CSCI 4229/5229
Computer Graphics
Fall 2006

Instructor

- Willem A (Vlakkies) Schreüder
- Email: willem@prinmath.com
  - Begin subject with 4229 or 5229
  - Resend email not answered promptly
- Office Hours: Tuesdays after Class
- Weekday Contact Hours: 6:30am - 9:00pm

Course Objectives

- Class: Theory and principles
  - Attendance is encouraged
- Assignments: Practical OpenGL
  - Applications
- No tests or exams
- By the end of the course you will:
  - Understand what OpenGL does internally
  - Be well versed in the use of OpenGL

Course Outline

- Basics (1/3)
  - Projections, transformations, clipping, rendering, text, color, hidden edge and surface removal, and interaction
- Advanced (1/3)
  - Illumination, shading, transparency, texture mapping, parametric surfaces
- Project (1/3)
  - Whatever you're interested in: games, modeling, visualization, 'Google Earth', ...

Text

- OpenGL Programming Guide (5ed)
  - Shreiner, Woo, Neider & Davis
  - “OpenGL Red Book”
  - Addison-Wesley, ISBN 0-321-33573-2
  - Download previous editions as PDF
- Computer Graphics: Principles & Practice (2ed)
  - Foley, van Dam, Feiner & Huges
  - Addison-Wesley, ISBN 0-201-84840-6
  - Avoid first edition (which uses Pascal)
- Neither text is required

OpenGL Resources

- www.google.com
- www.opengl.org
- nehe.gamedev.net
  - Excellent tutorial
- www.mesa3d.org

Grading

- Satisfactory complete all assignments => A
- Assignments must be submitted on time unless previous arrangements are made
  - Due Thursday evening 11:59 pm
  - Grace period until Friday morning at 06:30am
- Assignments must be completed individually
  - Stealing ideas are permitted
  - OpenGL code fragments from the web may be used

Nuts and Bolts

- Complete assignments on any platform
  - Assignments reviewed under Fedora Core
  - Set #ifdef so I can compile and run it
- Submit using moodle.cs.colorado.edu
  - ZIP or TAR
  - Name executables hw1, hw2, ...
  - Set makefile so I can do *make -DLINUX*
  - Set window title to *Assignment X: Your Name*
- Include number of hours spent on assignment

ITLL Orientation

- Half hour orientation and agreement
  - Required only once
  - Good for as long as you are at CU
- Required for access to ITLL after hours
  - Weekends are considered after hours
- Tuesday or Thursday at 5:05pm
  - Wait in ITLL lobby for person in purple vest

Assignment 0

- Due: Aug 31, 2006
- Email me:
  - Your name
  - Platform (Hardware, Graphics, OS, ...)
  - Background in computer graphics (if any)
  - Interest in computer graphics (games, scientific visualization, idle curiosity, ...)
  - Project ideas (if you have one already)

Assignment 1

- Due: Sep 7, 2006
- Get OpenGL to work on your platform
  - Compile and run *gears.c*
  - Report frame rate for 1x1, 300x300 and full screen
- If you are on an X based platform:
  - Run glxinfo and check if *direct rendering: yes*
  - Look into enabling hardware support
- Sign up with moodle.cs.colorado.edu
  - Enrollment key: 42295229

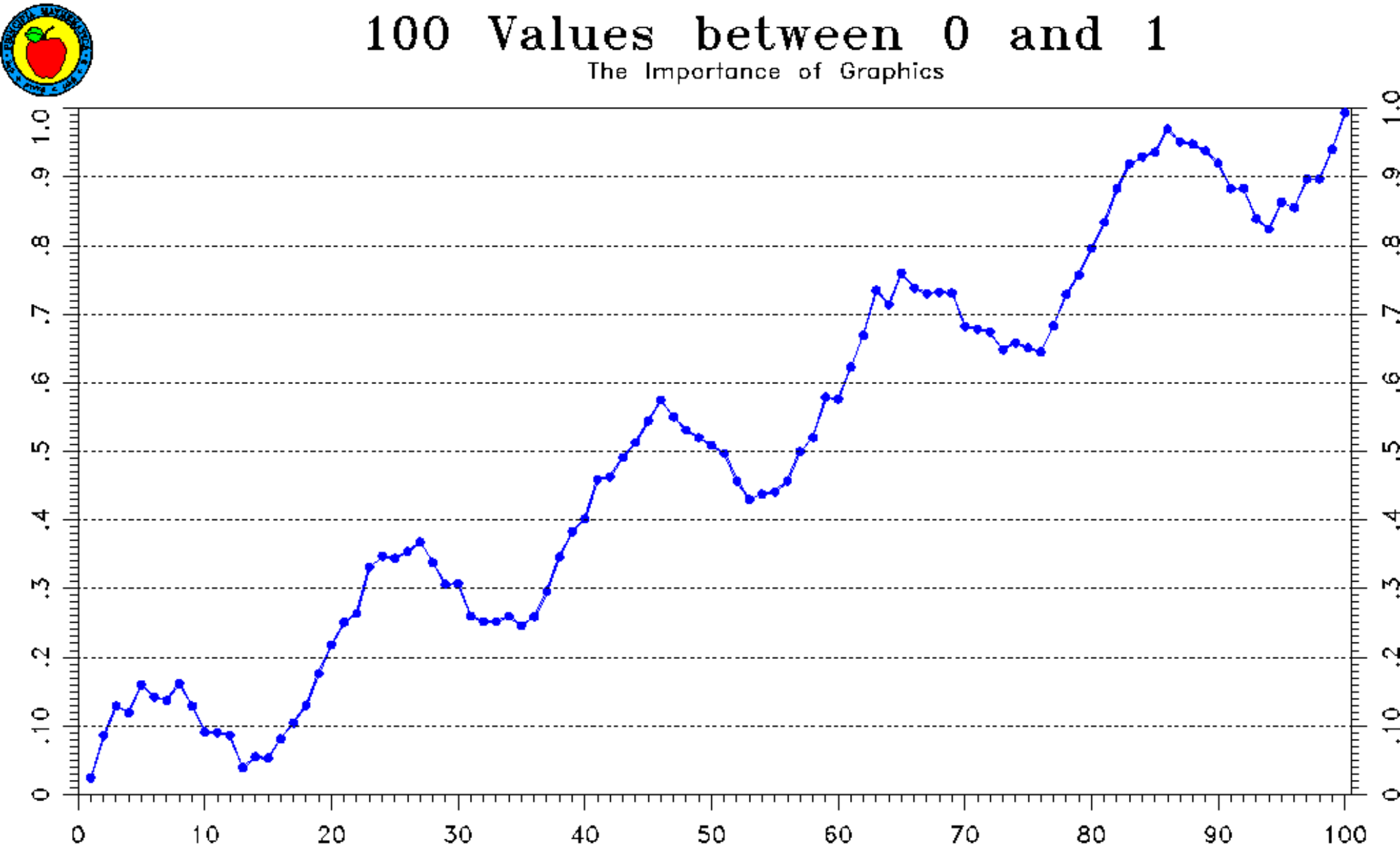
Assignment 2

- Due: Sep 14, 2006
- Write an OpenGL based visualization of the Lorenz Attractor
  - At a minimum show a static line path in 3D
  - Add rotation using cursor keys
  - Use your imagination
- The purpose is scientific visualization
  - Do some science

http://mathworld.wolfram.com/LorenzAttractor.html

The Importance of Graphics: 100 Values between 0 and 1

0.024	0.086	0.129	0.119	0.160	0.142	0.137	0.162	0.129	0.091
0.090	0.086	0.039	0.055	0.053	0.081	0.104	0.130	0.176	0.218
0.251	0.264	0.331	0.347	0.344	0.354	0.368	0.338	0.306	0.307
0.260	0.252	0.252	0.260	0.246	0.259	0.296	0.346	0.383	0.402
0.459	0.463	0.491	0.513	0.544	0.575	0.550	0.531	0.520	0.509
0.497	0.457	0.430	0.438	0.441	0.457	0.500	0.520	0.579	0.576
0.623	0.669	0.735	0.714	0.760	0.738	0.730	0.732	0.731	0.682
0.678	0.674	0.648	0.658	0.651	0.645	0.683	0.729	0.757	0.796
0.834	0.883	0.919	0.929	0.936	0.970	0.951	0.948	0.938	0.920
0.883	0.883	0.839	0.824	0.863	0.855	0.897	0.897	0.940	0.994


100 Values between 0 and 1
The Importance of Graphics
0
.10
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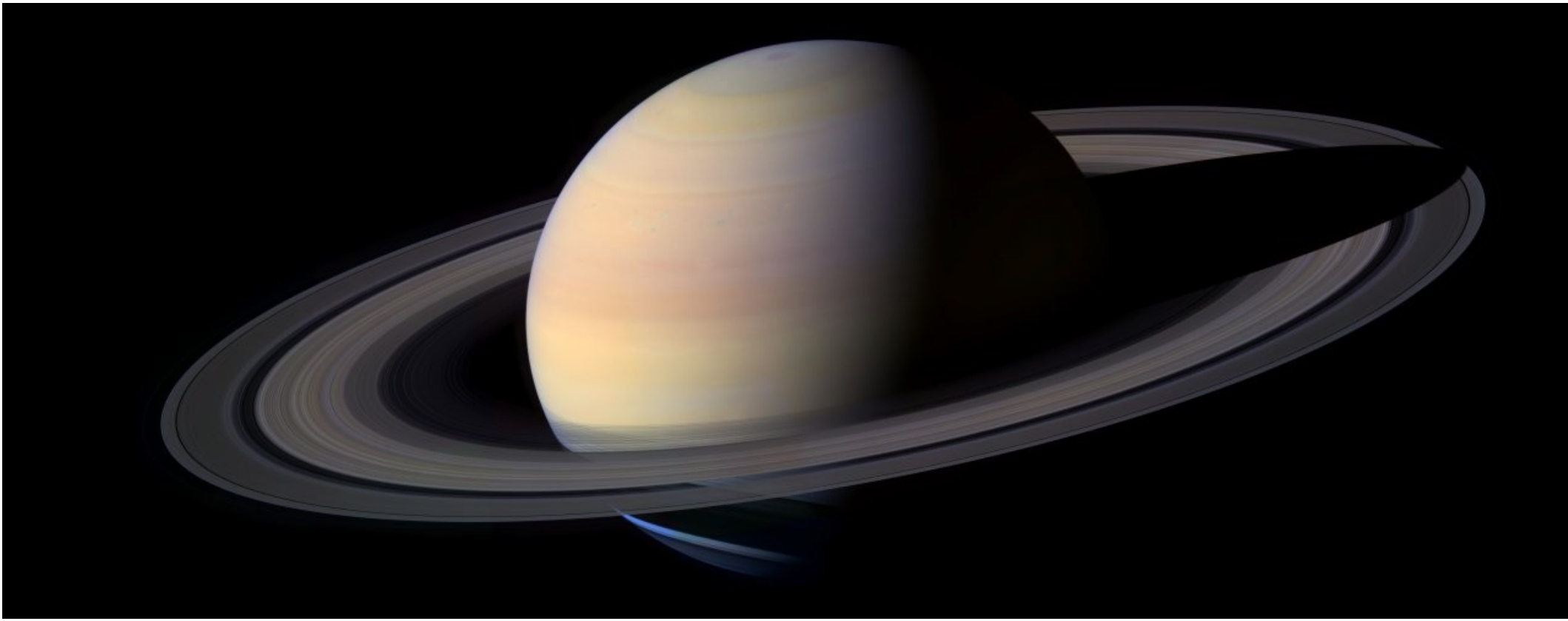
1.0
0
10
20
30
40
50
60
70
80
90
100

Graphic Design

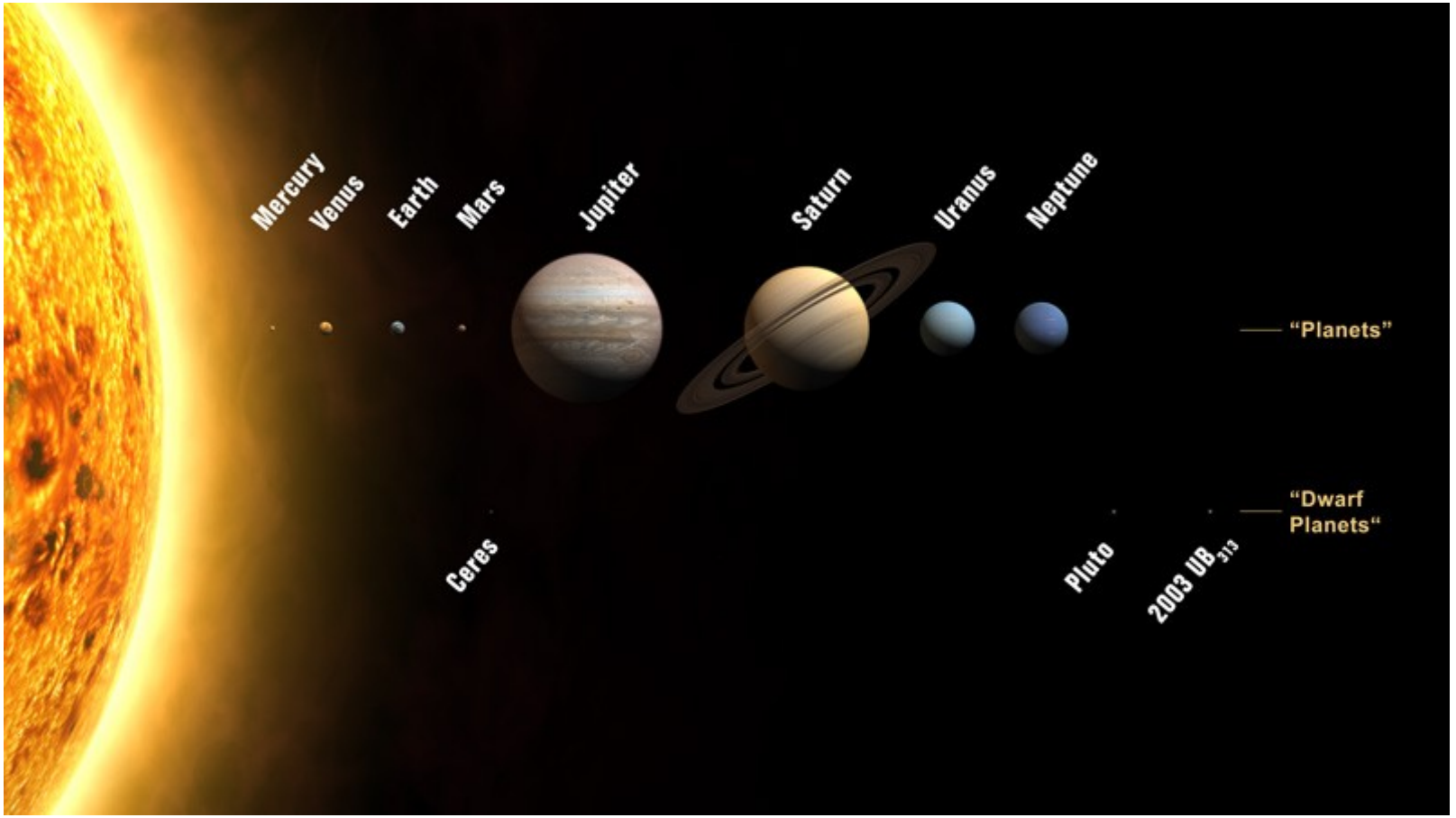
- 2D vs. 3D
  - Cool vs. informative
- Edward R. Tufte
  - Visual Explanations
  - Envisioning Information
  - The Visual Display of Quantitative Information
  - Beautiful Evidence

Saturn from Cassini Probe



Colorado Fall Colors

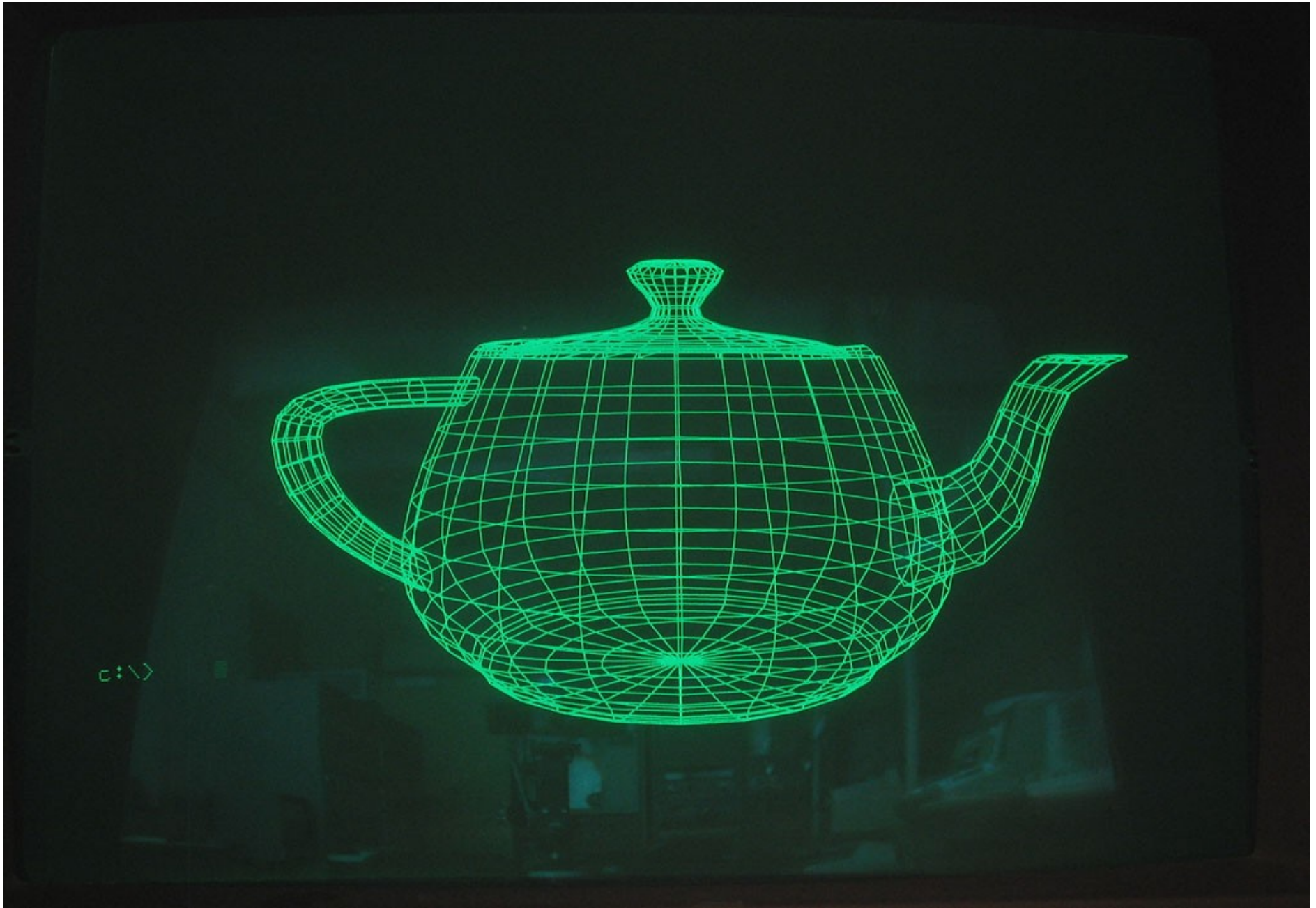
What is wrong with this picture?



In the beginning....

Storage Tube Terminals

Storage Display Images

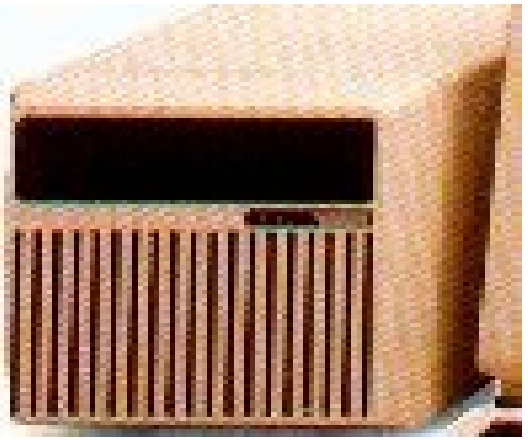


Color: Multiple Pen Plotters

Raster Graphic Terminals

Color Inkjets

Workstations: Apollo DN 330
12 MHz 68020, 3MB RAM, 70MB disk



Plotting Packages

- PLOT-10: Tektronix 4010 graphics
- PLOT88: PC graphics
- DISSPLA: NCAR graphics
- GINO: Portable graphics
- DIGLIB: LLNL device-independent, open source
- GKS: Graphics Kernel System (2D vector)
- PHIGS: 3D Interactive Graphics

The rise of OpenGL

- Originated as SGI IrisGL
- Vendor-neutral OpenGL controlled by ARB
- Hides the details of hardware
  - Software emulation when necessary
  - Hardware acceleration when possible
- Supports 2D to advanced 3D graphics
- Portable to most hardware and OS with WGL, AGL and GLX

Gaming and Graphics

- Text based/ASCII graphics (Pong, PacMan)
- 2D monochrome line graphics (Astroids)
- 2D images & sprites (Mario)
- 3D graphics
  - Flight Simulators (2D -> 3D)
  - First Person Shooters
  - Multi-player grames
- Games push the envelope
- Have you ever seen an arcade game BSOD?