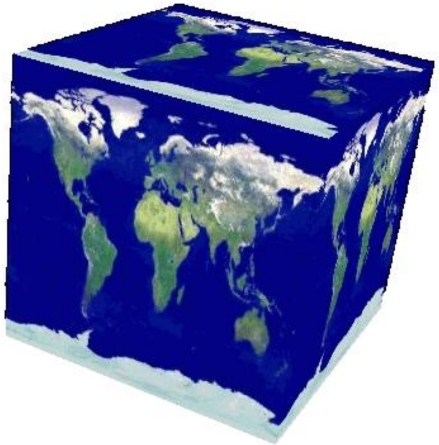
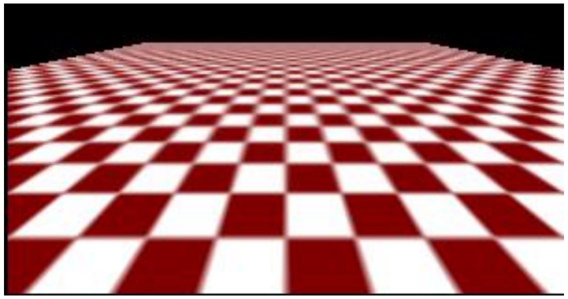
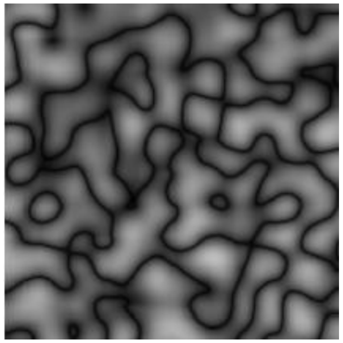
Texture Mapping



- A way of adding surface details
- Two ways can achieve the goal:
  - Surface detail polygons: create extra polygons to model object details
    - Add scene complexity and thus slow down the graphics rendering speed
    - Some fine features are hard to model!
  - ✓ Map a texture to the surface (a more popular approach)

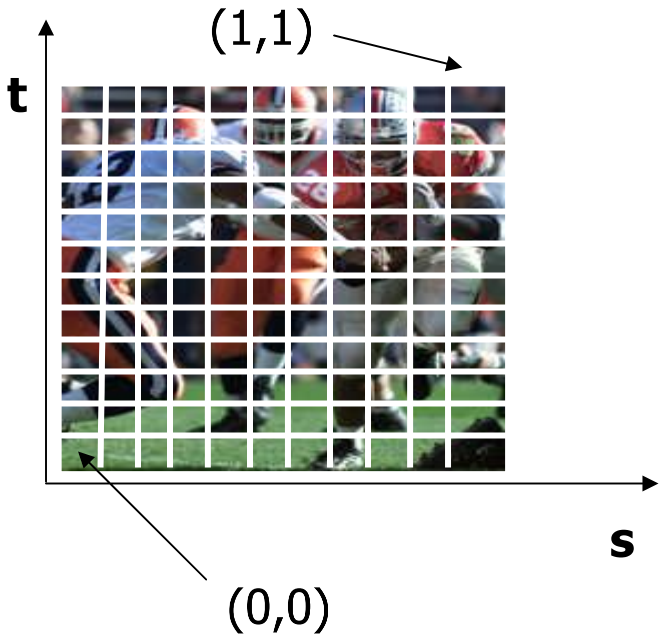




Complexity of images does
Not affect the complexity
Of geometry processing
(transformation, clipping…)

Texture Representation

- ✓ Bitmap (pixel map) textures (supported by OpenGL)
- Procedural textures (used in advanced rendering programs)



Bitmap texture:

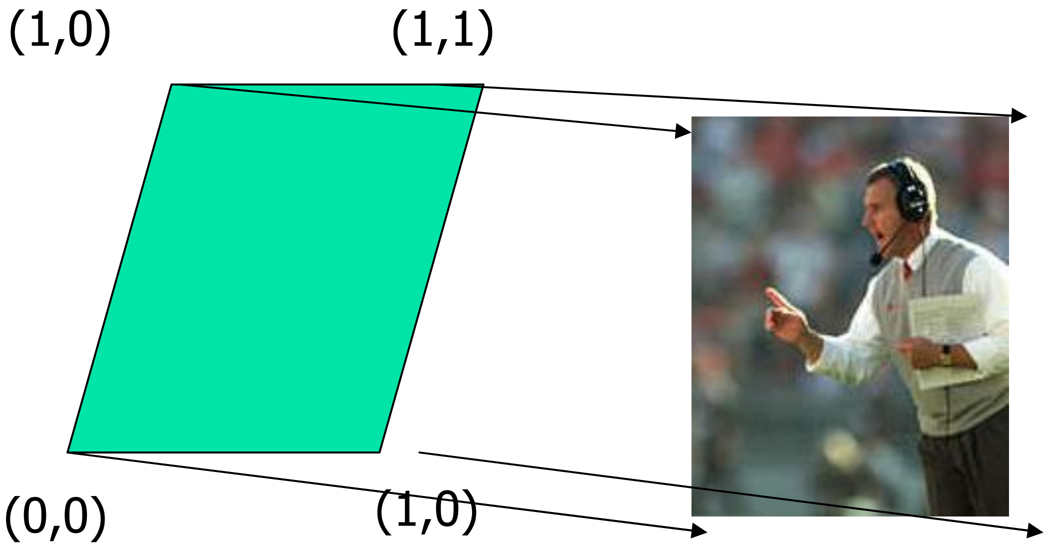
- ❑ A 2D image - represented by 2D array texture[height][width]
- ❑ Each pixel (or called **texel**) by a unique pair texture coordinate (s, t)
- ❑ The s and t are usually normalized to a [0,1] range
- ❑ For any given (s,t) in the normalized range, there is a unique image value (i.e., a unique [red, green, blue] set)

Map textures to surfaces

- Establish mapping from texture to surfaces (polygons):

  - Application program needs to specify texture coordinates for each corner of the polygon

The polygon can be in an arbitrary size



(1,0)

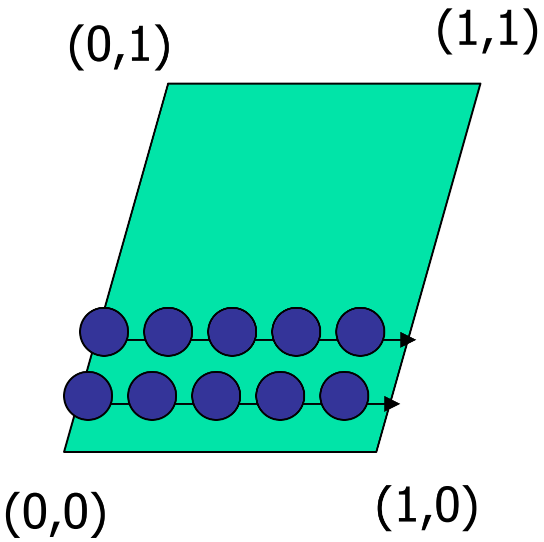
(1,1)

(0,0)

(1,0)

Map textures to surfaces

- Texture mapping is performed in rasterization (backward mapping)



❑ For each pixel that is to be painted, its texture coordinates (s, t) are determined (interpolated) based on the corners' texture coordinates (why not just interpolate the color?)

❑ The interpolated texture coordinates are then used to perform texture lookup

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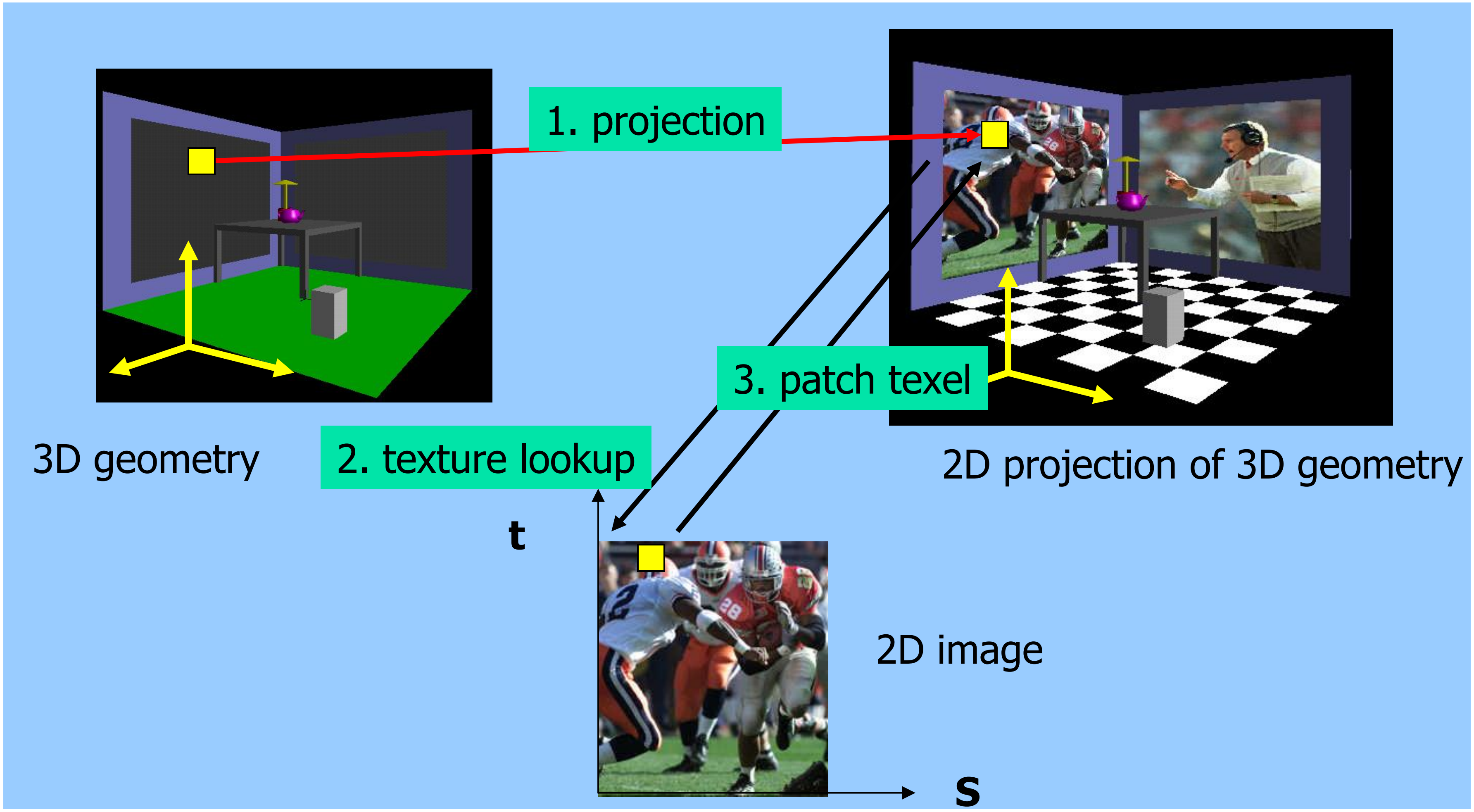


1. projection

3. patch texel

3D geometry

2. texture lookup

2D projection of 3D geometry

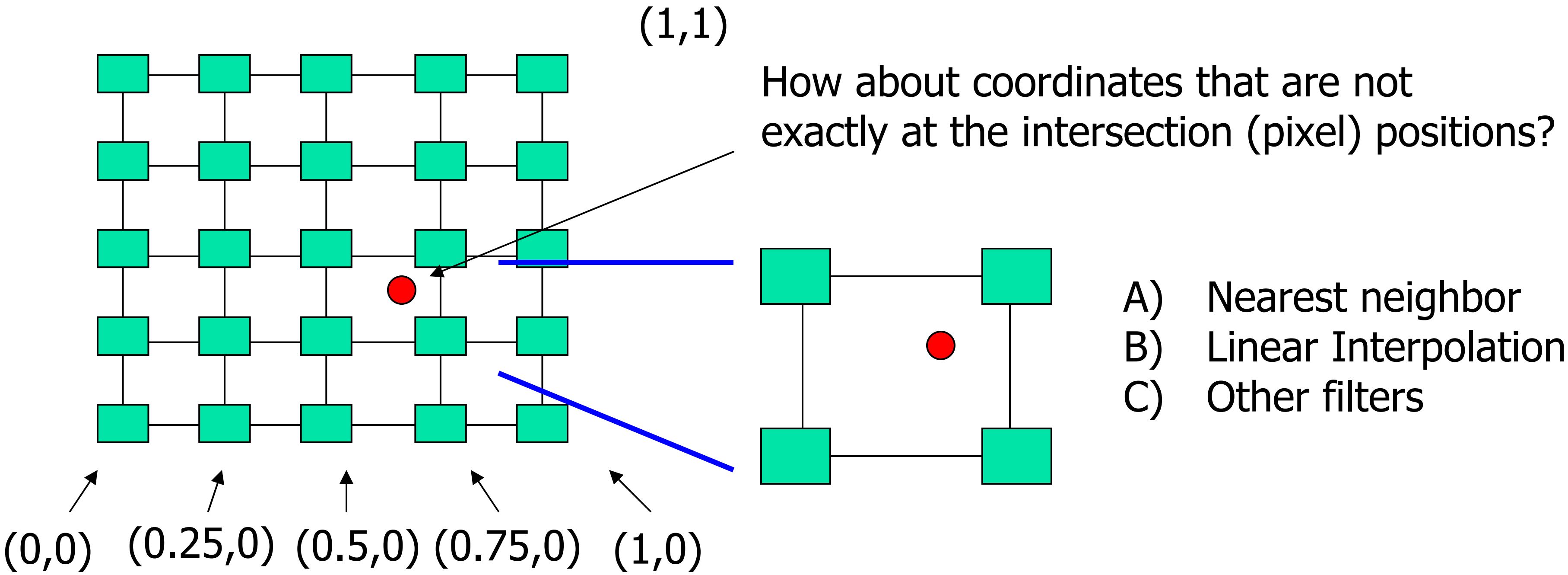
t

2D image

s

Texture Value Lookup

- For the given texture coordinates (s,t), we can find a unique image value from the texture map



How about coordinates that are not exactly at the intersection (pixel) positions?

A) Nearest neighbor
B) Linear Interpolation
C) Other filters