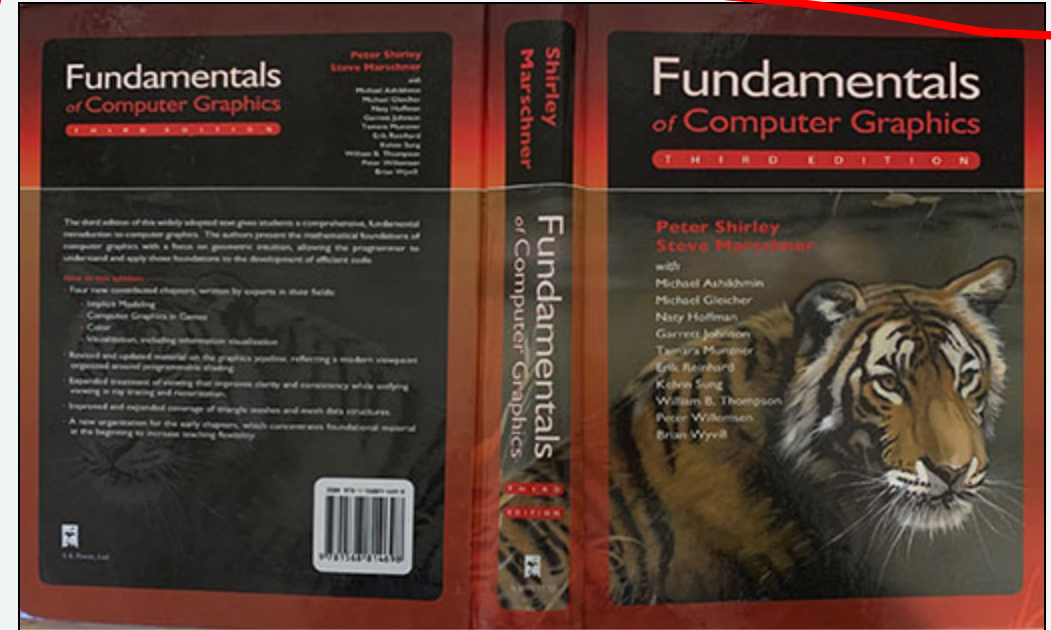


Can paint it yourself

Need to get things to match simple geometry

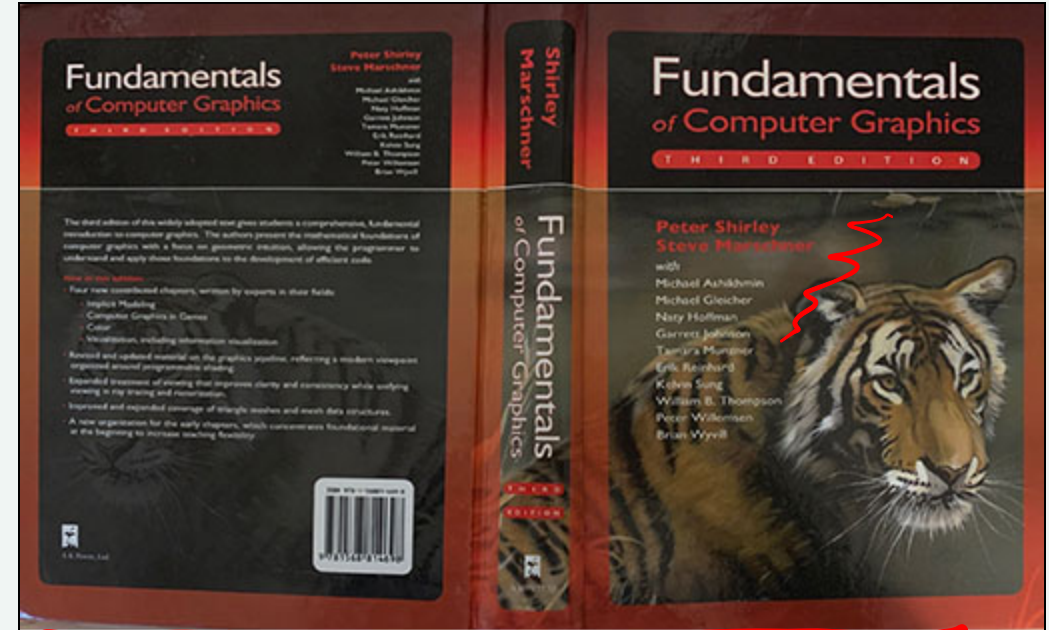
Process the Picture

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



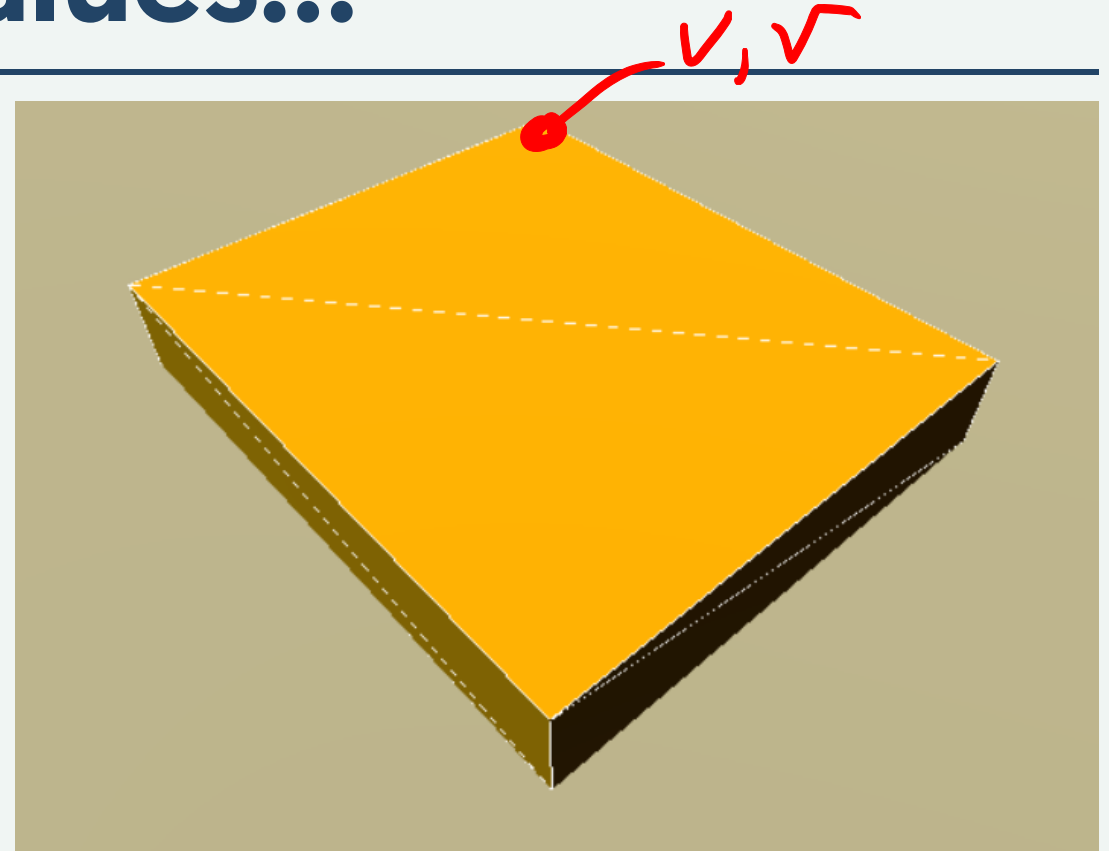
What do we need from a texture?

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

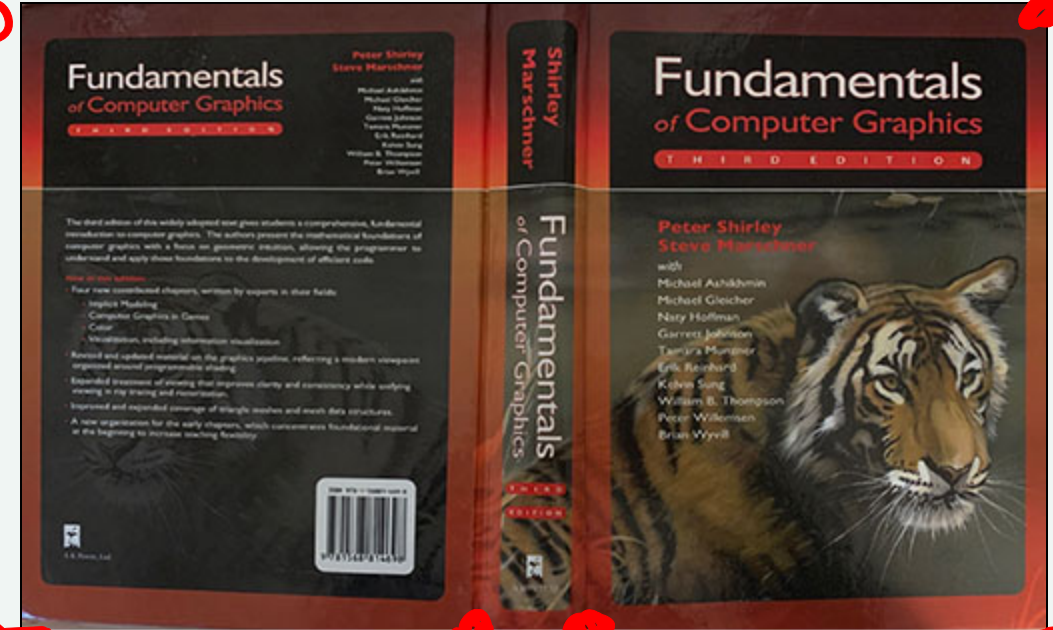
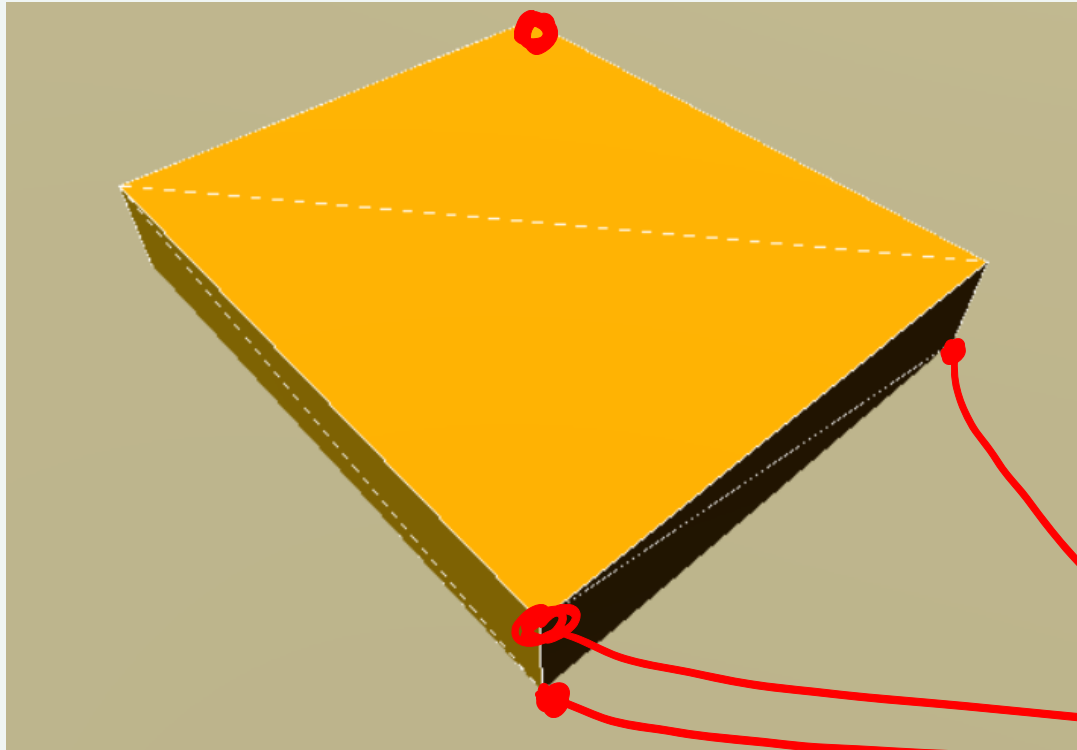


Getting those UV Values...

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

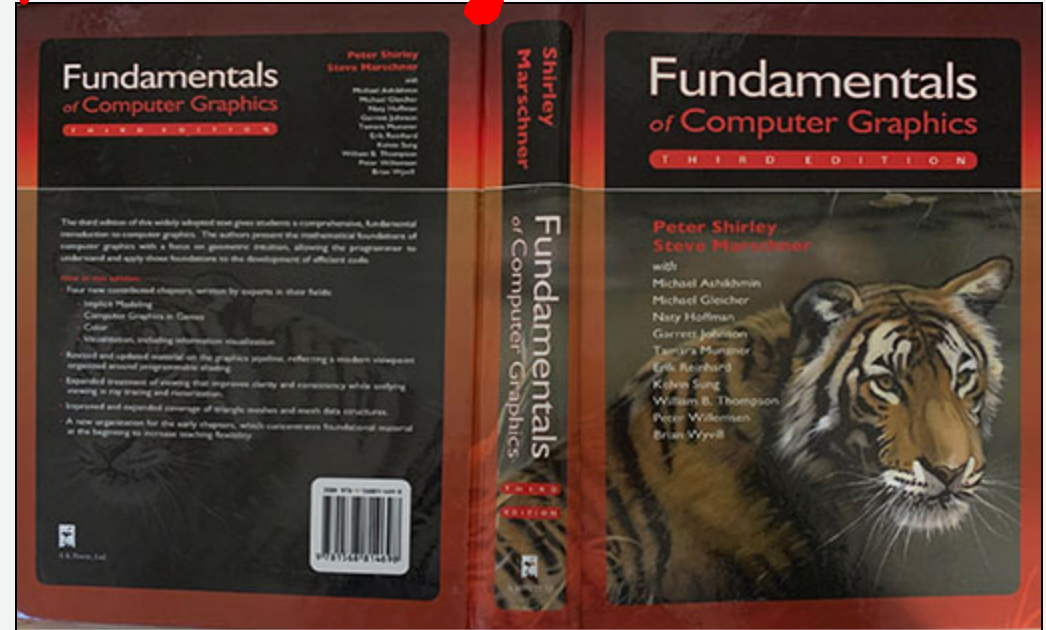


$1, 0$
 $512, 0$

311
 $\underline{512}$

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),  
]
```

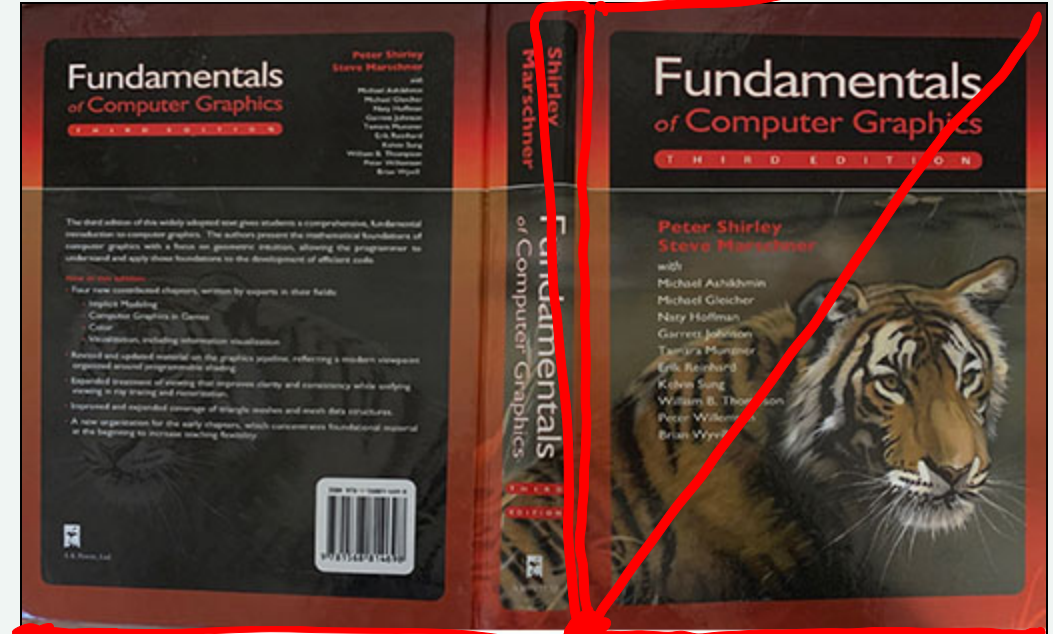


Put into the (weird) THREE structures

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

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

Why Per Face? - Vertex Splitting!

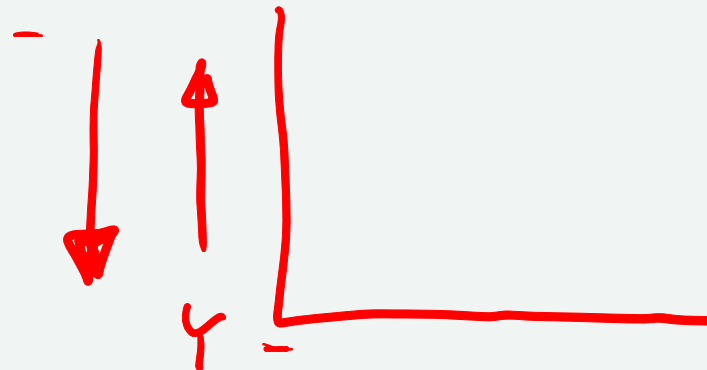


Put it together...

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**

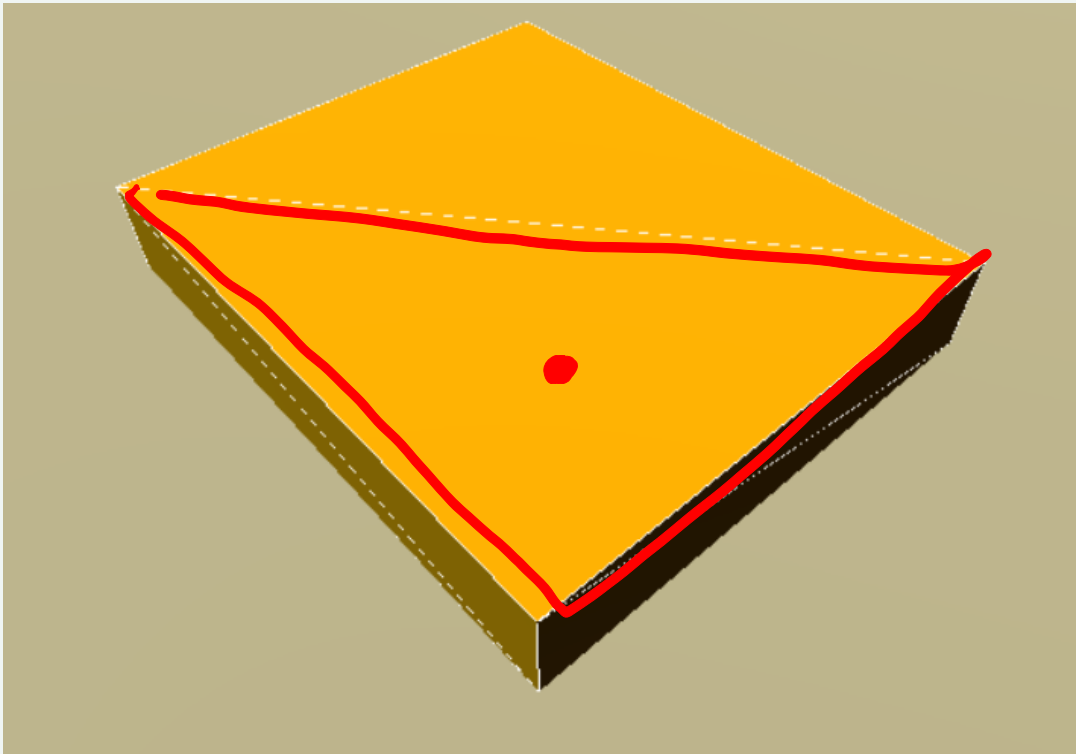
```
// load in the cover texture  
let fcg = new T.TextureLoader().load("fcg-texture.jpg");  
fcg.flipY = false;
```

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

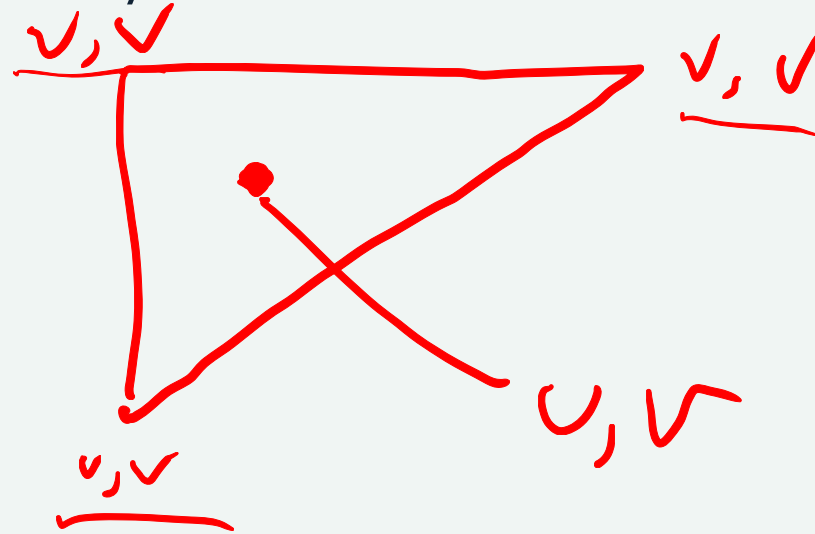


What the hardware does...

1. UV coordinates per pixel

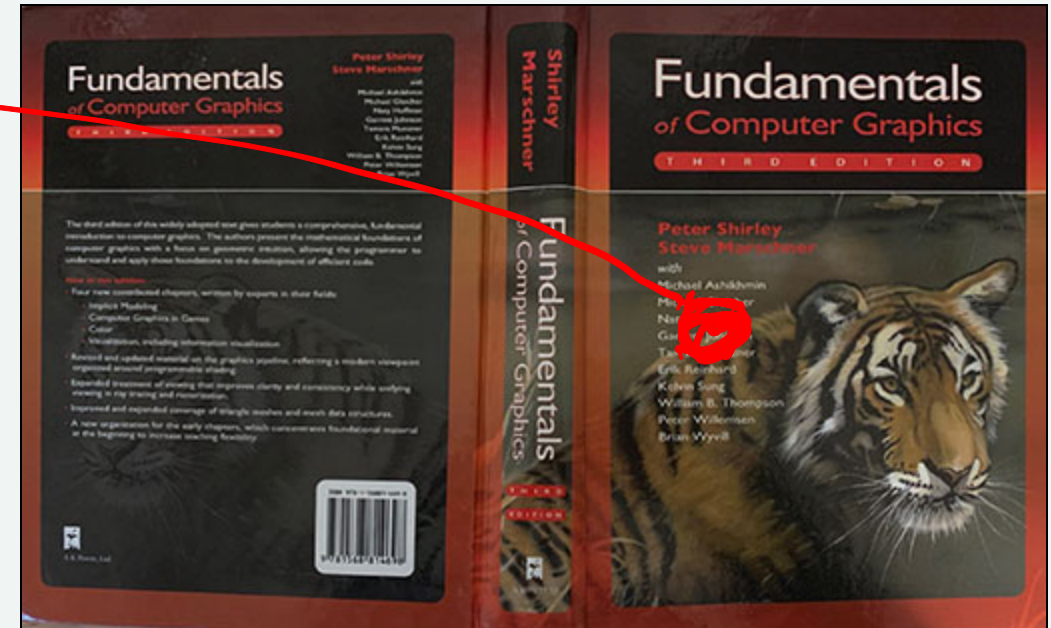
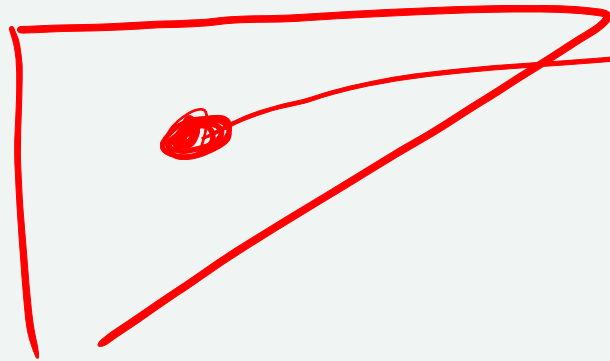


Barycentric Coordinates



What the hardware does...

2. Texture Lookup



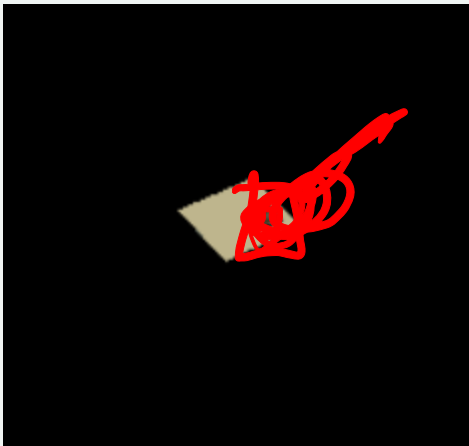
What the hardware does...

3. Texture Filtering

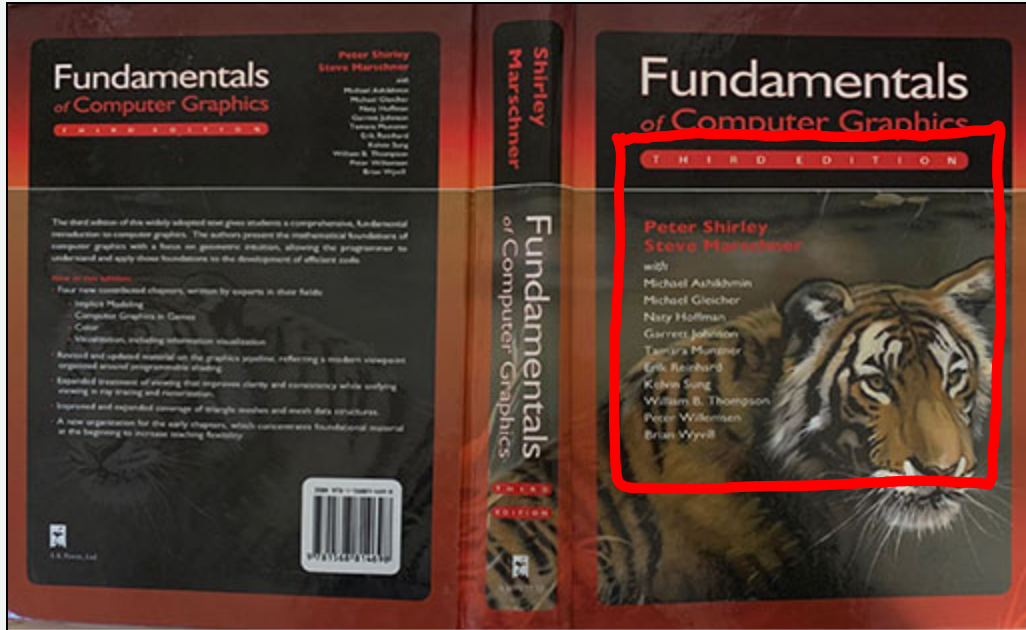
Each pixel maps to many texels

Can't pick one!

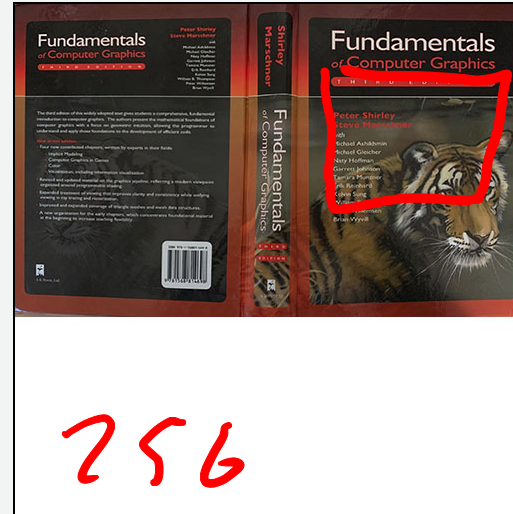
Average region together!



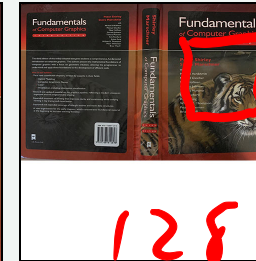
Filtering Fast... Mip Maps



512 x 512



256



128



Once you have the color...

Use as the material color (for lighting)