Vectors \( \mathbf{a}, \mathbf{b} \)

\( \Theta \) = angle \( \mathbf{a}, \mathbf{b} \)

\[ \cos \Theta = \frac{\mathbf{a} \cdot \mathbf{b}}{|\mathbf{a}| \cdot |\mathbf{b}|} \]

\[ |\mathbf{a}| = \sqrt{a_1^2 + a_2^2 + a_3^2} \]

\( \mathbf{a} = (1, 0, 0) \)

\( \mathbf{b} = (1, 2, 3) \)

\( \mathbf{a} \cdot \mathbf{b} = 1 \)

\[ |\mathbf{a}| = 1 \quad |\mathbf{b}| = \sqrt{14} \]

\[ \cos \Theta = \frac{1}{1 \cdot \sqrt{14}} = \frac{1}{\sqrt{14}} \]
Graphics pipeline

Vertices → Pixels

You ask. That pixel

Q Design API

What should 'pick'

Routine return?

A1 = Line of code

234.
SOLN

You decide what's important in objects.
You color each different object differently.
Turn off lighting.
To pick — read pixel value.

Light Pen Picking

As line is drawn, an 'ID register is updated
when photocell triggers, register copied.'
3M hypothetical machine would in future have 1 MB of memory today 1276B
1 MIPS 67F
1 M pixel. 27

progress is not uniform

shear

\[ \square \rightarrow \square \]
2D QUAD TREE
- Use 1-level uniform grids

- Quicker to code, optimize, and tune

- Actually is fast if done properly

- Parallelizable