



WPI

CS 543: Computer Graphics

Advanced Texture Mapping

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(with lots of help from Prof. Emmanuel Agu :-)

Texturing

- Created/manipulated using image-processing software...
 - Photoshop
 - Illustrator
- ...or computed from a scene description
 - Radiosity
 - Ambient occlusion
- Mapped to geometry (models)
- Very powerful image enhancing techniques
 - Can be used for fake shadows, fake reflections, much more

Mapping to Models

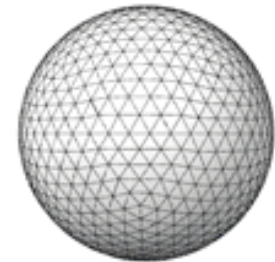
- Objects are made from
 - Geometry (a.k.a., polygons)
 - Lighting
 - Textures

- Vertices and connectivity
 - Triangles
 - Triangle-strips
 - Meshes
 - Patches/surfaces



Textures

- Images that are applied to geometry
- Many ways to apply textures
 - Decal
 - Blend
 - Layer
- Can use for other things as well
 - Height fields
 - Environment mapping
 - Bump mapping
 - Displacement mapping
 - ...



Sphere with no texture



Texture image



Sphere with texture

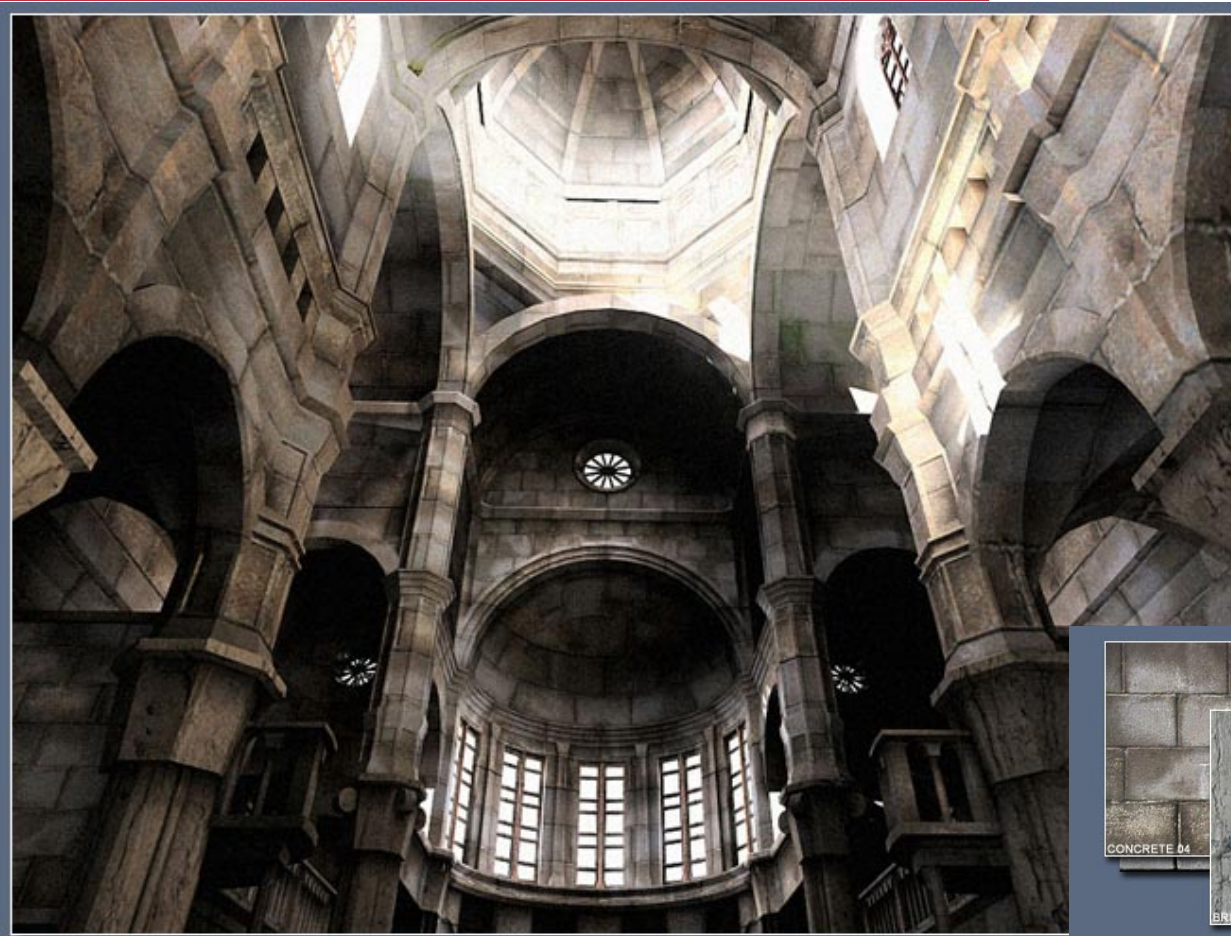
Scenes



Texture Mapping Example



Texture Mapping Example



Texture Detail Settings



Depth of Field

http://www.tweakguides.com/ClearSky_6.html



Depth of Field

□ Problems?

Bump Map Example: Texture



Bump Map Example: Bump Map



Bump Map Example

http://www.tweakguides.com/ClearSky_6.html



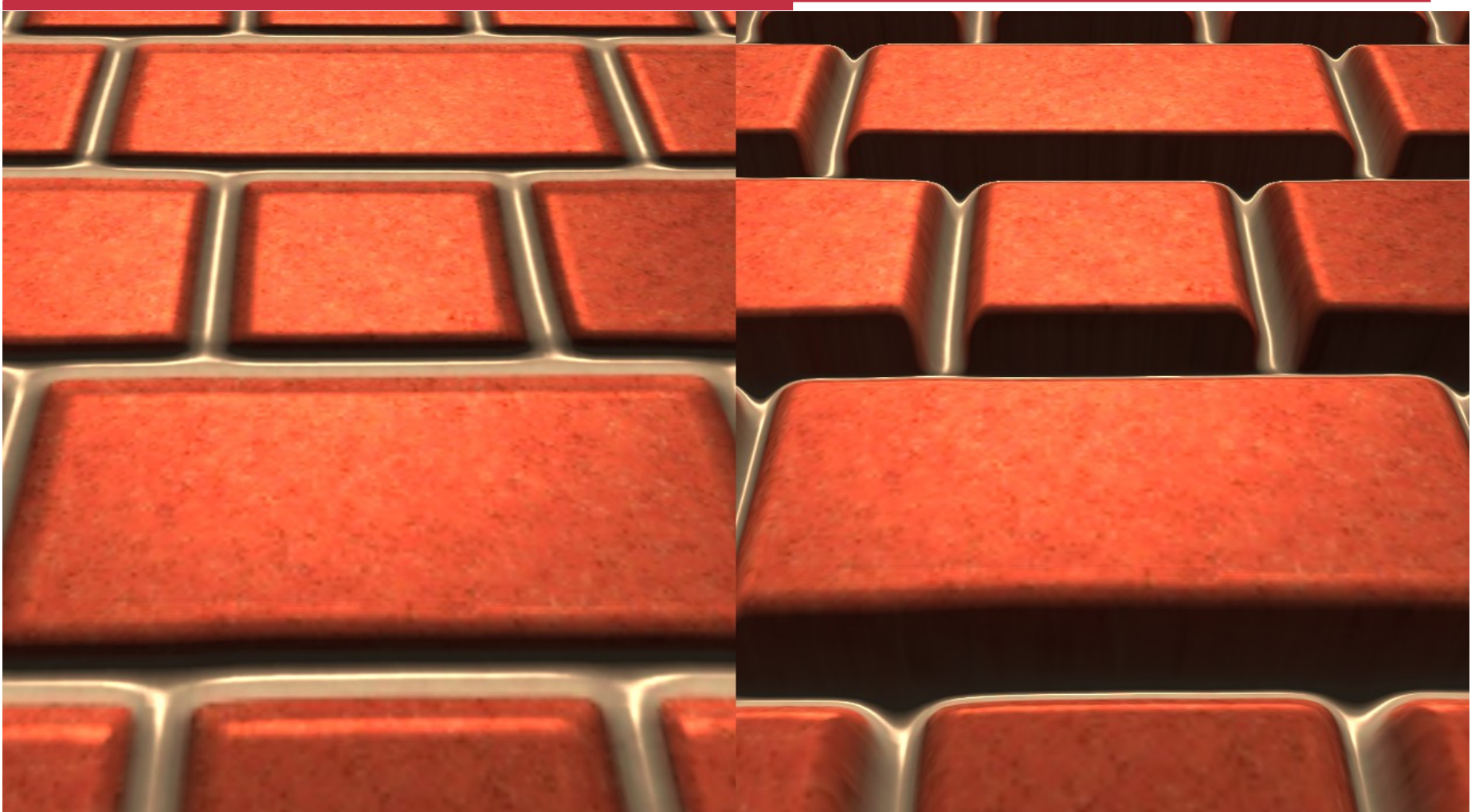
Advanced Mapping Techniques

- Parallax Mapping
- Ambient Occlusion
- Horizon Mapping
- Baked-on Radiosity

Parallax Mapping Example



Parallax Mapping Closeup



Parallax Mapping Example

http://www.tweakguides.com/ClearSky_6.html



Ambient Occlusion

- Sometimes called “Sky Light”
- Lighting models (e.g., Phong lighting) often consist of three types of lights
 - Ambient
 - Light that is just there because of light bouncing around the scene
 - Diffuse
 - Light that is proportional to the surface direction/ distance to light sources
 - Specular
 - Highlights that change depending on the location of the viewer

Ambient Occlusion (cont.)

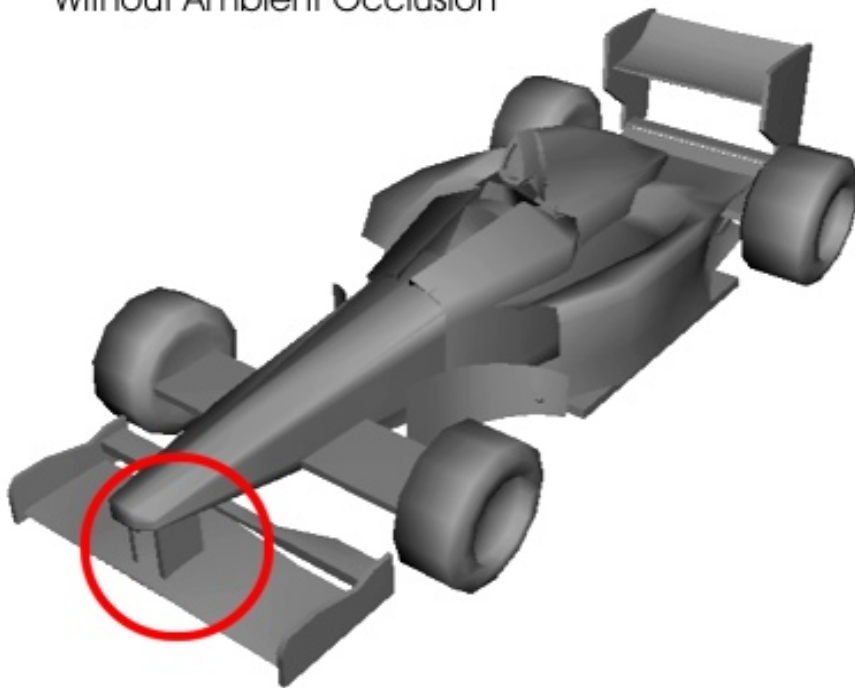
- Ambient light is often just a constant
- In “reality”, it is not constant, but rather is influenced by occluders
 - Light reaching points under a desk or inside a tube will be darker than others
- Ambient occlusion mapping pre-computes how much a point is blocked (occluded) by other surfaces in a scene, then applies it as a texture layer

Ambient Occlusion Calculation

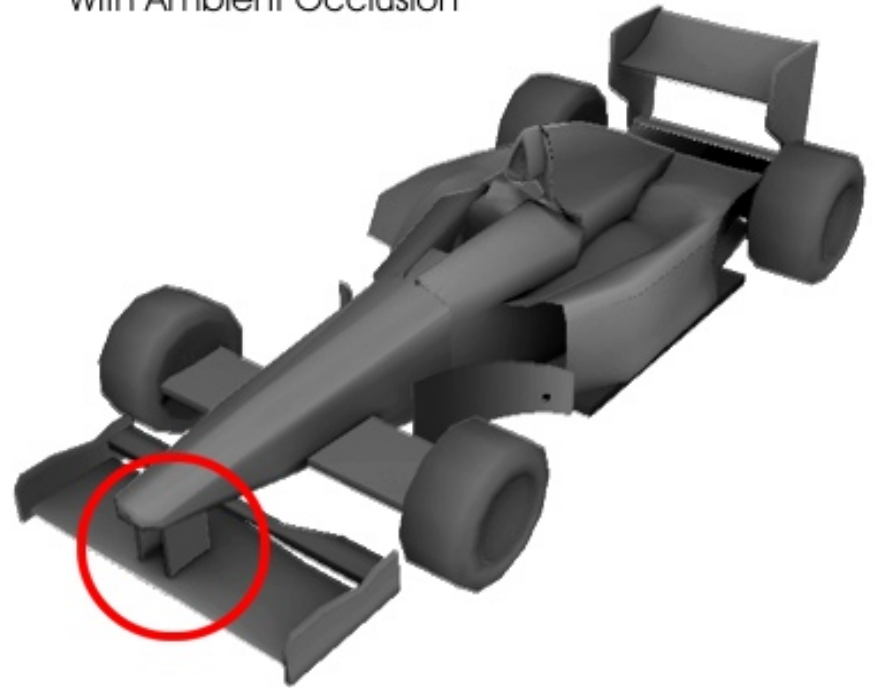
- How could you calculate this for a given point p in a scene?
- Can you do it at runtime?

Ambient Occlusion: Example 1

Without Ambient Occlusion



With Ambient Occlusion



Ambient Occlusion: Example 2 (StarCraft II)



Ambient Occlusion: Example 2 (StarCraft II)



Ambient Occlusion: Example 2 (StarCraft II)



Ambient Occlusion: Example 3



Horizon Mapping

- Works like parallax mapping, but takes into account light sources
- Can be done dynamically

Horizon Mapping: Example 1

http://www.terathon.com/wiki/index.php/Horizon_Mapping



Horizon Mapping: Example 2

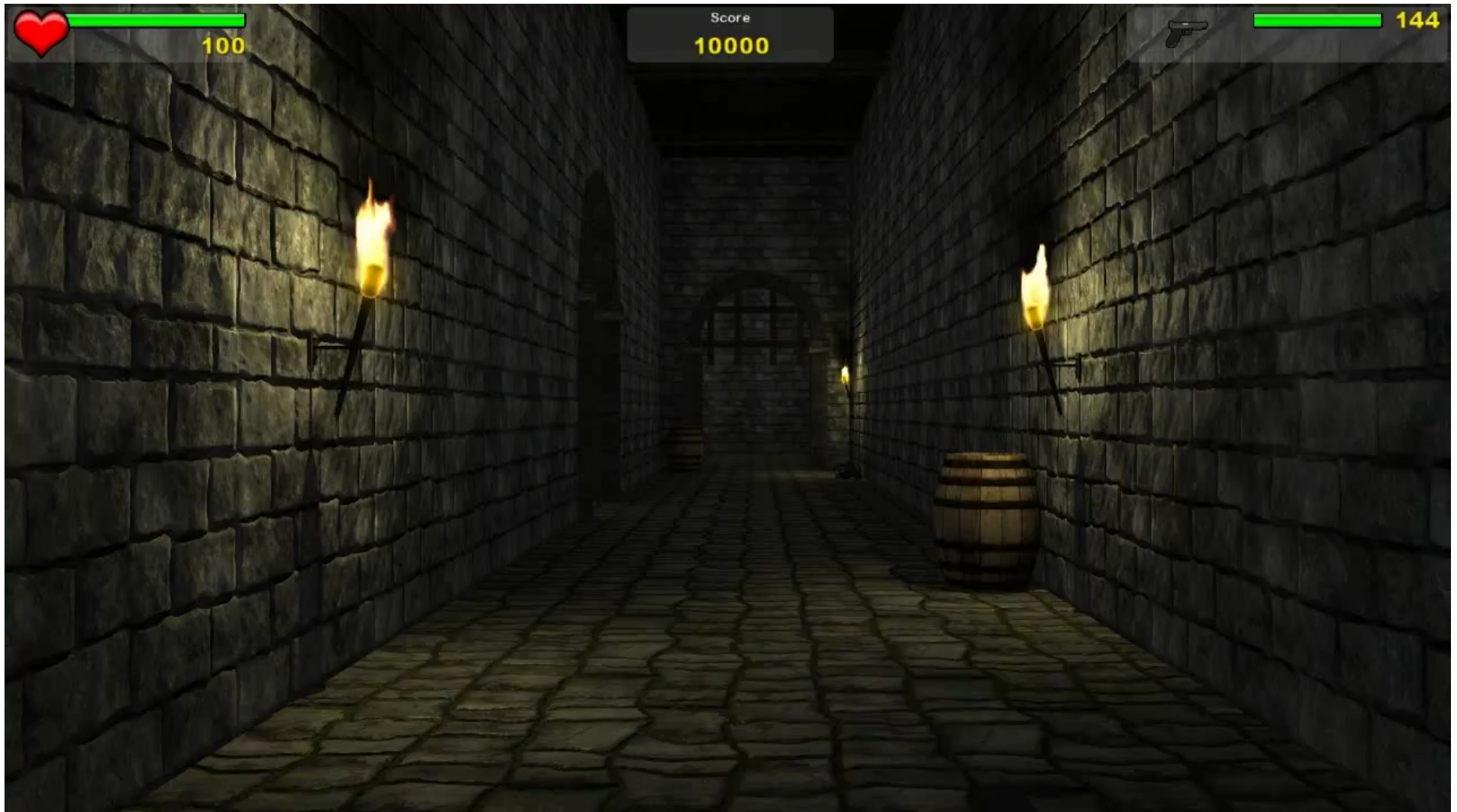
http://www.terathon.com/wiki/index.php/Horizon_Mapping



Dynamic Horizon Mapping



http://www.terathon.com/wiki/index.php/Horizon_Mapping

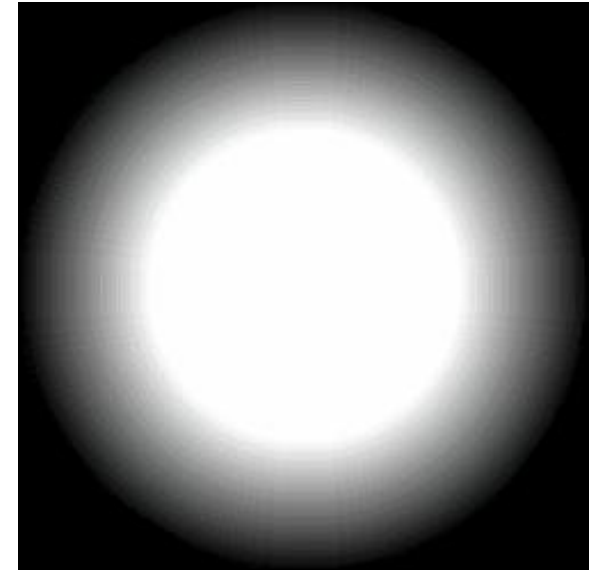


Interactive Media & Game Development

Radiosity

- What is it?

Example of Blending



Blending Result



Skybox Rendering

- Create ***really big*** a cube around the world
- Texture each side with a sky texture

Sources of Textures

- Computer-generated
 - Complete control, might not be realistic
 - Generate a repeating pattern
 - Generate a random pattern (like noise)
 - Simulate physical properties

- Digital camera
 - Realistic, but hard to control
 - Can stitch into mosaic

- Hybrid
 - Start with a photo, edit as necessary