Compositing Techniques

CS 211A

The Alpha Channel

- In addition to RGB, the fourth alpha channel
- Alpha blending
- Application can control the value of alpha at every pixel

Compositing Functions

- *Source* α - associated with the triangle
- *Destination* α – associated with a pixel in the frame buffer
- $S = [s_r, s_g, s_b, s_a]$, $D = [d_r, d_g, d_b, d_a]$
- $D' = f_s(s_a,d_a)S + f_d(s_a,d_a)D$

  $= s_aS + (1-s_a)D$ - Transparency

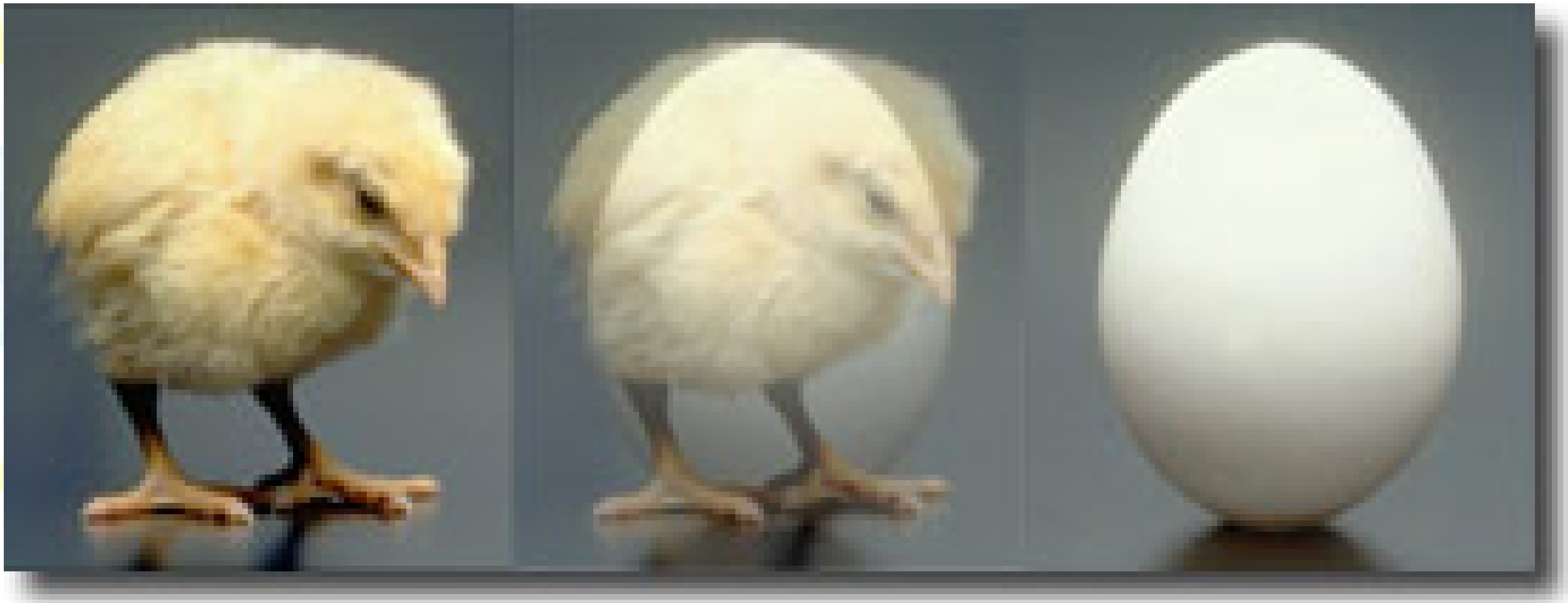
Transparency

- $D' = s_a S + (1 - s_a) D$
- Color of the triangle being rendered is attenuated by s_a
- Color existing in the framebuffer attenuated by $(1 - s_a)$
- These colors are added to create the new color in the framebuffer

Transparency

- $D' = s_a S + (1-s_a)D$
- Opaque triangle has $s_a = 1$
  - Framebuffer gets overwritten
- Transparent triangle has $s_a = 0$
  - Framebuffer remains unchanged
- Translucent triangle has $0 < s_a < 1$
  - Color gets blended

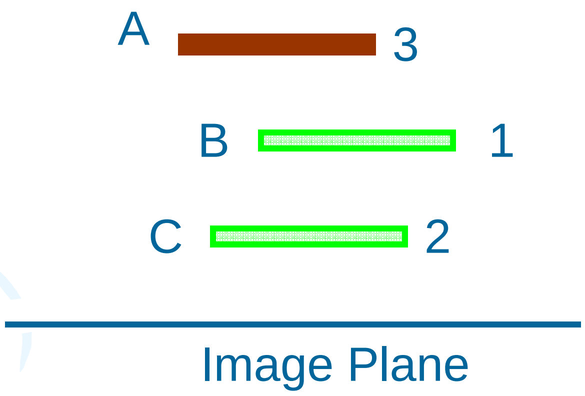
Transparency



Chicken = 1, Egg = 0 **Chicken = 0.5, Egg = 0.5** **Chicken = 0, Egg = 1**

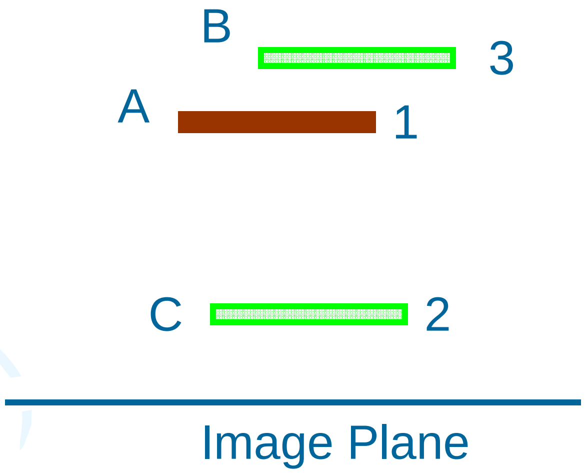
Problems

- Will show only A - Wrong



Problems

- Will have contribution from B – Wrong
- Depends on the order of rendering



How to solve this?

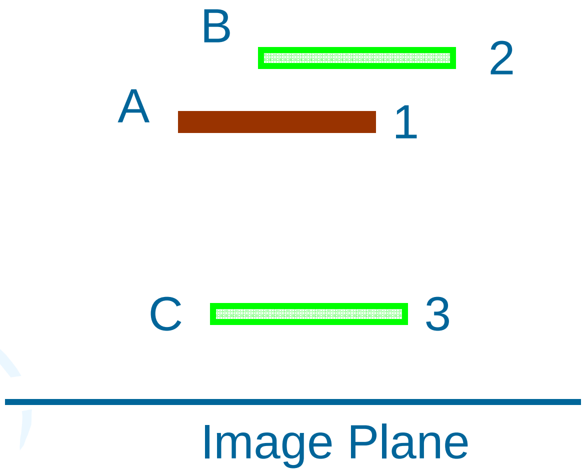
- Order triangles back to front and render
- Order-dependent rendering
  - Very Expensive

Optimizations

- Render opaque objects first (occlusion resolved)
- Order translucent objects back to front
- Render them back to front

Problems

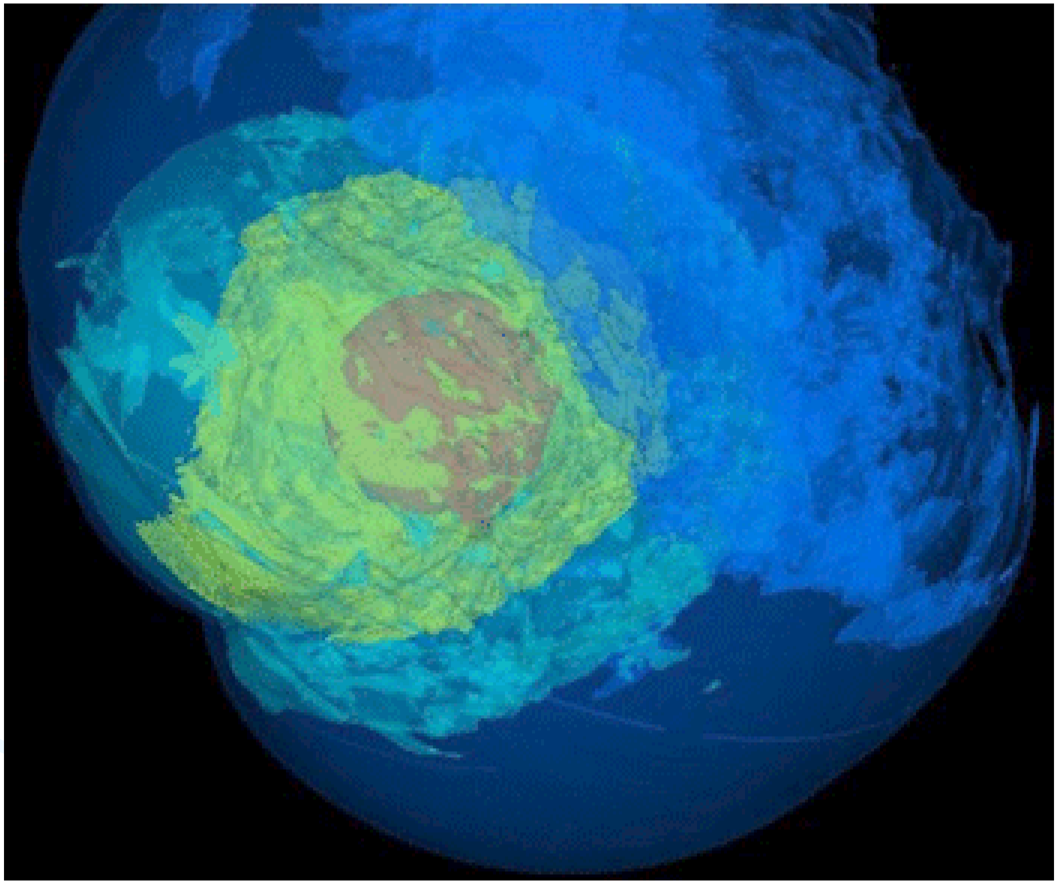
- This does not solve this problem



Optimizations

- Render opaque objects first (occlusion resolved)
- Set z-buffer to read only
  - Retains the depth of opaque objects only
- Order translucent objects back to front
- Render them back to front
  - Only if they pass the z-buffer test
  - Only if no opaque objects are in-front of it

Results



Accumulation Buffer

- Compositing images in framebuffer
- Limited color resolution
- Clamping and washed out appearance
- Accumulation buffer – floating point colors
  - Higher ***color*** resolution
- Do weighted accumulation
  - Transfer the result to framebuffer
  - Greater ***color*** precision

Anti-aliasing

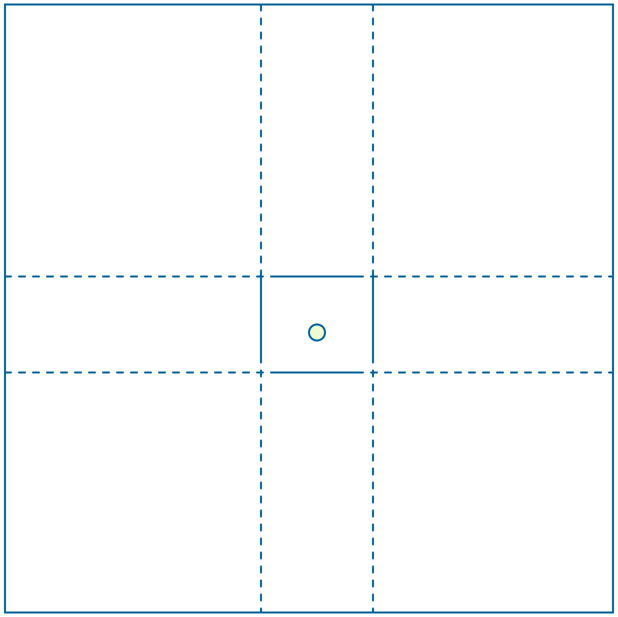
- Say we have a frame buffer of 100x100
- And our scene has frequencies till 100 Hz
- Approach
  - Render the scene in a 200x200 framebuffer
    - Sufficient sampling and hence no artifacts
  - Filter it to 100x100 to remove the higher frequencies
    - Suitable for 100x100 and hence **anti-aliased**

Anti-aliasing

- Say we have a frame buffer of 100x100
- And our scene has frequencies till 100 Hz
- Approach
  - **Super-sample** the scene at a higher resolution
  - **Filter** it to a lower resolution
- How to achieve this if your framebuffer has a limited ***spatial*** resolution?
  - Say, cannot have a framebuffer of more than 100x100 resolution

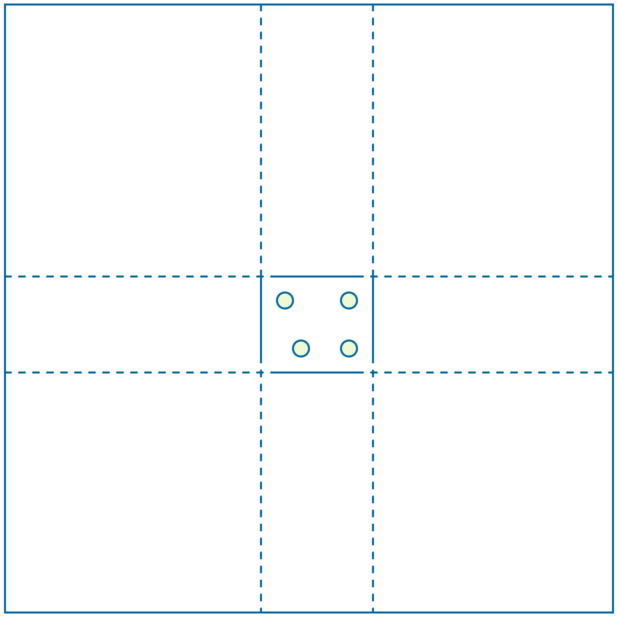
Use Accumulation buffer

- Each pixel generated is a point sample of the scene
- Rendering is a process of generating the point samples



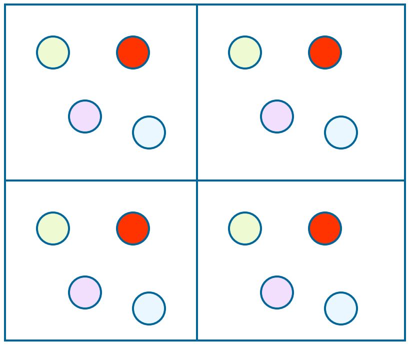
Use Accumulation buffer

- If we can generate more than one sample per pixel
- Average the samples
- Same effect



Jittering the view point

- Jitter the view point
- The projected screen coordinate jitter should be less than a pixel
- Keep accumulating with appropriate weight
- Can achieve the effect with a low ***spatial*** resolution accumulation buffer



¼ of green + ¼ of red
+ ¼ of blue + ¼ of orange