Texture Mapping

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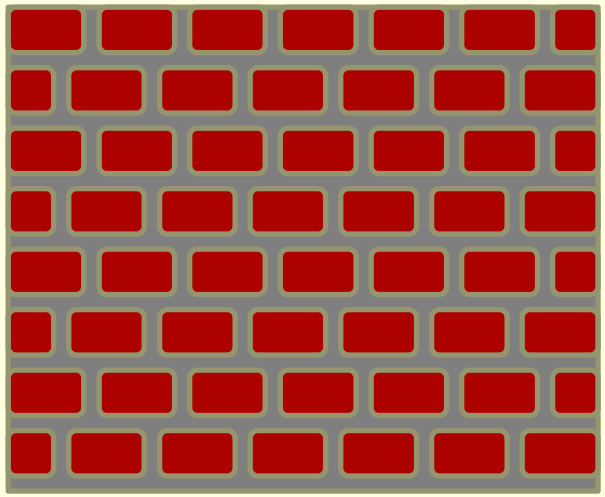
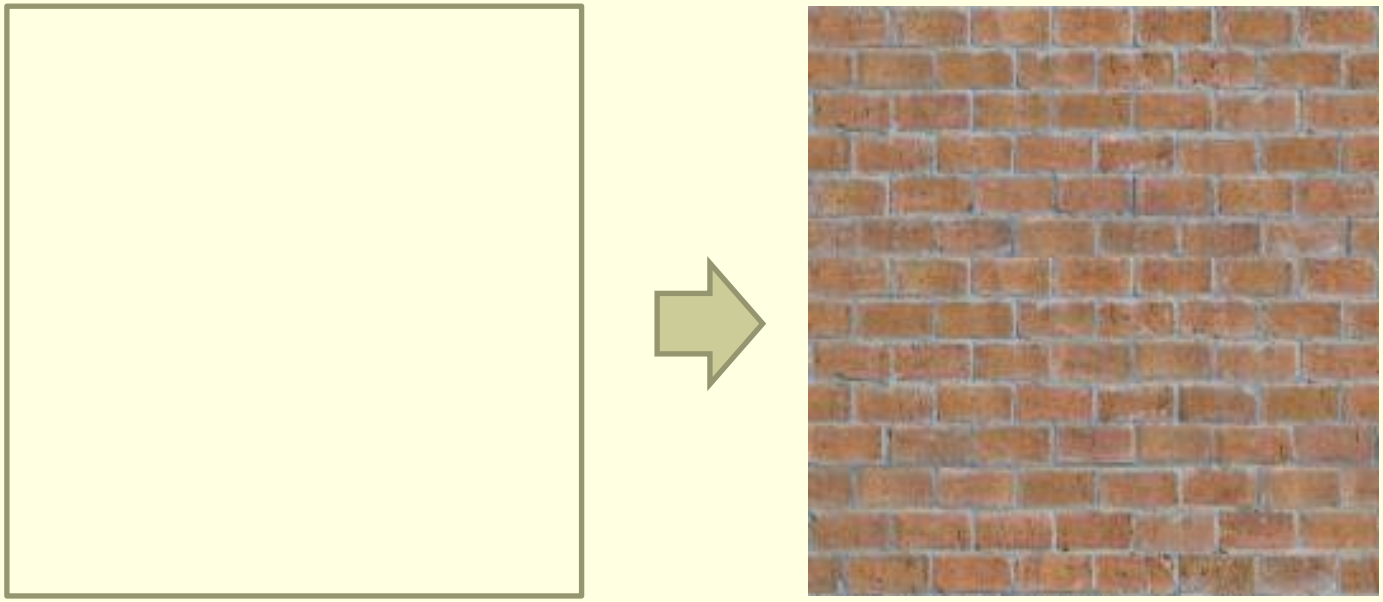
Introduction

- Let us assume we need to draw a brick wall:
  - We can compose it out of small polygons
  - The result is not realistic



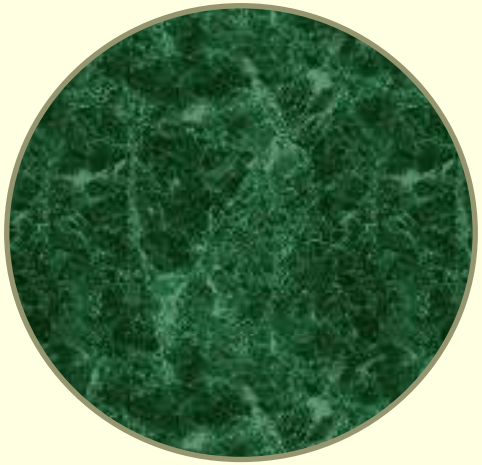
Introduction

- We can take a photograph of a real brick wall and employ it to fill a square polygon



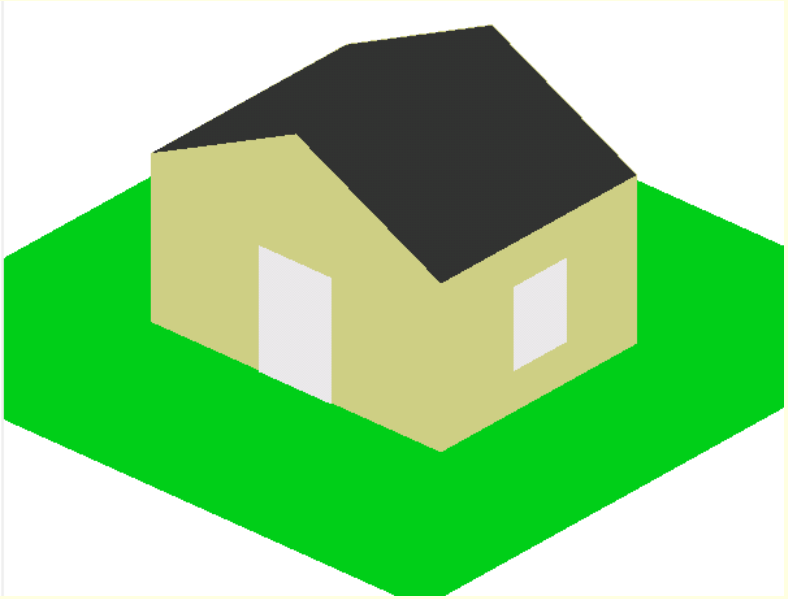
Texture mapping

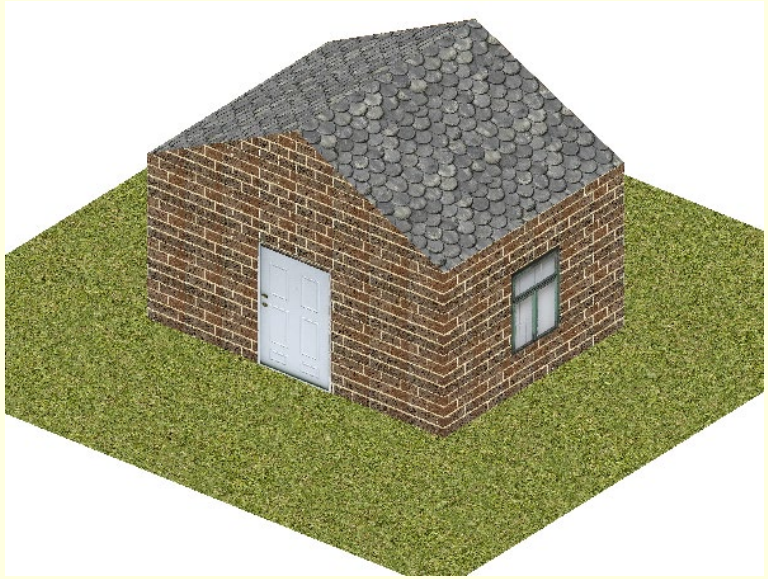
- This technique maps patterns onto the geometric description of the object



Texture mapping

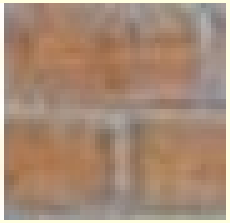
- More realistic images are achieved



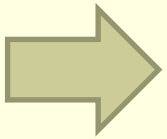


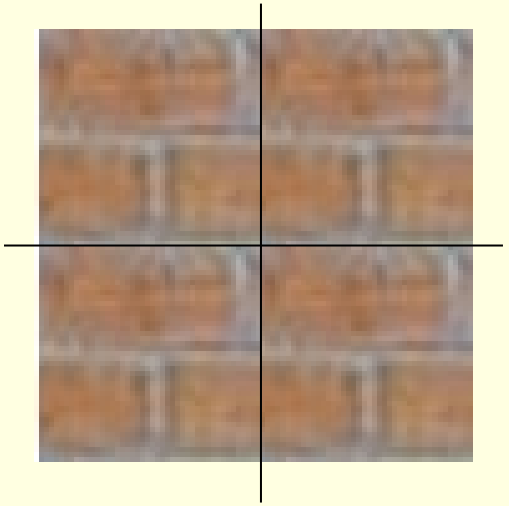
Texture mapping

- Texture pattern:



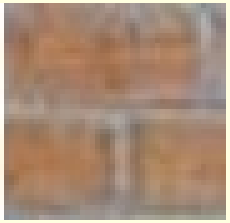
- Object:

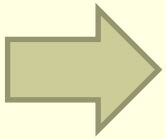


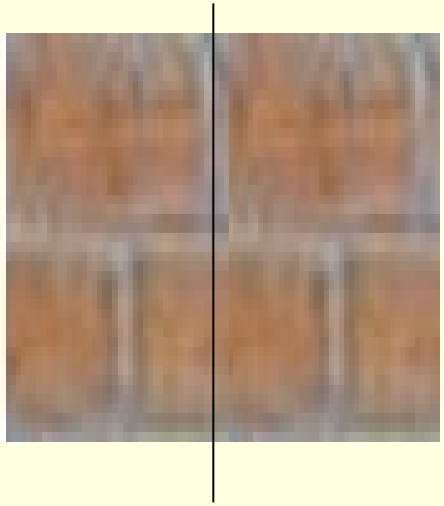


Texture mapping

- Mapping can be done in several ways:

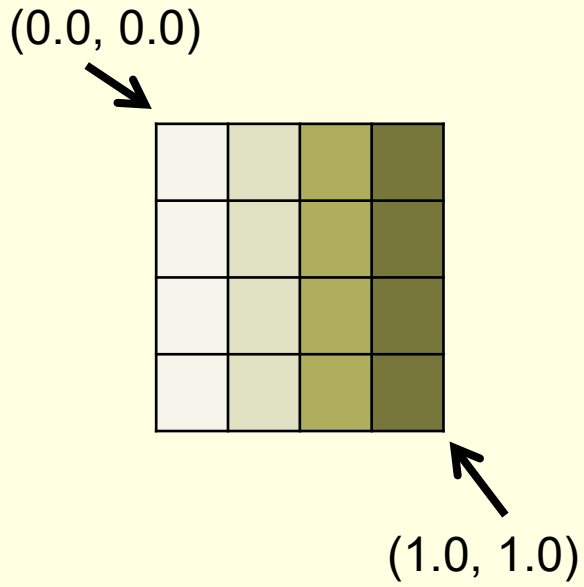






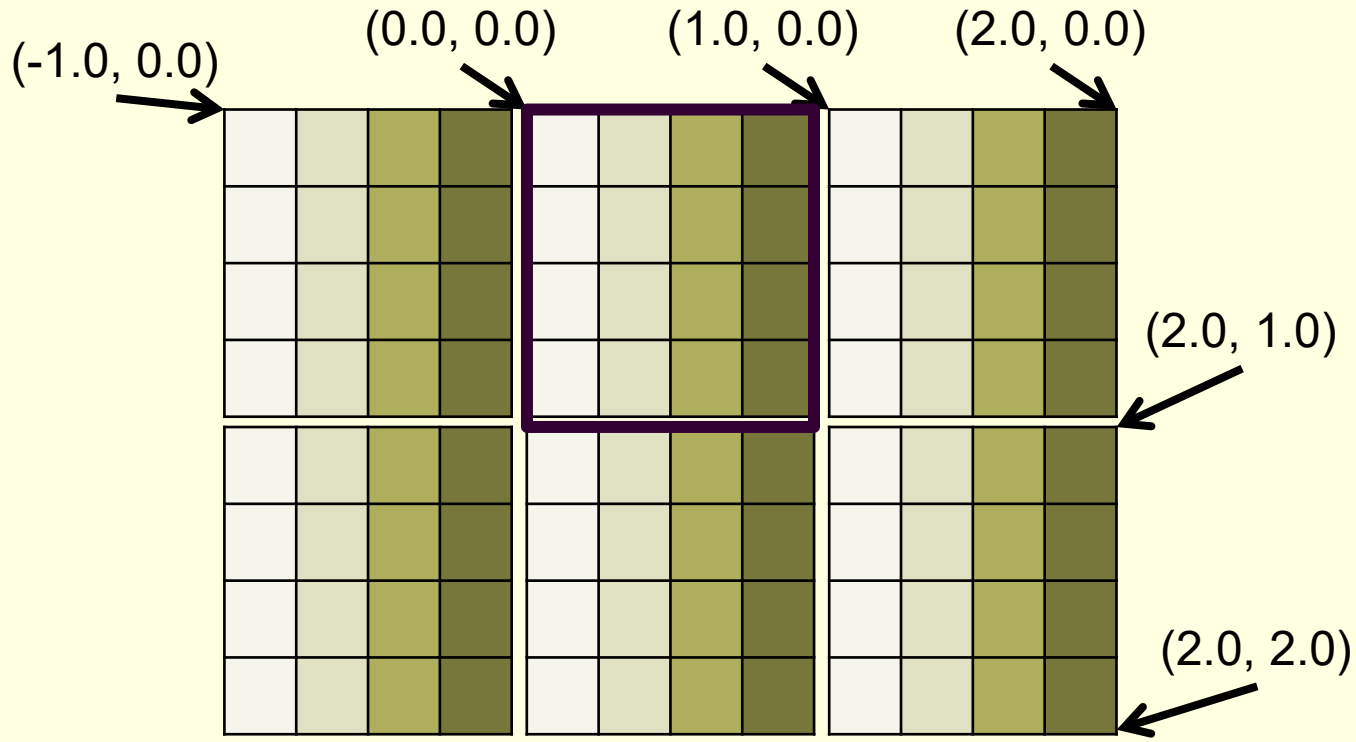
Texture mapping

- The (2D) texture pattern is given as a two-dimensional array
  - Indexed by real coordinates in the [0,1] range



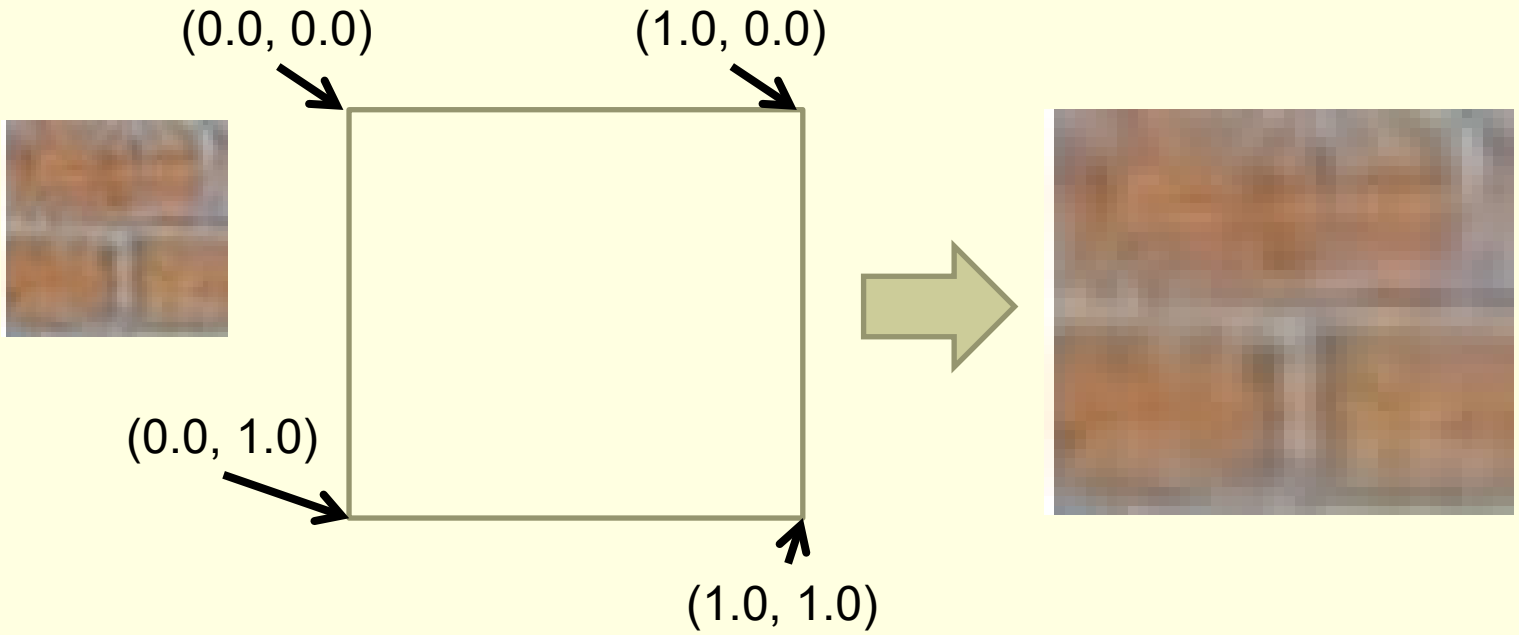
Texture mapping

- This array is assumed to span by repetition to the whole space

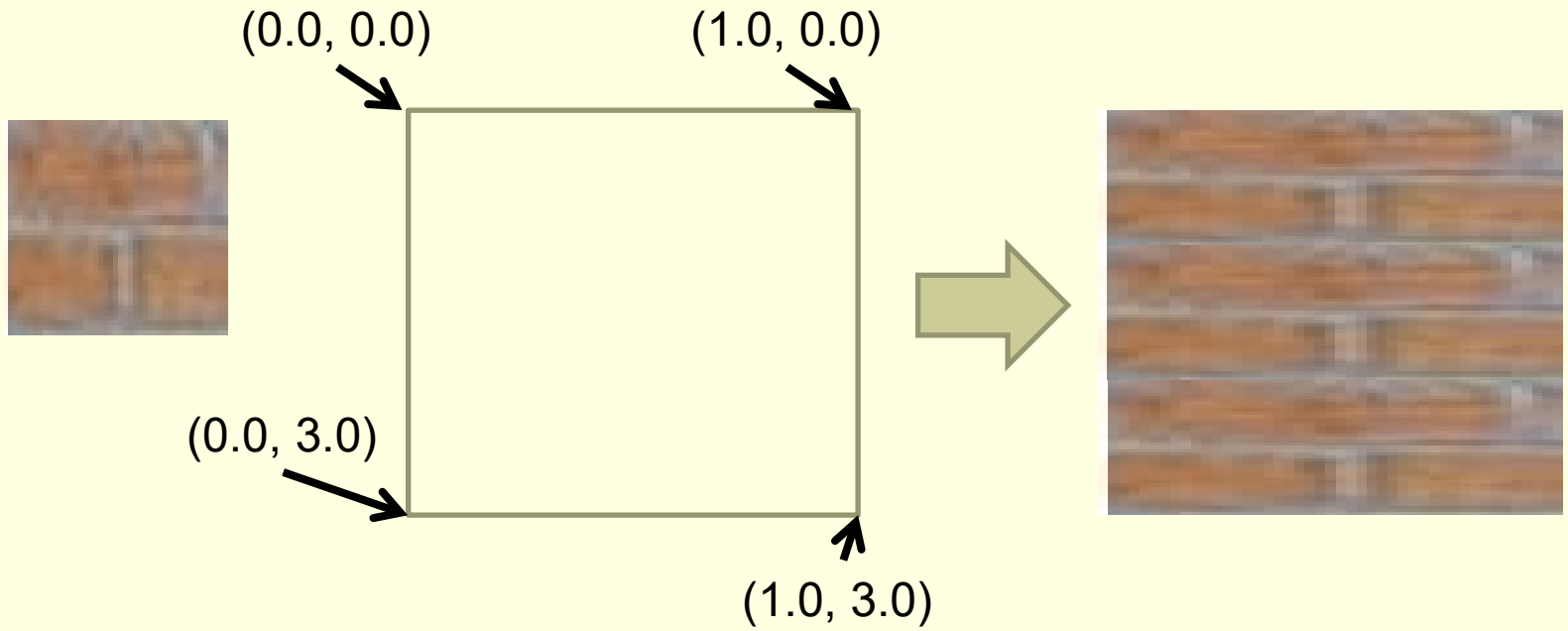


Texture mapping

- When you draw a polygon, you indicate the location in the texture space that corresponds to each vertex



Texture mapping



Textures in OpenGL

- **Array with the RGB patter description (dimensions must be a power of two)**
  - unsigned char textureArray[32][32][3]
- **What comes next refers to texture number 0**
  - glBindTexture(GL_TEXTURE_2D,**0**);

Textures in OpenGL

- **What to do if some part of the texture pattern has to be magnified or minimized**
  - **Assign the nearest texture color**

- glTexParameteri(GL_TEXTURE_2D,GL_TEXTURE_**MAG**_FILTER,**GL_NEAREST**);
- glTexParameteri(GL_TEXTURE_2D,GL_TEXTURE_**MIN**_FILTER,**GL_NEAREST**);

Textures in OpenGL

- **When plotting textured objects, texture color will replace the object color**
- glTexEnvi(GL_TEXTURE_ENV,GL_TEXTURE_ENV_MODE,**GL_REPLACE**);
- **Load the texture pattern**
- glTexImage2D(GL_TEXTURE_2D,0,GL_RGB,32,32,0,GL_RGB,GL_UNSIGNED_BYTE,**textureArray**);

Textures in OpenGL

- **Employing textures**

- glBindTexture(GL_TEXTURE_2D,**0**);
- glBegin(GL_QUADS);
- glTexCoord2f(0.0,3.0); glVertex3i(0,0,0);
- glTexCoord2f(3.0,3.0); glVertex3i(200,0,0);
- glTexCoord2f(3.0,0.0); glVertex3i(200,200,0);
- glTexCoord2f(0.0,0.0); glVertex3i(0,200,0);
- glEnd();

Texture libraries

- Some free texture repositories exist
  - www.textureking.com
  - www.cgtextures.com
  - (…)
- Textures are available as JPEG images

Using texture libraries

- You need a C library for reading JPEG images
  - Like: http://www.ijg.org/
- Textures are usually given in high resolution images (for instance 2240x1488)
  - It is a good idea to downsample them (for instance, reduce the image to 64x64 pixels)
- Remember that texture array dimensions must be a power of two