CS 114 - Final Project
Cel Shading Presentation

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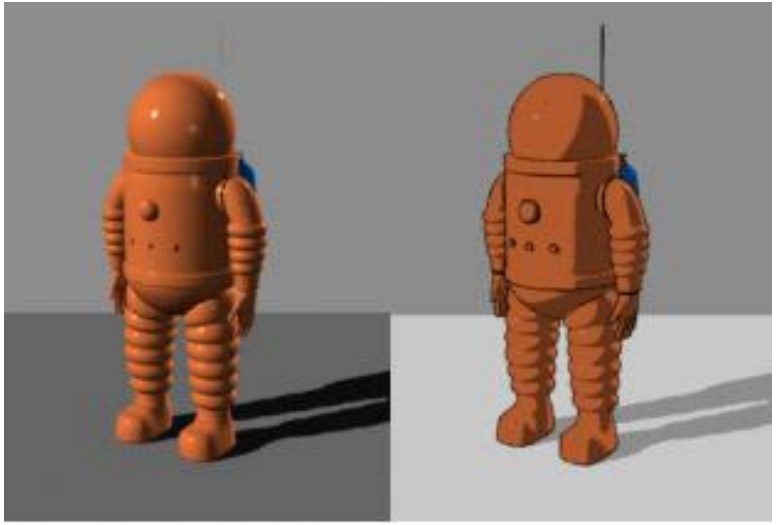
Cel Shading

- Type of non-photorealistic rendering (NPR) intended to make 3D graphics look flat or have a paper-like texture.
- The technique calculates the light intensity per pixel and then quantizes the pixel color into a small discrete range of colors.



Last Progress

- Utilized Program Assignment 1's code structure as a base
- Implemented base version of cel shading
- Currently implementing the sobel operator for edge detection

Current Progress

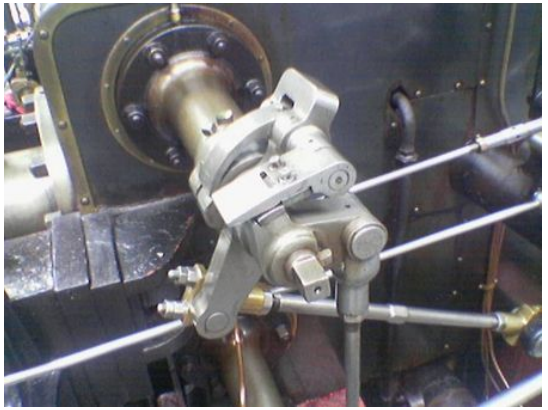
- **In Progress:** Outlining the Model
  - Sobel Operator & Multi-pass Shaders
  - Outline color can be modified
  - Outline thickness can be modified
- Light Power & Cel Bands
  - Light power now successfully modifies the cel bands
  - Limited cel bands between 3 (default) to 6 (2x default)

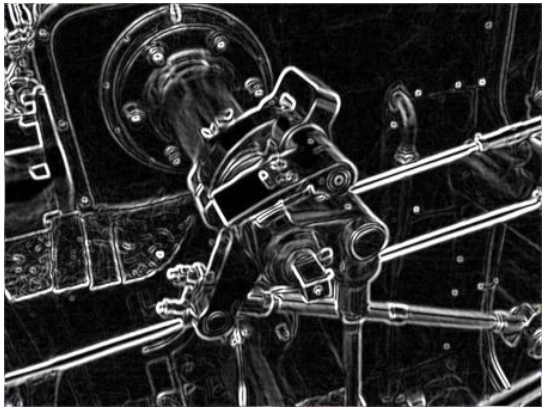
Sobel Operator

- 2D image filter that detects the edges of an image by calculating the differences in pixel intensity in each region.
- The algorithm looks for sharp changes in the vertical and horizontal directions and then combines them.

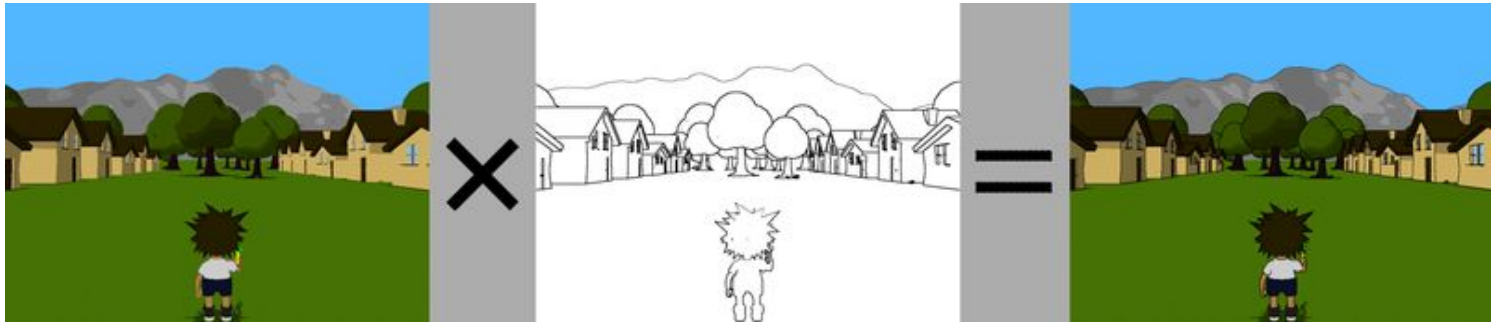
$$\mathbf{G}_x = \begin{bmatrix} +1 & 0 & -1 \\ +2 & 0 & -2 \\ +1 & 0 & -1 \end{bmatrix} * \mathbf{A} \quad \text{and} \quad \mathbf{G}_y = \begin{bmatrix} +1 & +2 & +1 \\ 0 & 0 & 0 \\ -1 & -2 & -1 \end{bmatrix} * \mathbf{A}$$

$$\mathbf{G} = \sqrt{{\mathbf{G}_x}^2 + {\mathbf{G}_y}^2}$$





The Rendering Process



1. Cel-shaded scene is rendered.

2. The scene's normal and depth information used to generate outlines.

3. Cel-shaded scene and outlined scene are composited.

Final Goals & Obstacles

- Successfully implement an outline for the 3D model
  - Specifically get the two shaders to appear at the same time
- Add a few more basic 3D models
  - Generate a 3D scene rather than standalone objects within the canvas

Demo