

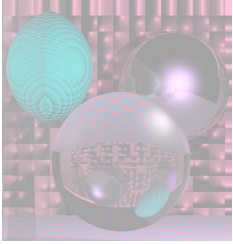
CS 4300

Computer Graphics

Prof. Harriet Fell

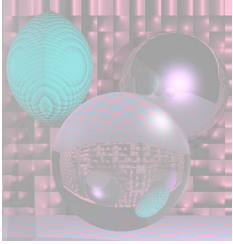
Fall 2012

Lecture 1 – September 5, 2011



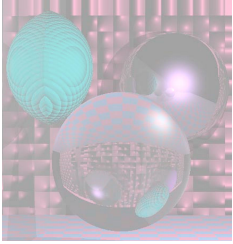
Course Overview - Topics

- This course will chart a path through all the major aspects of mainstream computer graphics.
- You will learn the fundamental mathematics, algorithms, data structures, and programming techniques that are at the core of modern 2D and 3D graphics applications in practice
 - (drawing and design programs, data visualization interfaces, desktop window systems, and games)
- We will start with 2D graphics in the first half of the course, and extend to 3D in the second half.



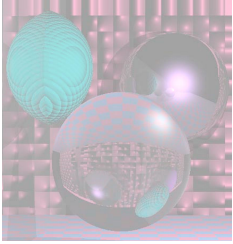
Homework assignments

- Homework will consist largely of software development tasks where you will use your own creativity to apply the methods learned in class in building several interesting 2D and 3D graphics applications.
- There will also be a significant English writing component to at least one of the assignments.
- You will also be required to give at least one presentation of your work to the class.



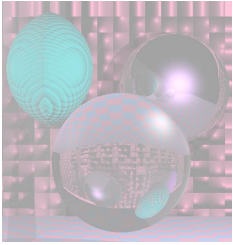
Grading

- Programming Assignments 50%
 - Sampler (10 %)
 - 2-D-Project Functional Spec (5 %)
 - 2-D-Project (10 %)
 - Color Triangle (5 %)
 - Poly Mesh (10 %)Ray
 - Tracing (10 %)
- Two 65 minute exams (25% each)
 - The exams will be closed book.
 - You may bring one two-sided sheet of notes.



Early History

- <http://accad.osu.edu/~waynec/history/timeline.html>
- http://sophia.javeriana.edu.co/~ochavarr/computer_graphics_history/historia/
- 1801 Joseph-Marie Jacquard invented an automatic loom using punched cards to control patterns in the fabrics. The introduction of these looms caused the riots against the replacement of people by machines.
- 1941 First U.S. regular TV broadcast,
1st TV commercial (for Bulova watches)
- 1948 Transistors
- 1949 Williams tube (CRT storage tube)



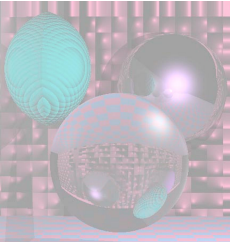
Jacquard Loom



From Wikipedia.org

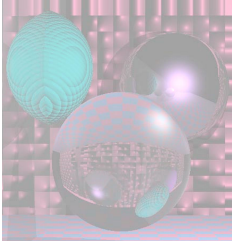
September 3, 2012

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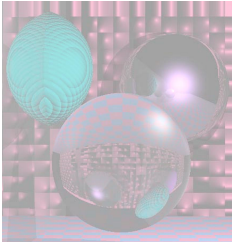
Early TV





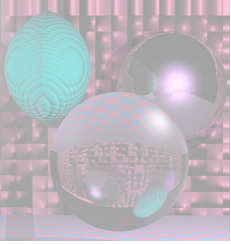
History – the 50s

- 1951 Graphics display, Whirlwind computer
- 1954 color TV
- 1955 Light Pen, SAGE- Lincoln Lab
- 1958 Graphics Console, TX-1 MIT
- 1958 John Whitney Sr. uses analog computer to make art



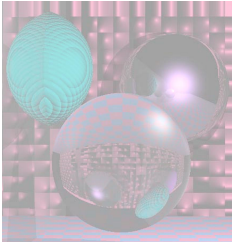
1951 Graphics display, Whirlwind computer



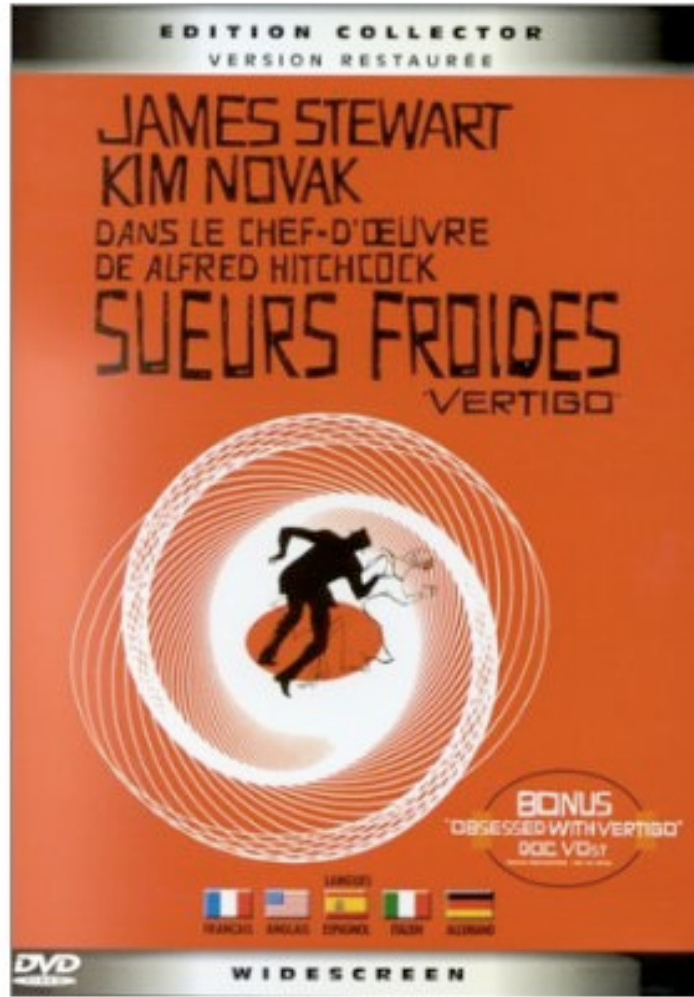


SAGE

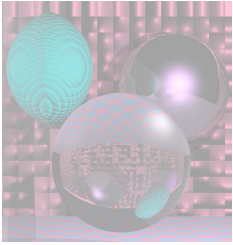




John Whitney Sr. 1958 CG

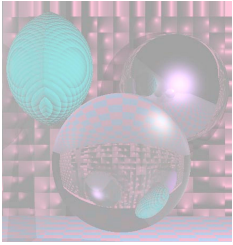


Vertigo Start Titles

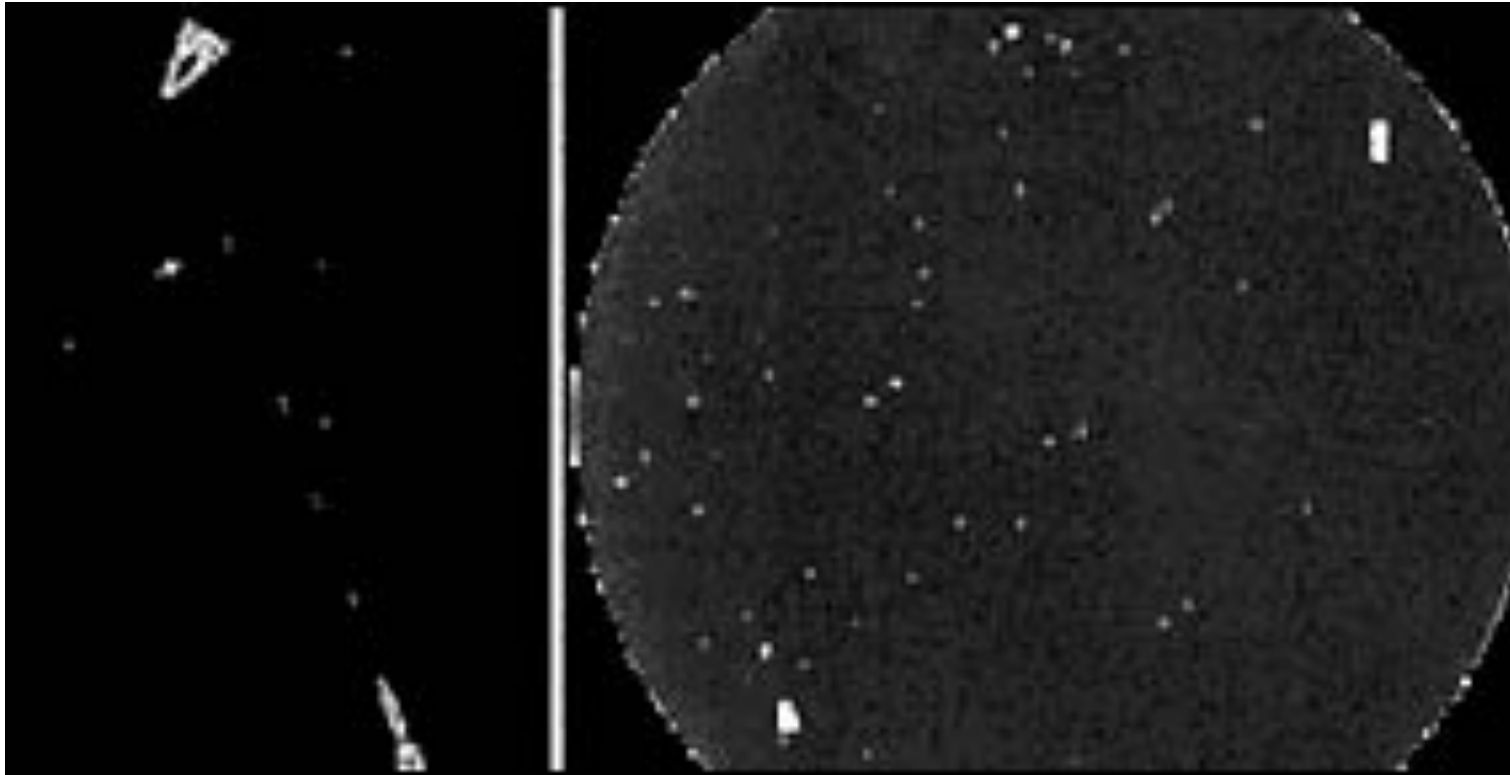


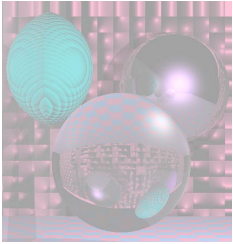
History - the 60s

- 1961 Spacewars, 1st video game, Steve Russell, MIT for PDP-1
- **1963** Sketchpad, Ivan Sutherland, MIT
- 1963 Mouse invented, Doug Englebart, SRI
- 1963 Roberts hidden line algorithm, MIT
- 1965 Bresenham Algorithm for plotting lines, IBM
- 1966 Odyssey, home video game, Ralph Baer,
 - Sanders Assoc, is 1st consumer CG product
- 1967 Full-color, real-time, interactive flight simulator for NASA - Rod Rougelet, GE

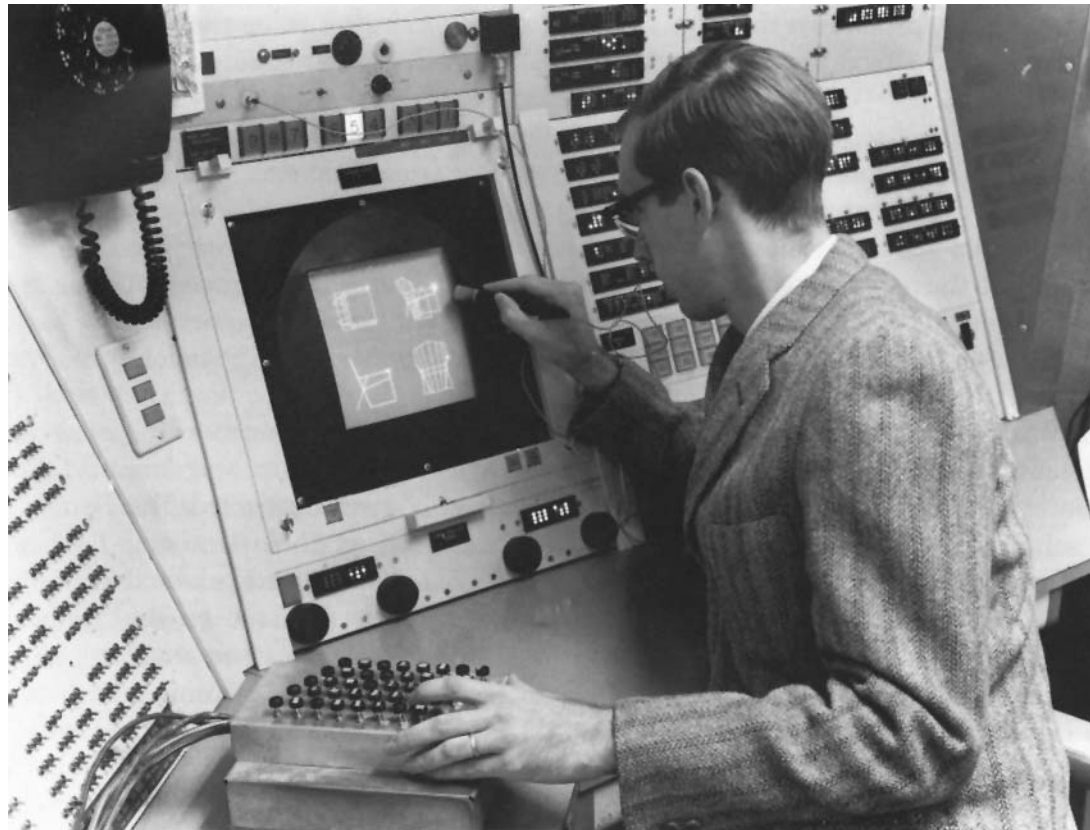


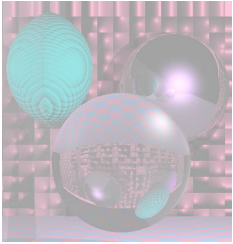
Spacewars





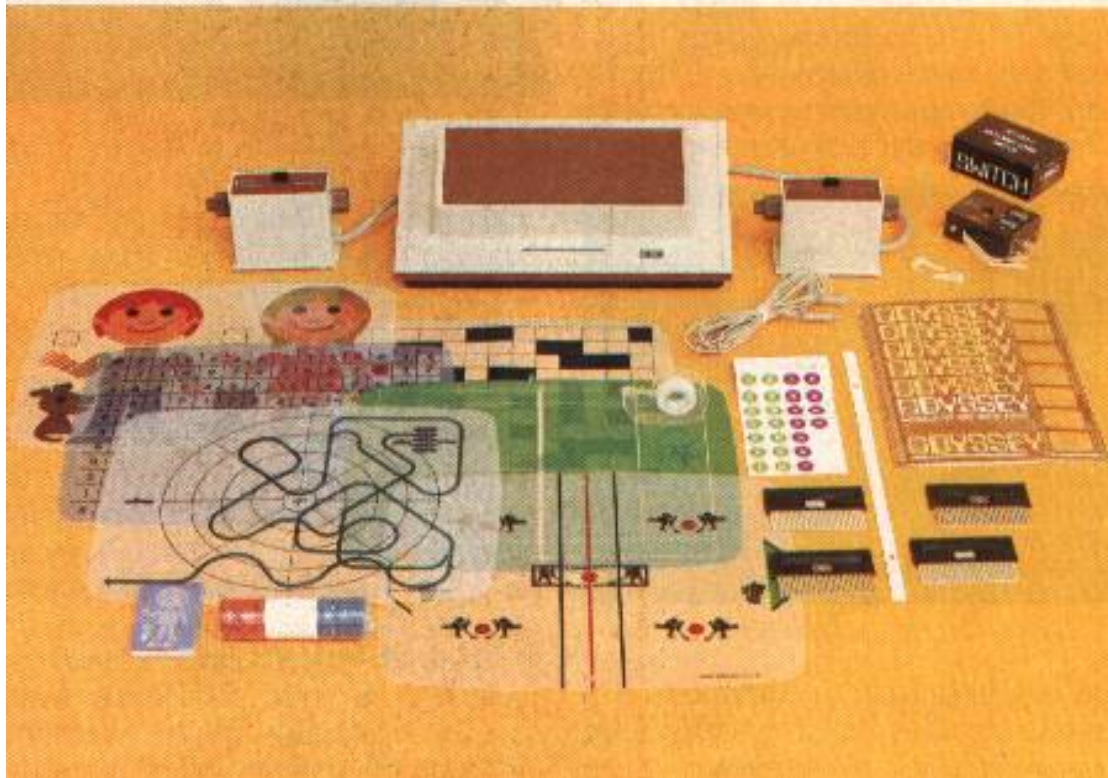
Ivan Sutherland & Sketchpad System on TX-2 at MIT(1963)



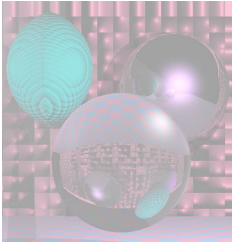


Odyssey

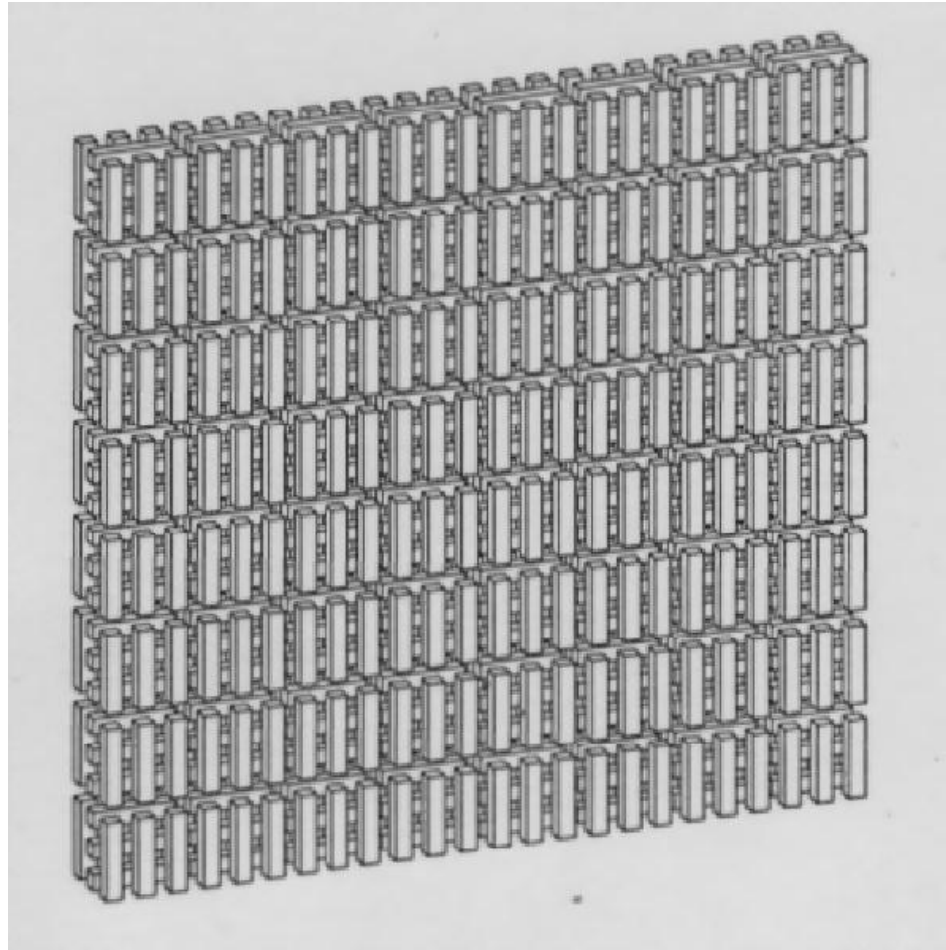
The very first home videogame, Odyssey, used Laner-created transparent overlays in lieu of computer-generated graphics.

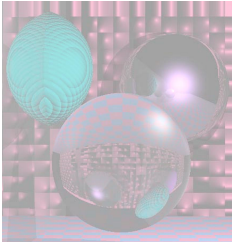


<http://gamesmuseum.pixesthesis.com/history/gen1/pong/>

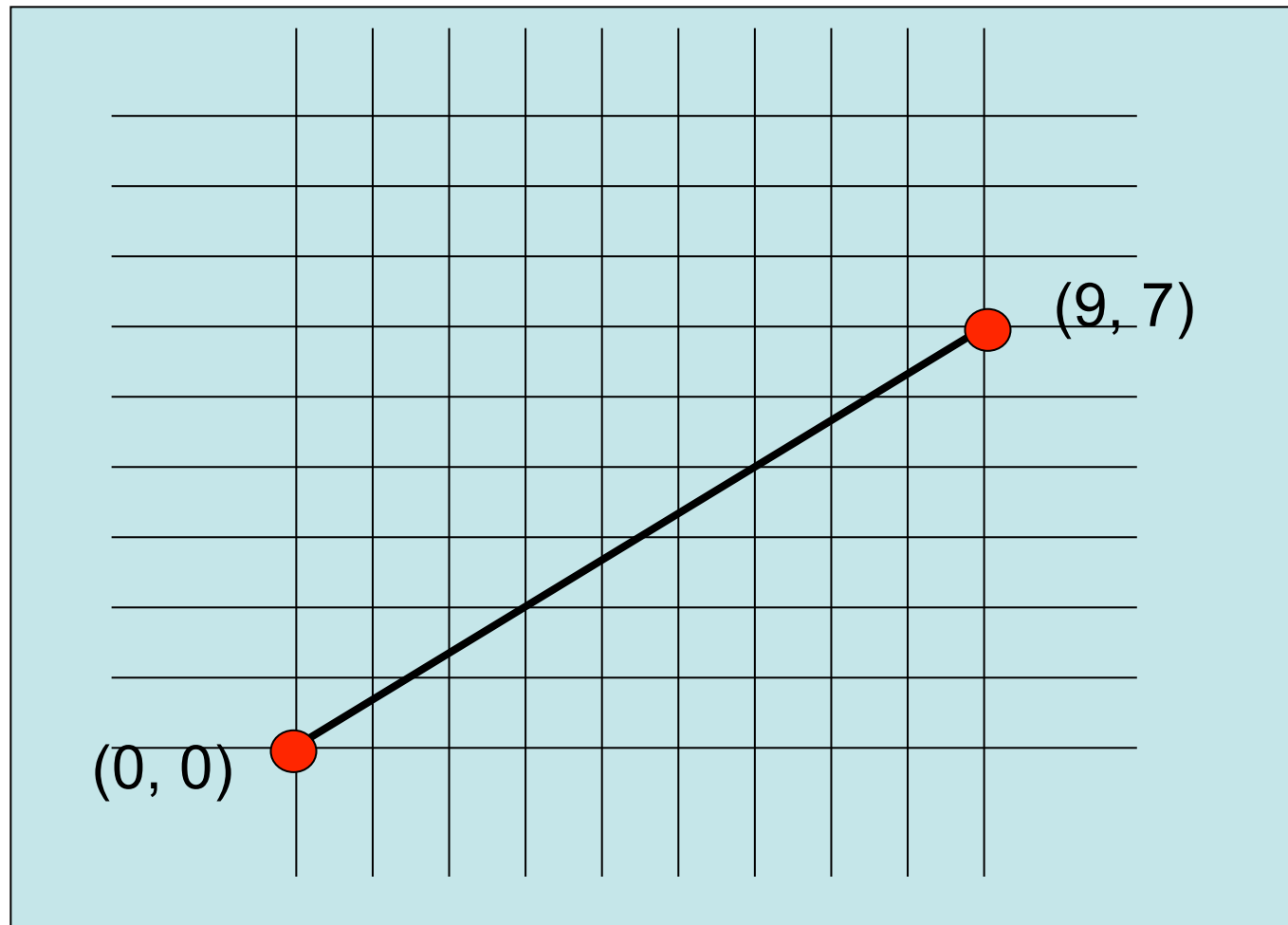


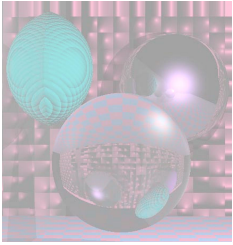
Roberts Hidden Line Algorithm Block scene (576 blocks)





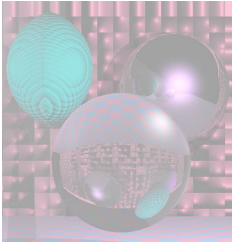
Bresenham Line Algorithm



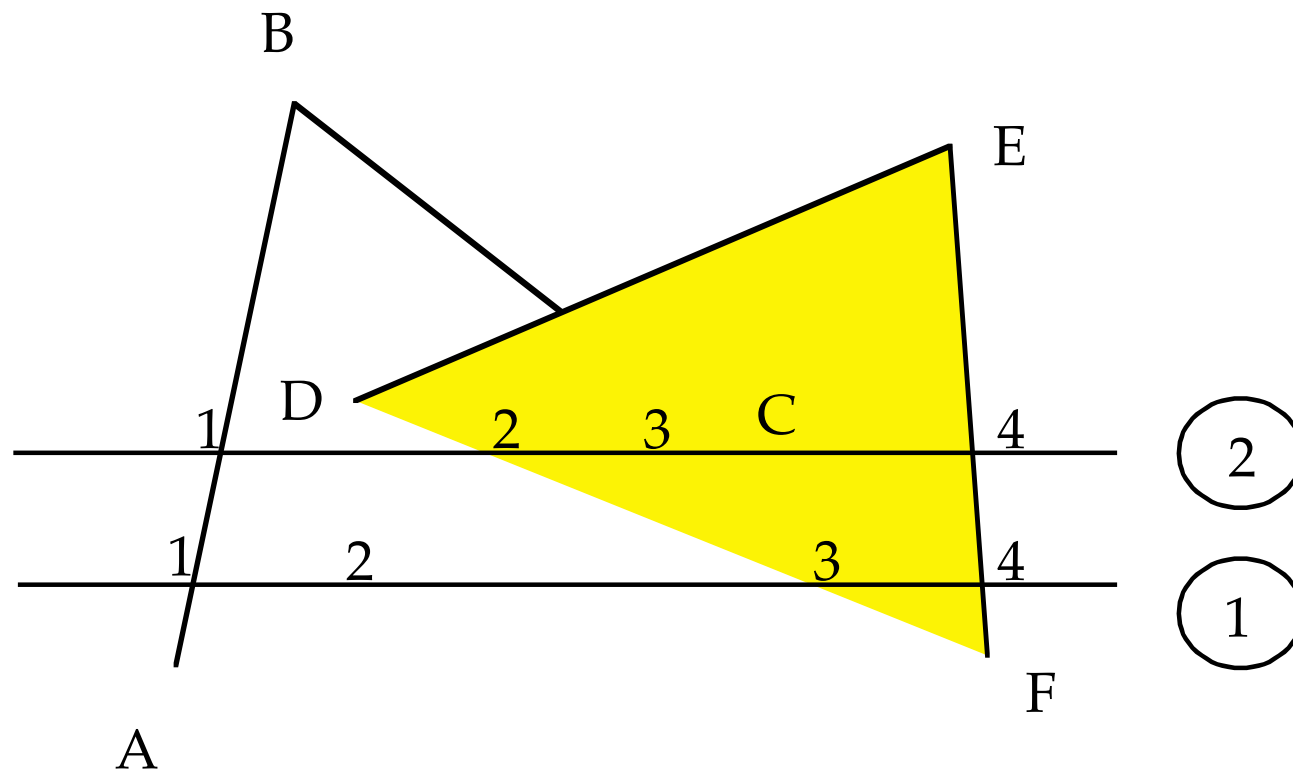


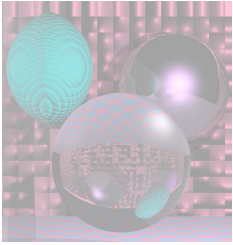
History – the 70s

- **1970s** **Utah dominated - algorithm development**
- 1970 [Watkins algorithm for visible surfaces](#)
- 1970 [Bezier free-form curve](#) representation
- 1971 [Gouraud shading](#)
- 1973 Principles of Interactive Computer Graphics (Newman and Sproull)
- 1974 Addressable cursor in a graphics display terminal - DEC VT52
- 1974 z-buffer developed by Ed Catmull (Univ of Utah)
- 1975 [Phong shading](#)
- 1975 [Fractals](#) - Benoit Mandelbrot (IBM)
- 1978 [Bump mapping](#), Blinn
- 1979 George Lucas starts Lucasfilm
 - with Ed Catmull, Ralph Guggenheim, and Alvy Ray Smith

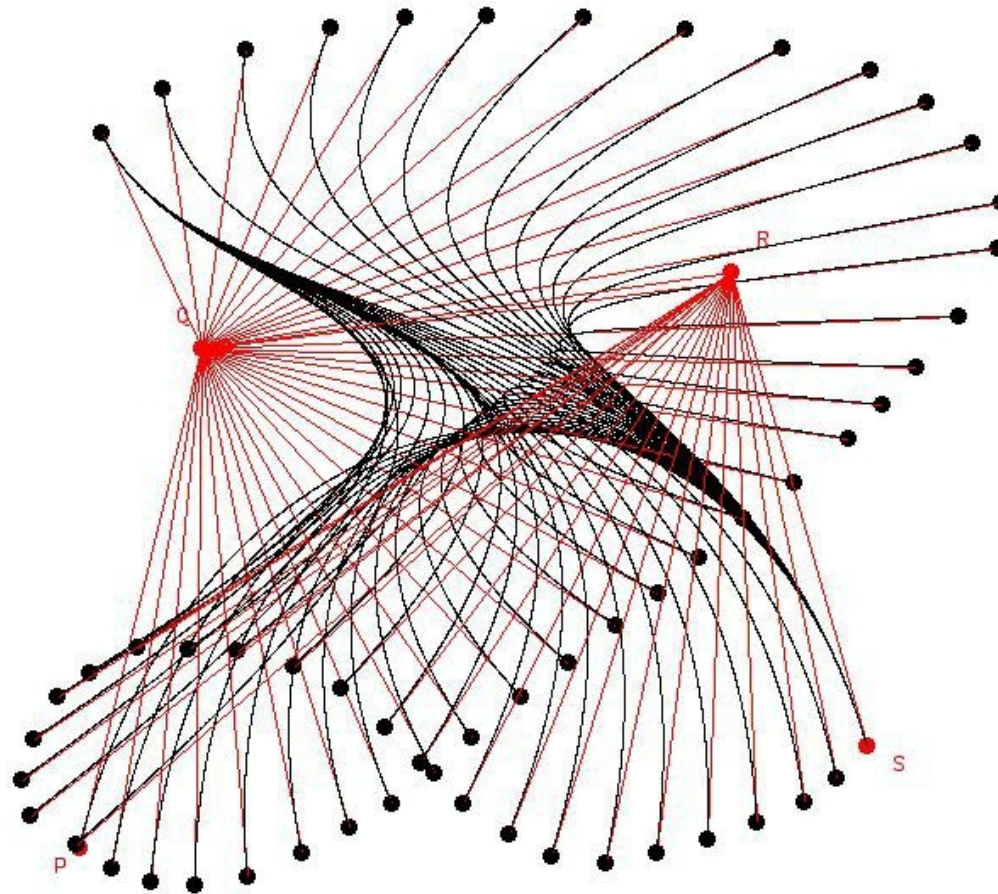


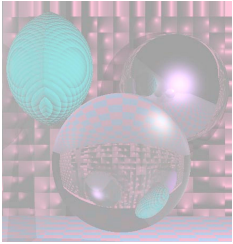
Watkins Scan-Line Algorithm



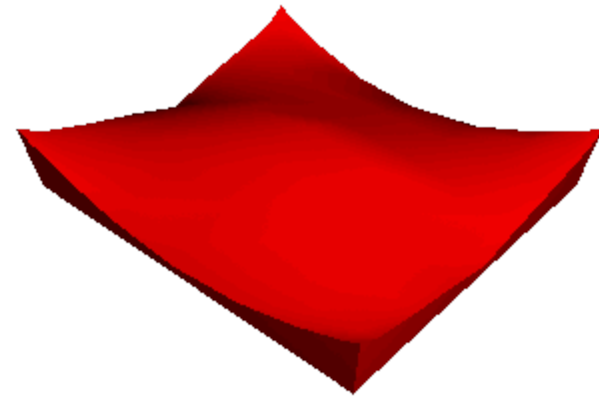
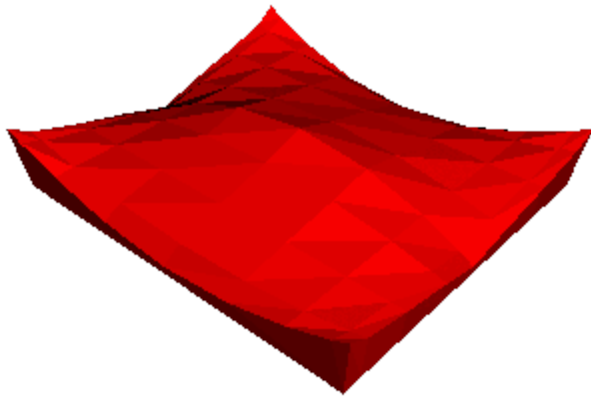


Bezier Curves

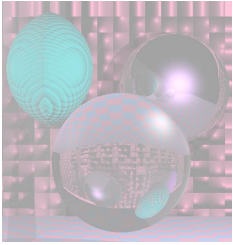




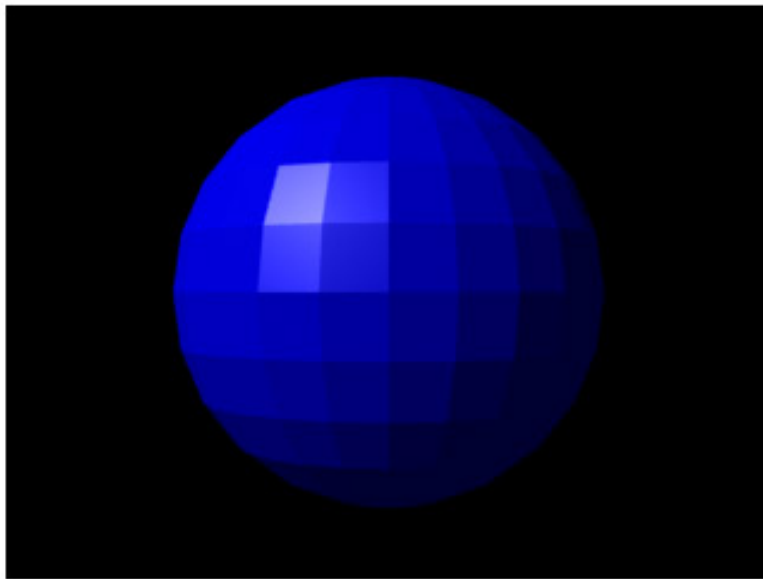
Gouraud Shading



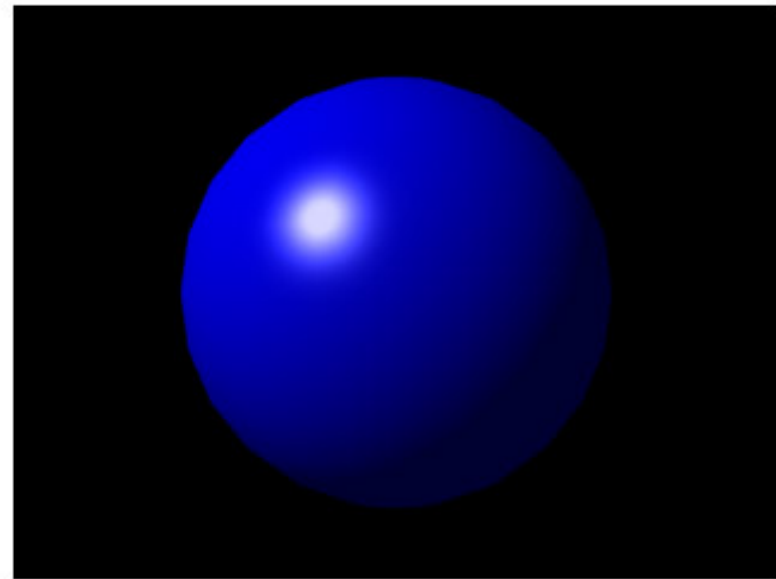
http://freespace.virgin.net/hugo.elias/graphics/x_polygo.htm



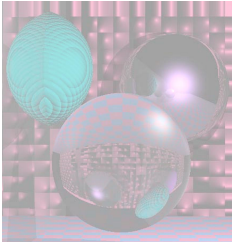
Phong Shading



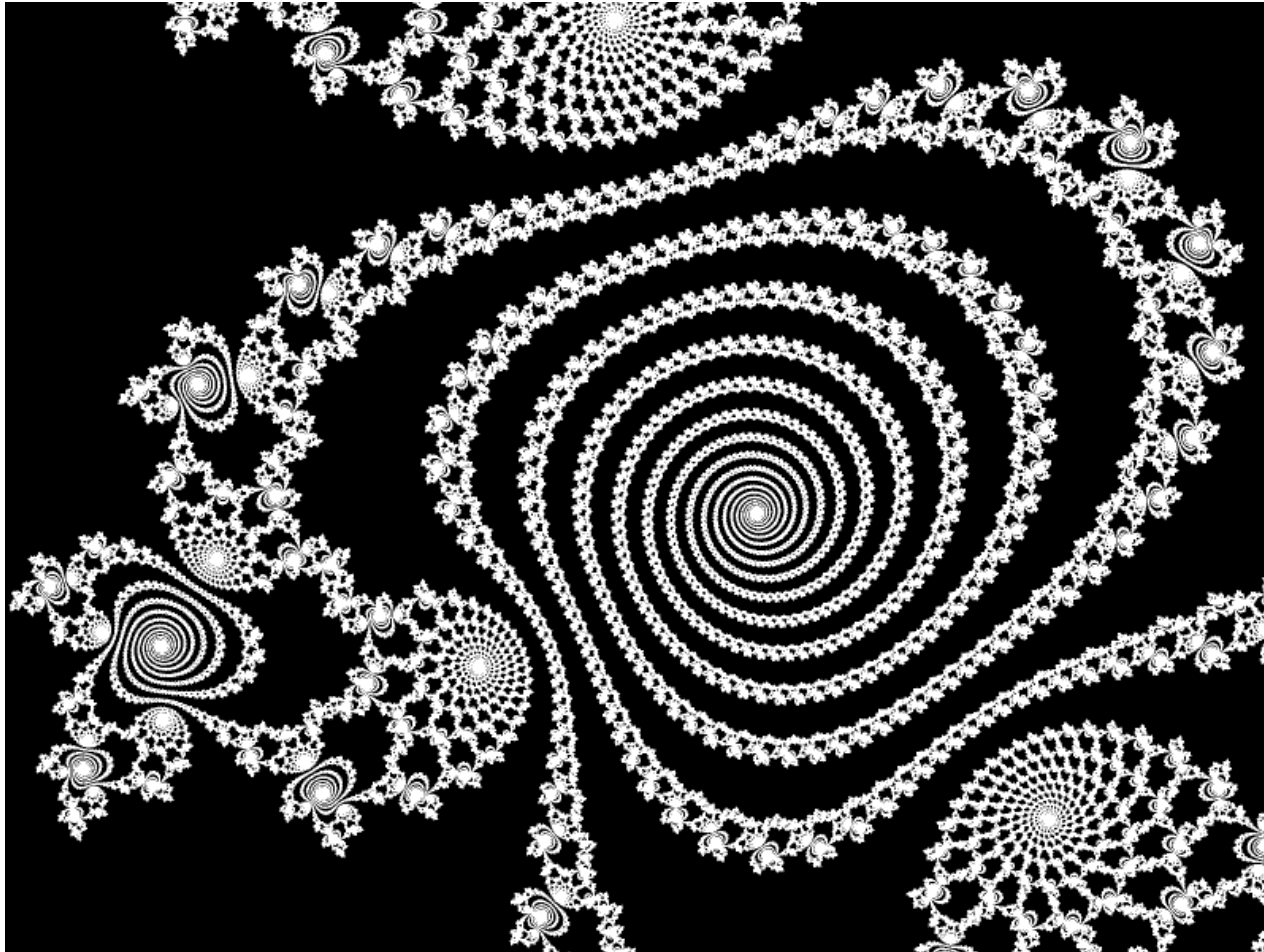
FLAT SHADING

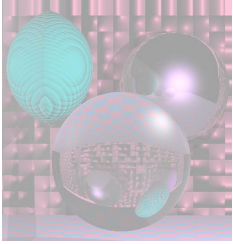


PHONG SHADING

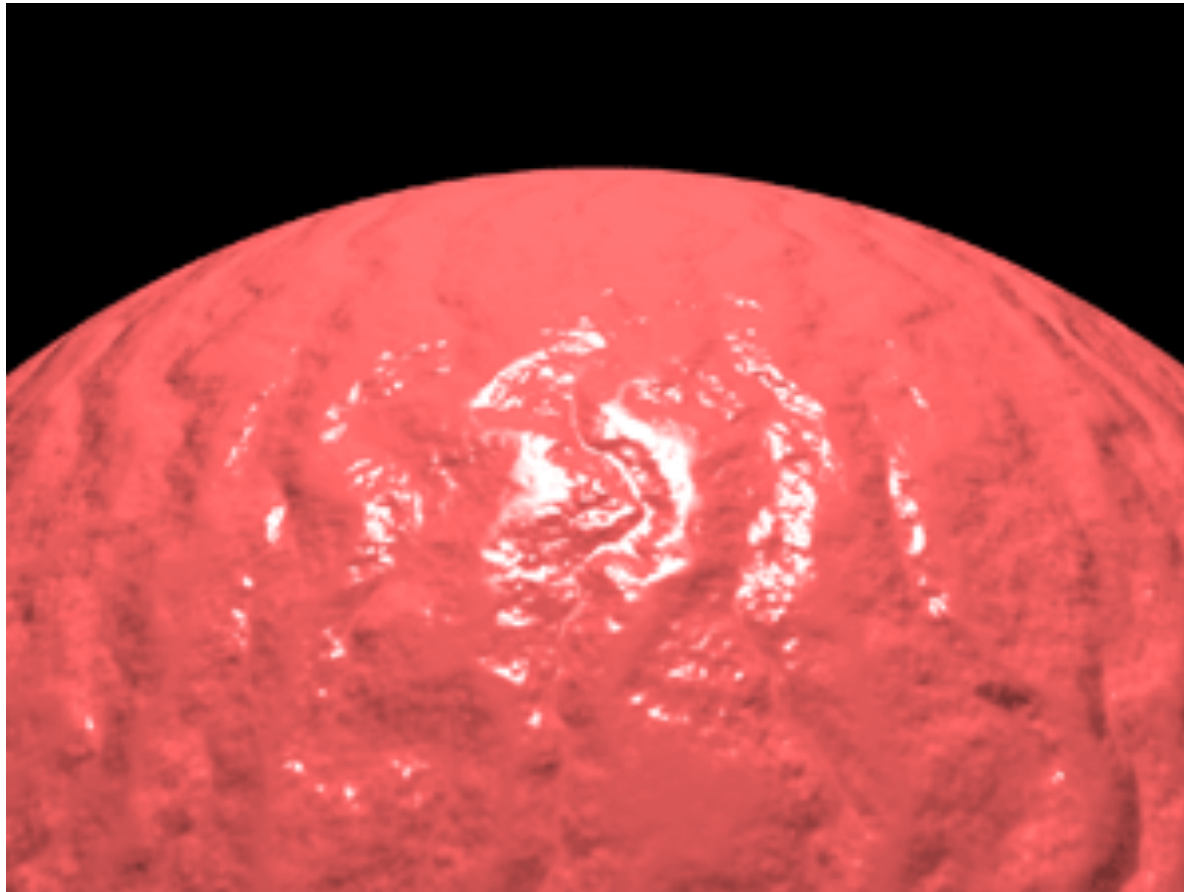


Fractals

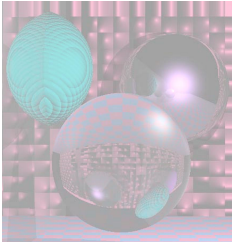




Bump Map

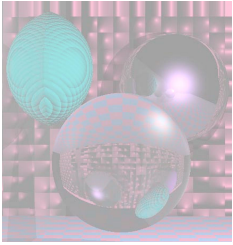


Bump Maps in PovRay

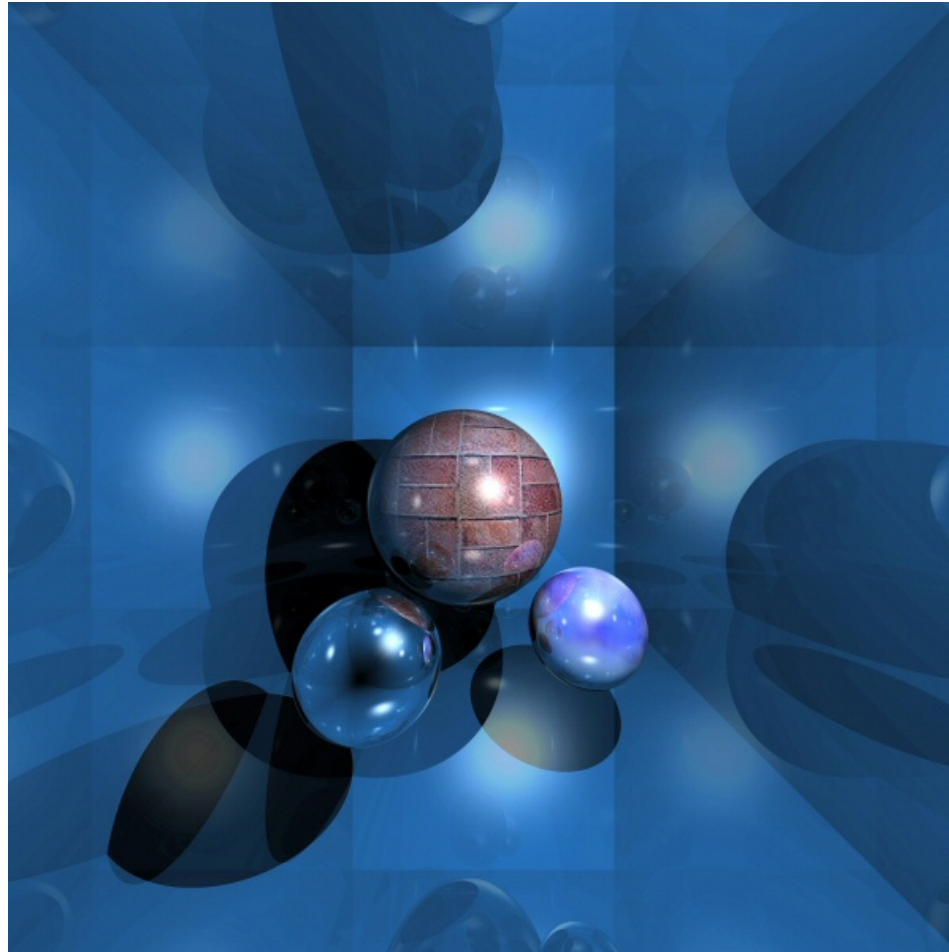


History - the 80s

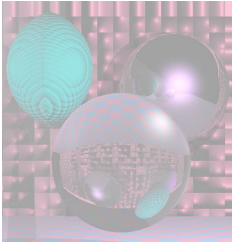
- **1980s Cheaper machines, memory - quest for realism**
- 1980 [Ray Tracing](#), Turner Whitted, Bell Labs
- 1981 IBM introduces the first IBM PC (16 bit 8088 chip)
- 1982 Data Glove, Atari
- 1984 [Macintosh](#) computer
 - introduced with Clio award winning commercial during Super Bowl
- 1985 [Perlin Noise](#)
- 1986 GIF format (CompuServe)
- 1988 [Who Framed Roger Rabbit](#) live action & animation



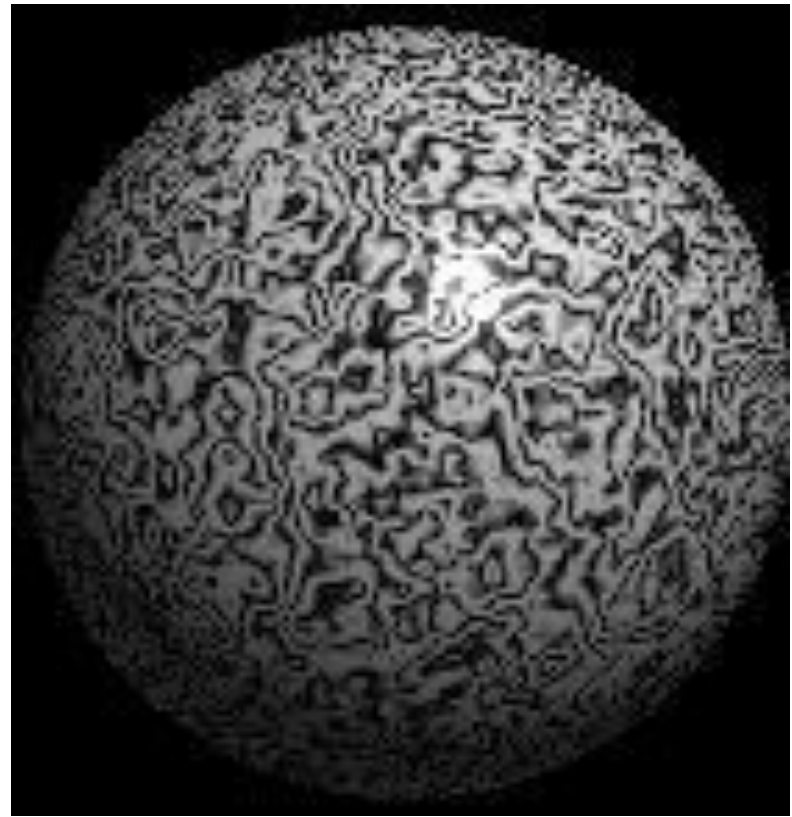
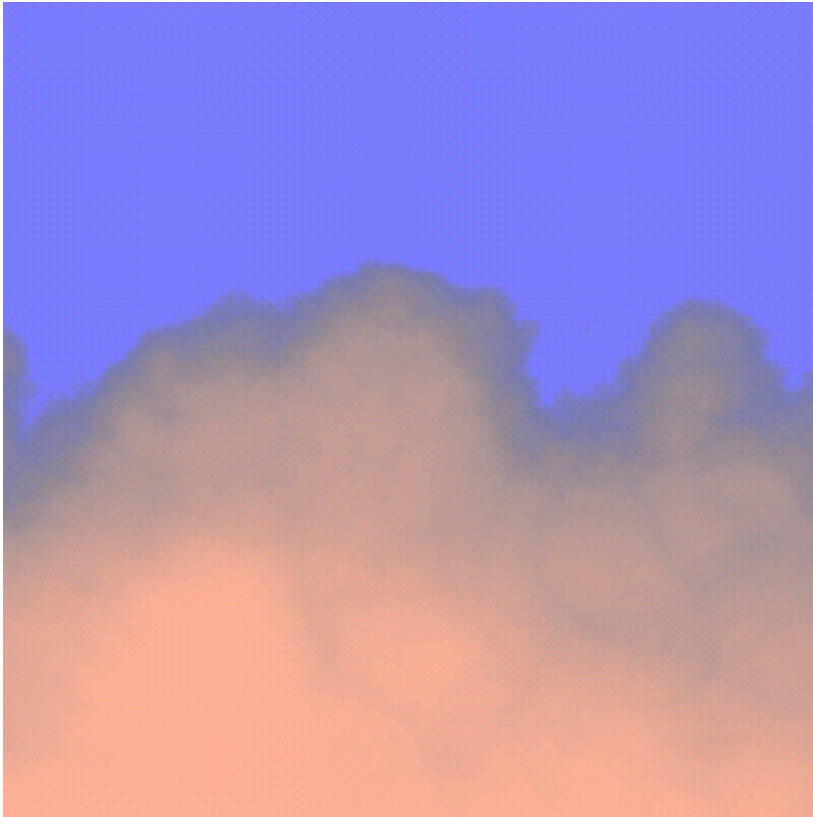
Whitted Ray-Tracing

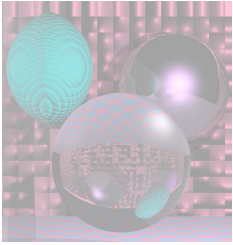


http://en.wikipedia.org/wiki/Ray_tracing



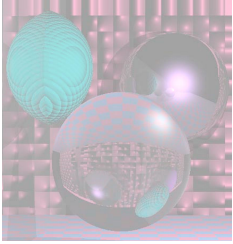
Perlin Noise





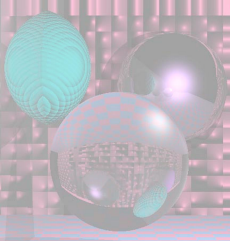
Who Framed Roger Rabbit





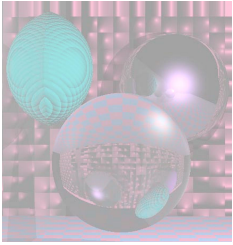
History- the 90s

- **1990s Visualization, Multimedia, the Net**
- 1991 JPEG/MPEG
- 1993 [Myst](#), Cyan
- 1994 U.S. Patent to Pixar
 - for creating, manipulating and displaying images
- 1995 [Toy Story](#), Pixar
- 1995 Internet 2 unveiled
- 1997 DVD technology unveiled
- 1998 XML standard
- 1999 deaths



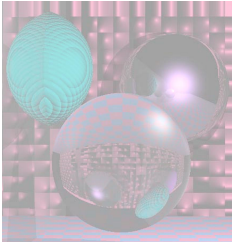
Myst





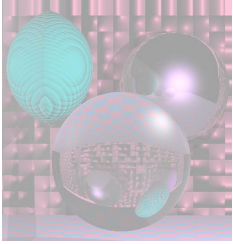
Toy Story





Recent History

- **2000s Virtual Reality, Animation Reality**
- 2001 Significant Movies
 - Final Fantasy, Square)
 - Monsters Inc, Pixar
 - Harry Potter, A.I., Lord of the Rings, Shrek, PDI
 - The Mummy, ILM
 - Tomb Raider, Cinesite
 - Jurassic Park III, Pearl Harbor, ILM
 - Planet of the Apes, Asylum
- 2001 Microsoft xBox and Nintendo Gamecube
- 2001, 2002, 2003 [Lord of the Rings](#)
 - [Bringing Golum to Life](#)



from Lord of the Rings

- **Motion Capture Technology**
 - Andy Serkis "played" Gollum by providing his voice and movements on set, as well as performing within a motion capture suit.
- **SKIN**
 - Christopher Hery, Ken McGaugh and Joe Letteri received a 2003 Academy Award, Scientific or Technical for implementing the BSSRDF (Bidirectional Surface Scattering Reflection Distribution Function) technique used for Gollum's skin in a production environment. Henrik Wann Jensen, Stephen Robert Marschner, and Pat Hanrahan, who developed BSSRDF, won another the same year.
- **MASSIVE**
 - a computer program developed by WETA to create automatic battle sequences rather than individually animate every soldier. Stephen Regelous developed the system in 1996, originally to create crowd scenes in *King Kong*.