

CG

an almost factual account of the  
history of computer graphics

a long long time ago ...

before buzz ...

before quake ...

before microslot windows ...

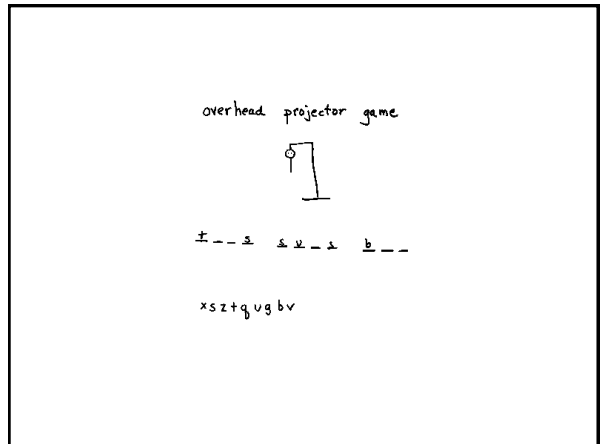
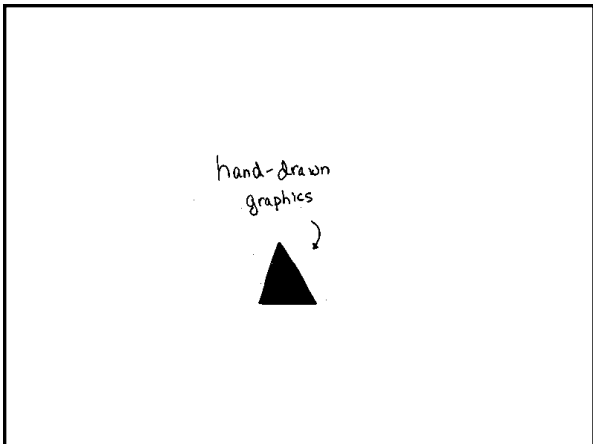
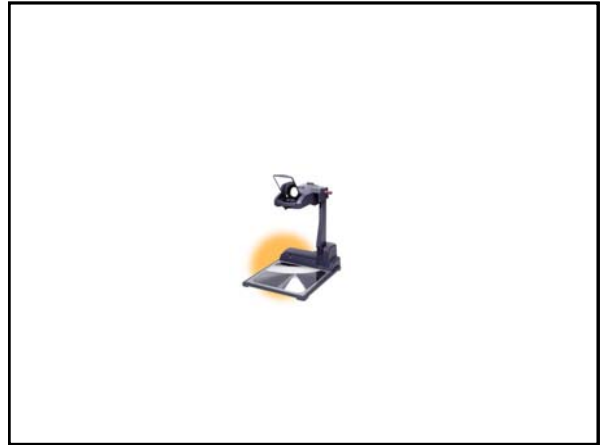
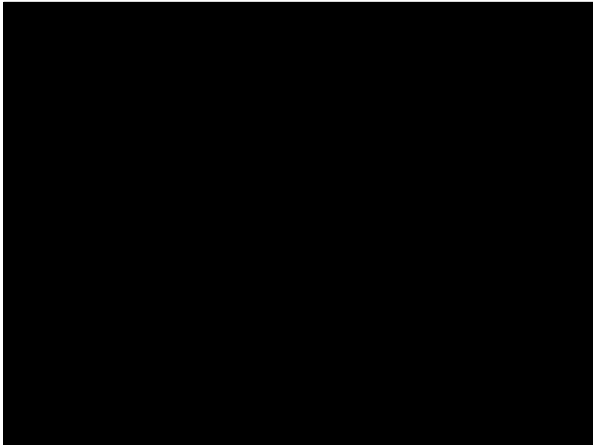
before most of you were born ...

the world existed without computer graphics

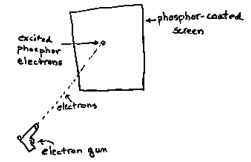
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inspiration



excited phosphor demo



instant replay

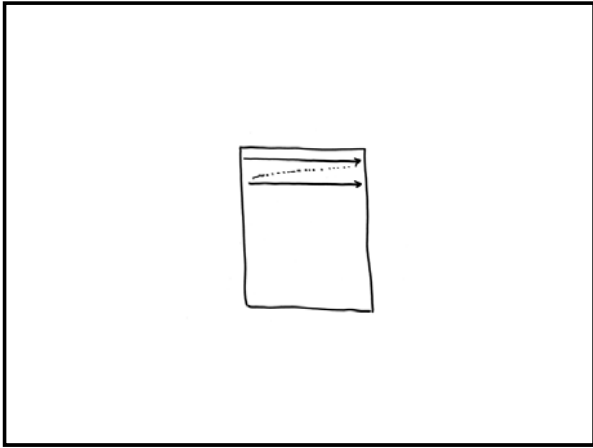


moving electron beam demo



an even less moving  
moving electron beam demo

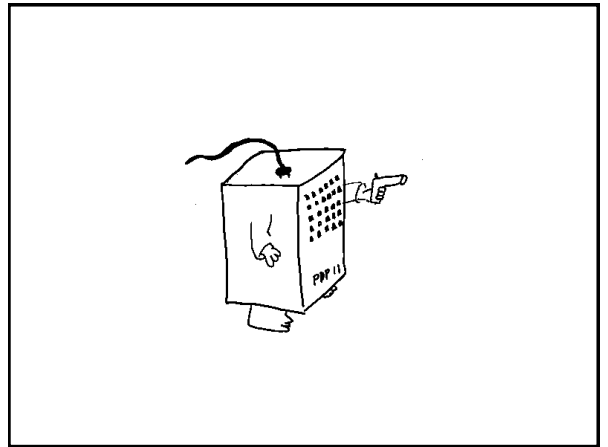
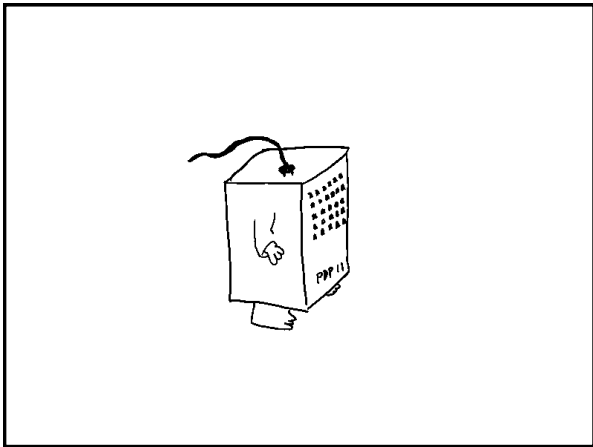




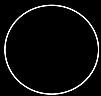
society would reap huge benefits ...



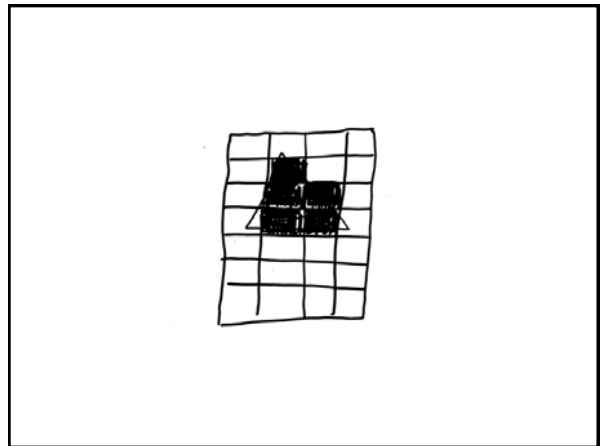
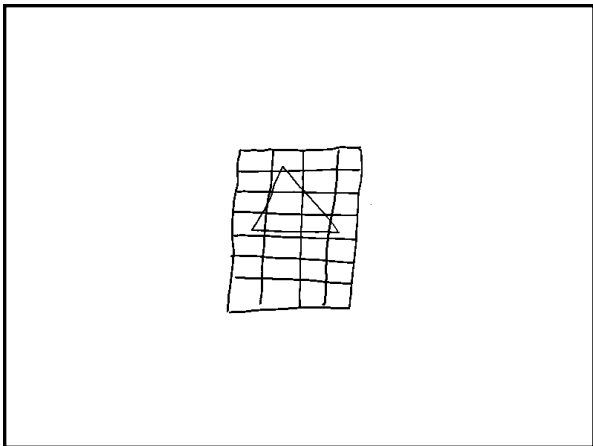
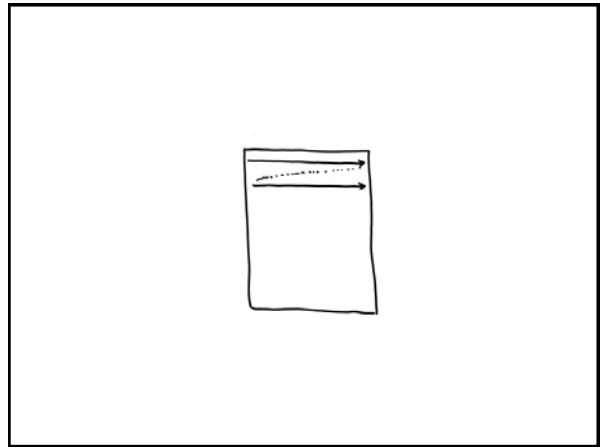
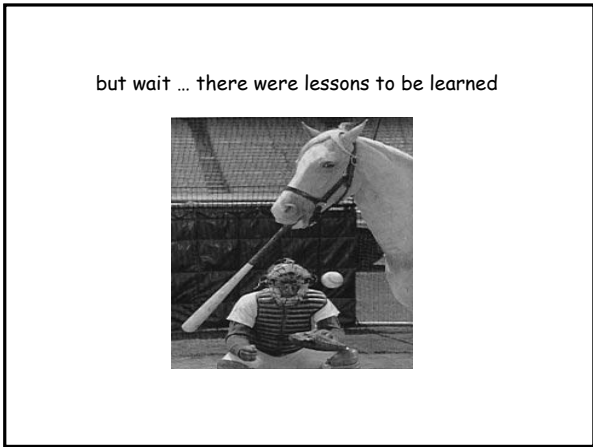
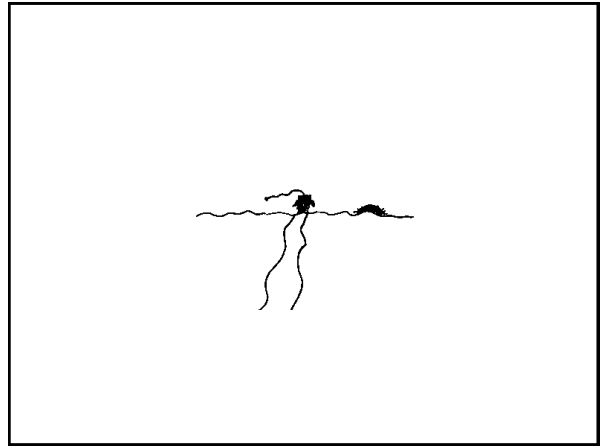
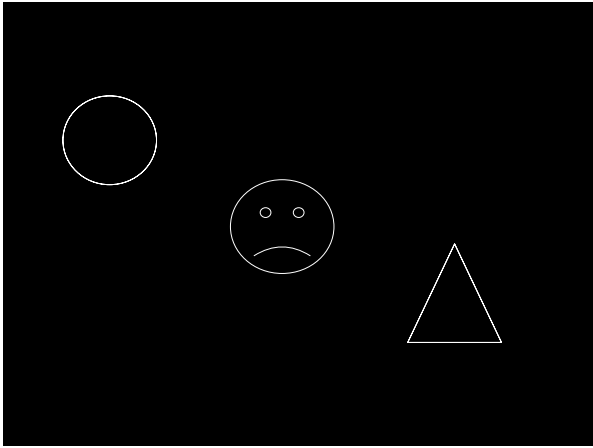
but that is a different story

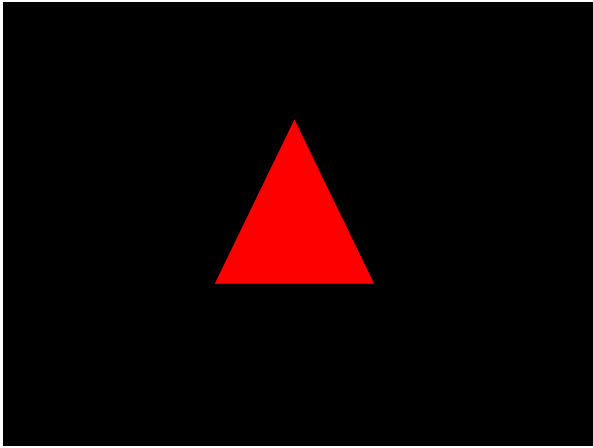


a fast draw



filled triangle





and it only took

Three 3D rectangular boxes are shown, each containing a different arrangement of small, multi-colored dots (red, blue, yellow, green, cyan) scattered across their surfaces.

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vector vs. raster graphics

Two square boxes are shown side-by-side. The left box contains a red triangle with a small black arrow pointing to its left side, representing a vector graphic. The right box contains a red triangle with a horizontal line passing through its center and a small black arrow pointing to the right, representing a raster graphic.

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meanwhile  
back in cambridge

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A person with glasses is shown smiling. A speech bubble above them says "hmmm". They are holding a remote control with a red arrow pointing towards a television. The television screen shows a black and white image of a horse and a person. A speech bubble above the TV says "V".

remote control

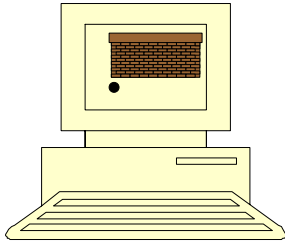
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and a few years later...

A simple line drawing of a computer monitor and keyboard. The monitor screen displays a solid red triangle.

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and more



meanwhile  
back in hollywood

digital compositing

blend parts from different  
digital images to create a new  
image



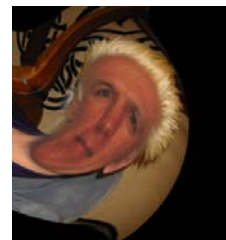
more famous composites



and more



another technique: warping



# morphing

transform one image  
into another by  
compositing and warping  
across time

# morphing



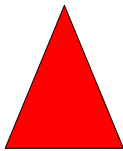
cs155 fall 2004

# computer graphics

2D image processing (synthesis)

meanwhile  
back in utah

# the lowly triangle



# triangle mesh





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## triangle mesh



stanford michaelangelo project

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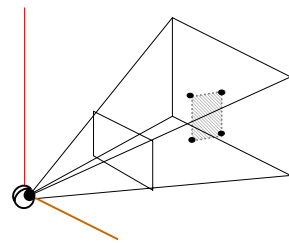
## the graphics pipeline

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## pipeline: build scene

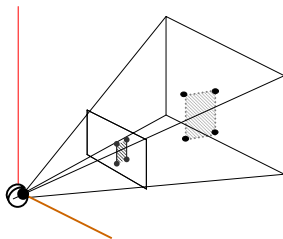


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## pipeline: project

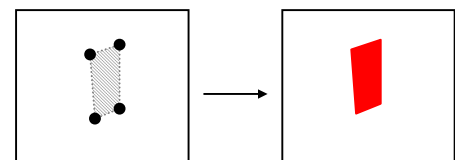


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## pipeline: scan convert



vertices in view plane

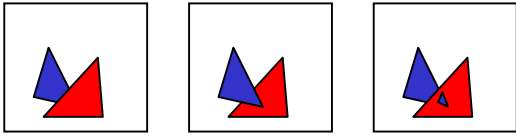
frame buffer

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## hidden surface removal



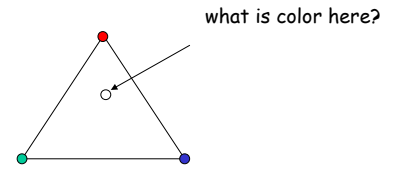
which is right?

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## shading

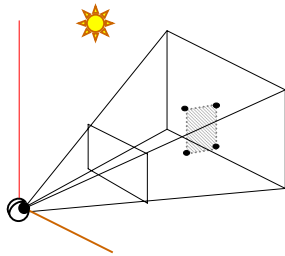


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## local illumination



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## the holy grail

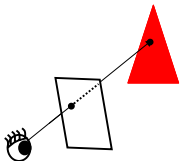
photo-realism

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## ray tracing



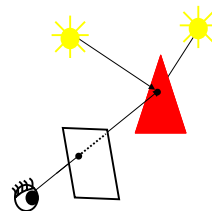
- cast ray through pixel into scene
- find intersection point (if any) that is closest to eye
- compute luminance at intersection

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## luminance



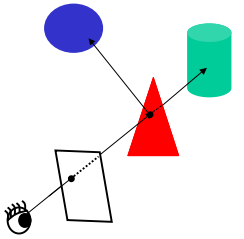
- direct illumination from light sources
  - reflection off surface
  - transmission through surface
  - subject to occlusions

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## luminance



- direct illumination
- inter-object specular reflection

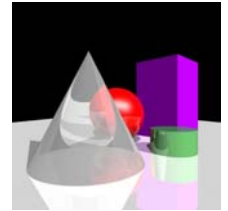
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## ray tracing

```
<scene>
  <cone material="glass">
  <sphere color="red">
  <box color="purple">
  <floor material="marble">
</scene>
```



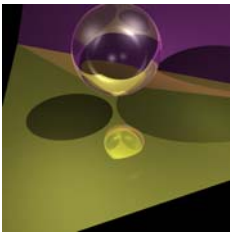
peter henry

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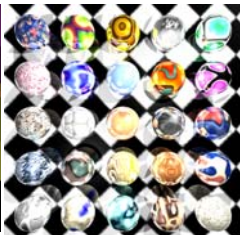
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## ray tracing



andrew mcdonnell



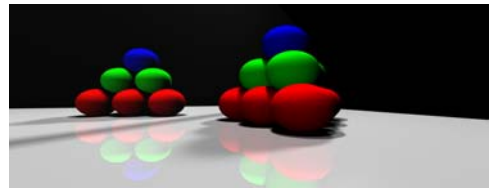
drew levin

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## ray tracing



jason wither

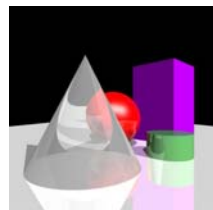
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## semi-local illumination

what is wrong with this picture?



peter henry

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## diffuse reflections



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## the holy grail

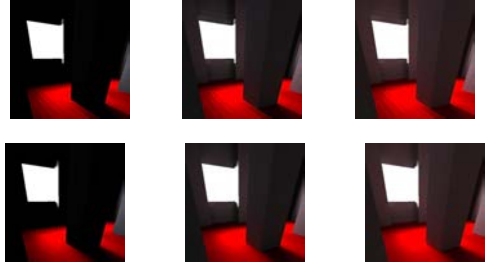
photo-realism

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## radiosity



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## computer graphics

1. image processing
2. rendering

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## polygon mesh



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## surface modeling



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## computer graphics

1. image processing
2. rendering
3. modeling
4. animation

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## computer graphics

1. image processing
2. rendering
3. modeling
4. animation

CS155: Computer Graphics

CS157: Computer Animation

## a CS157 film



## CS155 Prerequisites

- Linear algebra
- C++ programming
- Algorithms & data structures

## warning

this class is a lot of work!! drop it now if

- you have a heavy load this semester
- you haven't had the prerequisites
- you aren't a capable programmer

P.S. this class is also a lot of fun!

## basic course requirement

you cannot blow off any assignment  
to pass the class you must submit a solution for each project that successfully implements at least 50% of the assigned features.

## course info

[www.cs.hmc.edu/courses/year/semester/cs155](http://www.cs.hmc.edu/courses/year/semester/cs155)