Shadows and Faking Intensity

CS116B

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Outline

- Shadows
- Camera Parameters
- Displaying Light Intensities
- Halftone Patterns and Dithering

Shadows

- Visibility detection algorithms can be used to locate regions that are not illuminated by light light sources.

- Just take the viewing position at the light source and see what is and is not visible.

- Shadowed areas can be illuminated with the ambient light only

Camera Parameters

- Might want to render a scene so that only some of the items in the scene are in focus. In particular, making distant objects out of focus.

- This can be simulated by projecting each position in the 3D scene to multiple pixel positions on the scene based on depth.

- As this idea is similar to anti-aliasing can be incorporated into scan-line algorithms in much the same way.

Displaying Light Intensities

- In our model a surface light intensity is some value between 0.0 and 1.0 for each color.

- Typically, a computer only has a fixed number bits to represent this value.

- In color limited display mode, we might have to do tricks to get things to draw approximately correct.

Distributing System Intensity Levels

- Want that if the light intensity goes from .2 to .4, it looks that it increased by about the same as going from .4 to .6

- However, humans perceive light on a logarithmic scale. Thus, if break the interval between 0.0 and 1.0 into n parts and we need

  $I_1/I_0 = I_2/I_1 = \ldots = I_n/I_{n-1} = R$

  Then we must have $I_k = r^k I_0$.

  So $r = (1/I_0)^{1/n}$ and $I_k = (I_0)^{(n-k)/n}$

  For instance might take $I_0 = 0.1$.

Gamma Correction and Video Lookup Tables

- For a CRT, the monitor response curve is described with the exponential function $I = aV^{\gamma}$. Here V is the supplied voltage and a and γ depend on the monitor.

- So to get the voltage correct for the given intensity we need to set it to:

  $(I/a)^{1/\gamma}$.

- This is called the **gamma correction** for the intensity. In reality have a separate γ for each of red, green, and blue.

- If this is combined with the way humans perceive intensity as given in the last slide we have:

  $V_k = (I_k/a)^{1/\gamma}$.

- For LCD devices, the intensity also depends on voltage; however, it is in general a much more non-linear function.

Halftone Patterns

- If only a few intensity levels are available can group together a few pixels into the display of each point of the scene. i.e., could plot a single point using a 2x2 region of pixels and set each of these four pixels to different intensity levels to fake more colors.

- This is called halftoning.

- Below is a 2x2 pattern when constructing larger patterns want to avoid symmetrical patterns. If can have more intensity values per dot then want them to count up
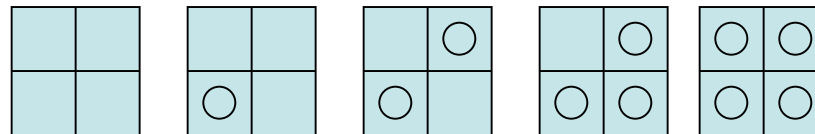
0-0.2   0.2-0.4   0.4-0.6   0.6-0.8   0.8-1

Dithering

- Is a technique for producing halftone like results without reducing resolution as grid patterns do.

- The idea is that random values are added to pixel intensities. (**Dithered noise**).

- We will continue this topic after the midterm.