University of British Columbia
CPSC 314 Computer Graphics
Jan-Apr 2008

Tamara Munzner

Intro
(Guest Lecturer: Michiel van de Panne)

Week 1, Mon Jan 7

http://www.ugrad.cs.ubc.ca/~cs314/Vjan2008

Outline

- Defining Computer Graphics
- Course Structure
- Course Content Overview

What is Computer Graphics?

- create or manipulate images with computer
  - this course: algorithms for image generation

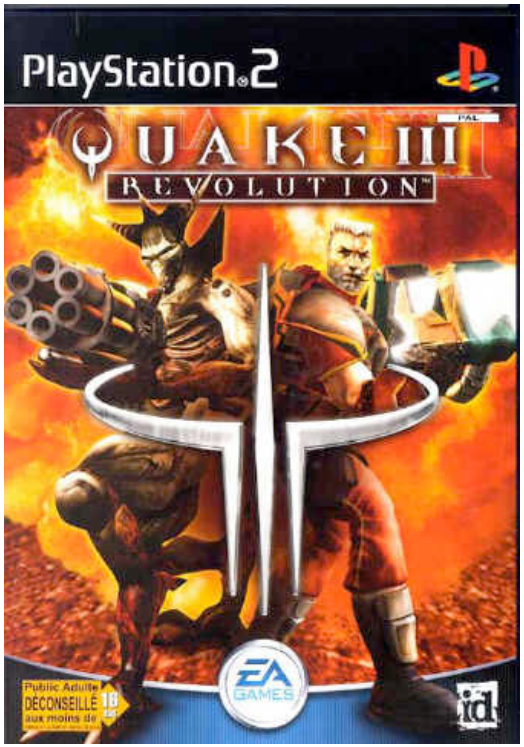
What is CG used for?

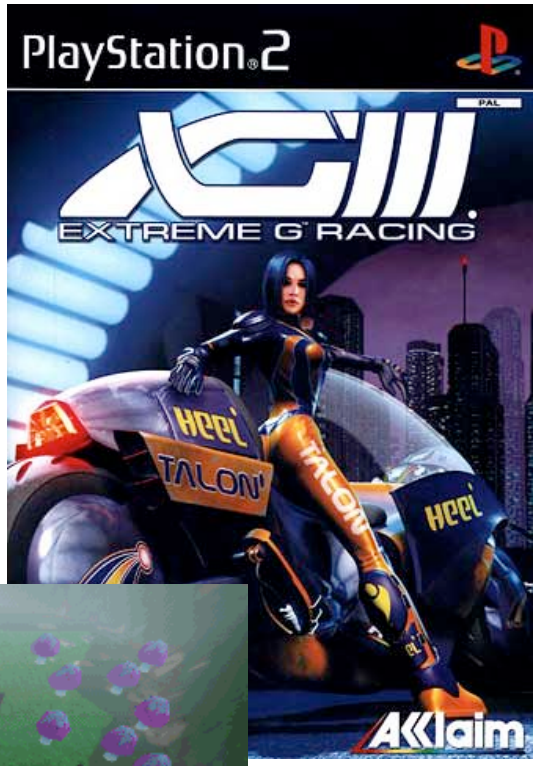
- movies
  - animation
  - special effects

Inspector Gadget © 1999 Walt Disney Pictures.
Visual Effects by Dream Quest Images.

What is CG used for?

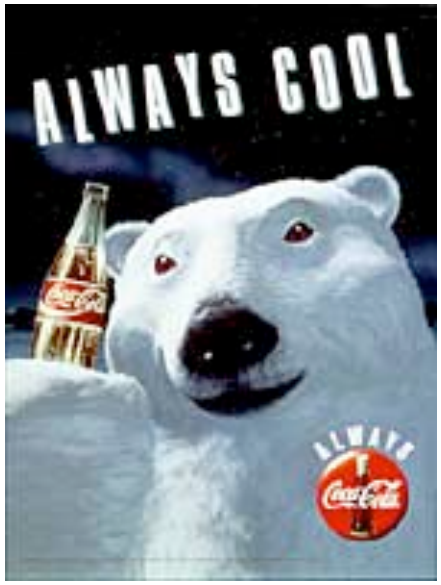
- computer games





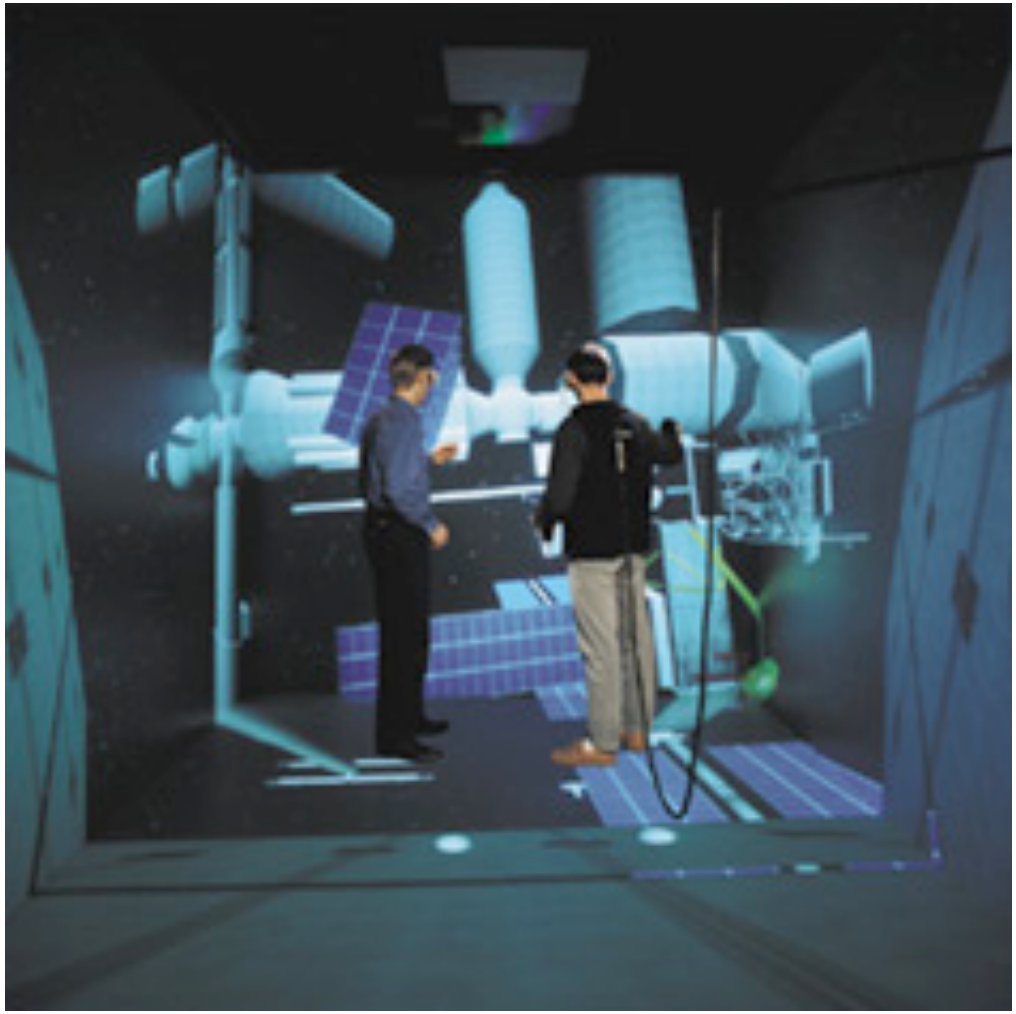
What is CG used for?

- images
  - design
  - advertising
  - art



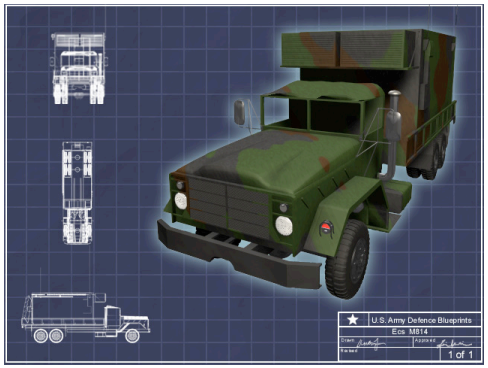
What is CG used for?

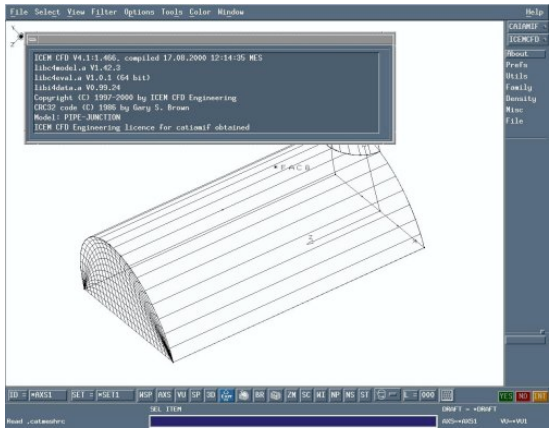
- virtual reality / immersive displays

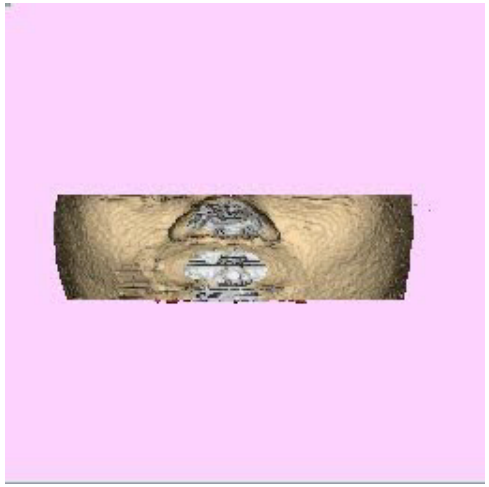


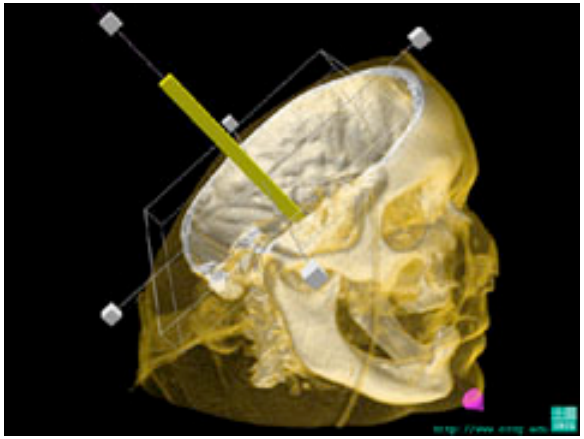
What is CG used for?

- graphical user interfaces
  - modeling systems
  - applications
- simulation & visualization





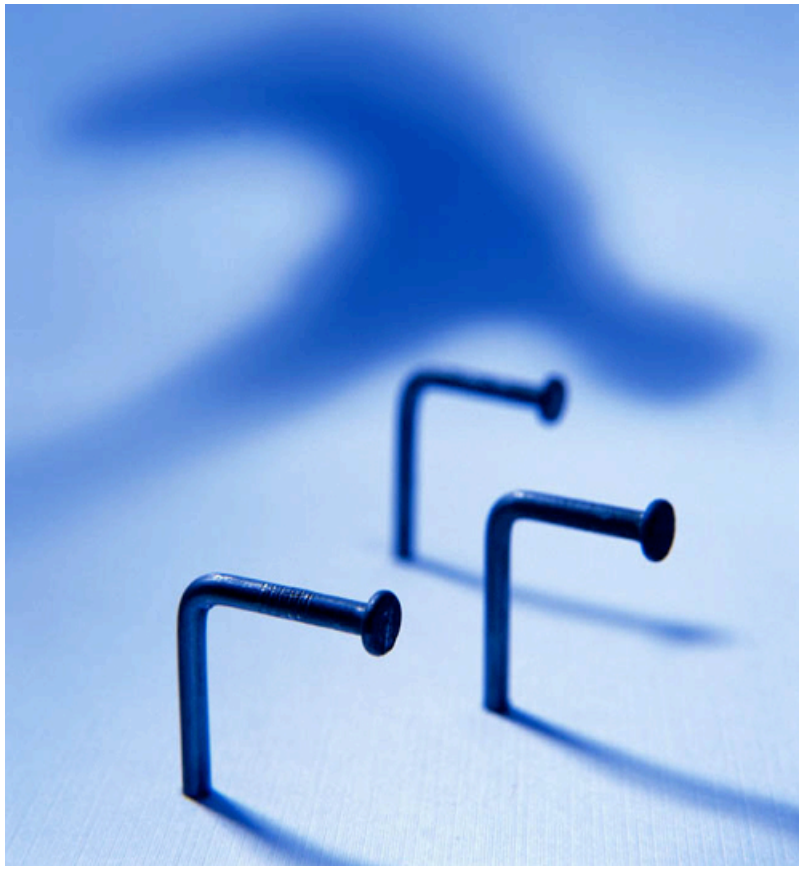




Real or CG?

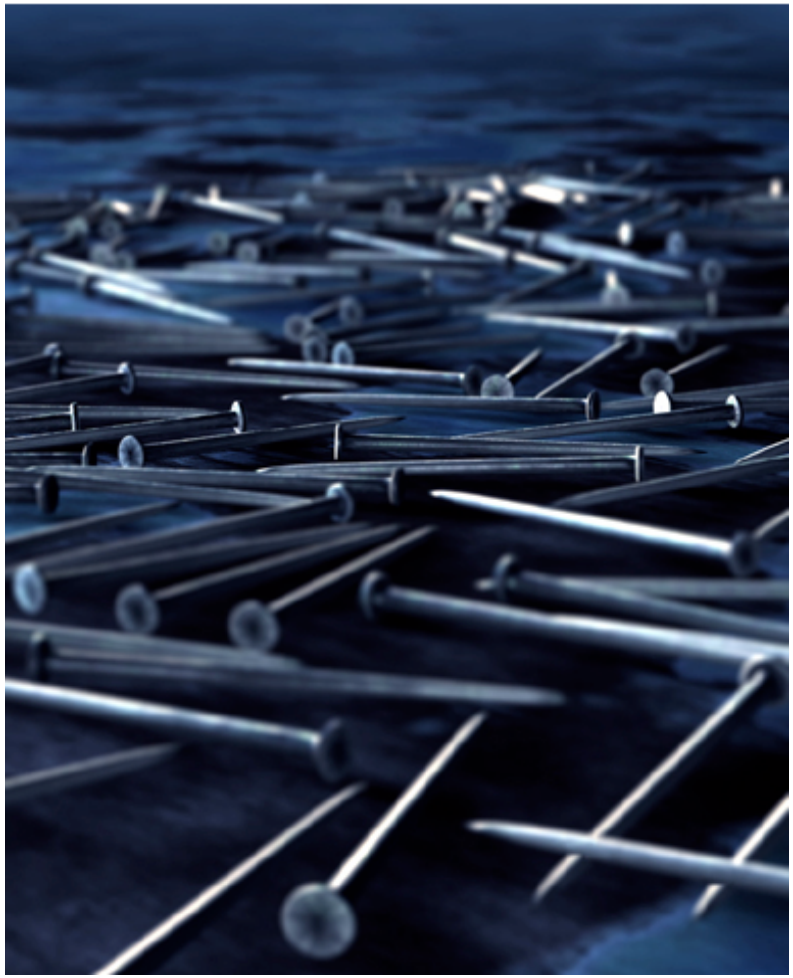
http://www.alias.com/eng/etc/fakeorfoto/quiz.html

1



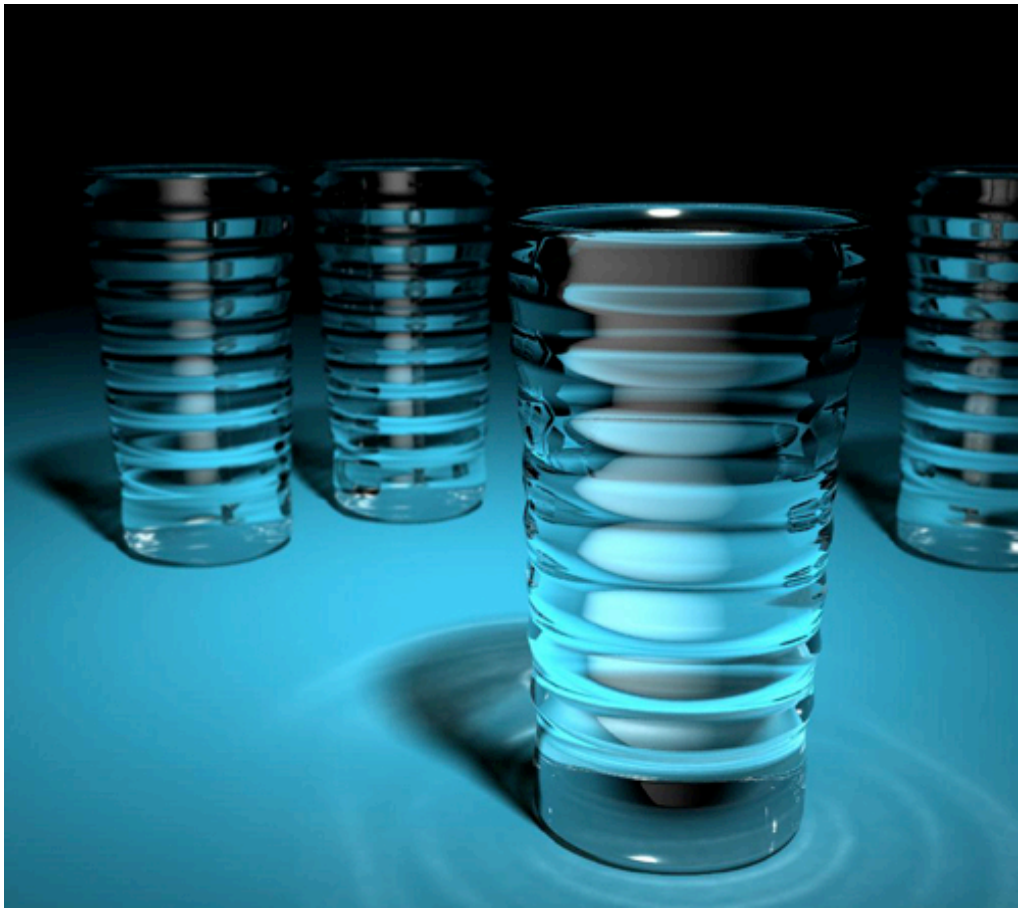
Real or CG?

2



Real or CG?

3



Real or CG?

4

Expectations

- hard course!
  - heavy programming and heavy math
- fun course!
  - graphics programming addictive, create great demos
- programming prereq
  - CPSC 221 (Program Design and Data Structures)
  - course language is C++/C
- math prereq
  - MATH 200 (Calculus III)
  - MATH 221/223 (Matrix Algebra/Linear Algebra)

Course Structure

- 39% programming projects
  - 8% project 1 (building beasties with cubes and math)
  - 8% project 2 (flying)
  - 8% project 3 (ray tracer)
  - 15% project 4 (create your own graphics game)
- 25% final
- 20% midterm (week 8 Fri 3/7)
- 16% written assignments
  - 4% each HW 1/2/3/4
- programming projects and homeworks synchronized

Programming Projects

- structure
  - C++, Linux
    - OK to cross-platform develop on Windows, Mac
  - OpenGL graphics library
  - GLUT for platform-independent windows/UI
  - face to face grading in lab
- Hall of Fame
  - first project: building beasties
    - previous years: spiders, armadillos, giraffes, frogs, elephants, birds, poodles, dinos, cats…
  - last project: create your own graphics game

Late Work

- 3 grace days
  - for unforeseen circumstances
  - strong recommendation: don't use early in term
  - handing in late uses up automatically unless you tell us
- otherwise: 50% if one day (24 hrs) late, 0% afterwards
- **only** exception: severe illness or crisis
  - as per UBC rules
  - must let me know ASAP (in person or email)
    - at latest, 7 days after return to school
  - **must** also turn in form with documentation (doctor note)

    http://www.ugrad.cs.ubc.ca/~cs314/Vjan2007/illness.html

Regrading

- to request assignment or exam regrade
  - give me paper to be regraded, and also **in writing**
    - what problem you're disputing
    - detailed explanation why you think grader was wrong
  - I will not accept until next class after solutions handed out
- I may regrade entire assignment
  - thus even if I agree with your original request, your score may nevertheless end up higher or lower

Course Information

- course web page is main resource
  - http://www.ugrad.cs.ubc.ca/~cs314/Vjan2008
  - updated often, reload frequently
- newsgroup is ubc.courses.cpsc.414
  - note old course number still used
  - readable on or off campus
- (no WebCT)

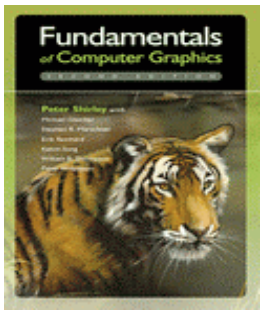
Teaching Staff

- instructor: Tamara Munzner
  - tmm@cs.ubc.ca
  - office hrs in ICICS/CS 011 (our lab)
    - Wed/Fri 2-3
  - or by appointment in X661
- TAs: Stephen Ingram, Cody Robson, Michael Welsman-Dinelle
  - sfingram@cs.ubc.ca
  - cjrobson@cs.ubc.ca
  - mwelsman@cs.ubc.ca
- use newsgroup, not email, for all questions that other students might care about

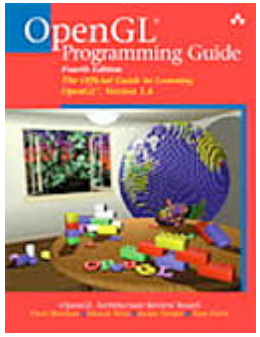
Labs

- attend one lab per week
  - Mon 12-1, Thu 10-11 (Stephen Ingram)
  - Tue 1-2, Fri 12-1 (Cody Robson)
  - mix of activities
    - example problems in spirit of written assignments and exams
    - help with programming projects
    - tutorials
  - no deliverables (unlike intro classes)
  - strongly recommend that you attend

Required Reading



- Fundamentals of Computer Graphics
  - Peter Shirley, AK Peters, 2nd edition



- OpenGL Programming Guide, v 2.1
  - OpenGL Architecture Review Board
  - v 1.1 available for free online

- readings posted on schedule page

Learning OpenGL

- this is a graphics course using OpenGL
  - not a course *on* OpenGL
- upper-level class: learning APIs mostly on your own
  - only minimal lecture coverage
    - basics, some of the tricky bits
  - OpenGL Red Book
  - many tutorial sites on the web
    - nehe.gamedev.net

Plagiarism and Cheating

- don't cheat, I will prosecute
  - insult to your fellow students and to me
- programming and assignment writeups must be individual work
  - can discuss ideas, browse Web
  - cannot just copy code or answers
  - cannot do team coding
  - exception: final project can be team of two or three
- you must be able to explain algorithms during face-to-face demo
  - or no credit for that part of assignment
  - and possibly prosecution

Citation

- cite all sources of information
  - what to cite
    - study group members, books, web sites
  - where to cite it
    - README for programming projects
    - end of writeup for written assignments
  - http://www.ugrad.cs.ubc.ca/~cs314/Vjan2008/policies.html#plag

Course Content Overview

This Course

- we cover
  - basic **algorithms** for
    - rendering – displaying models
    - (modeling – generating models)
    - (animation – generating motion)
  - programming in OpenGL, C++
- we do not cover
  - art/design issues
  - commercial software packages

Other Graphics Courses

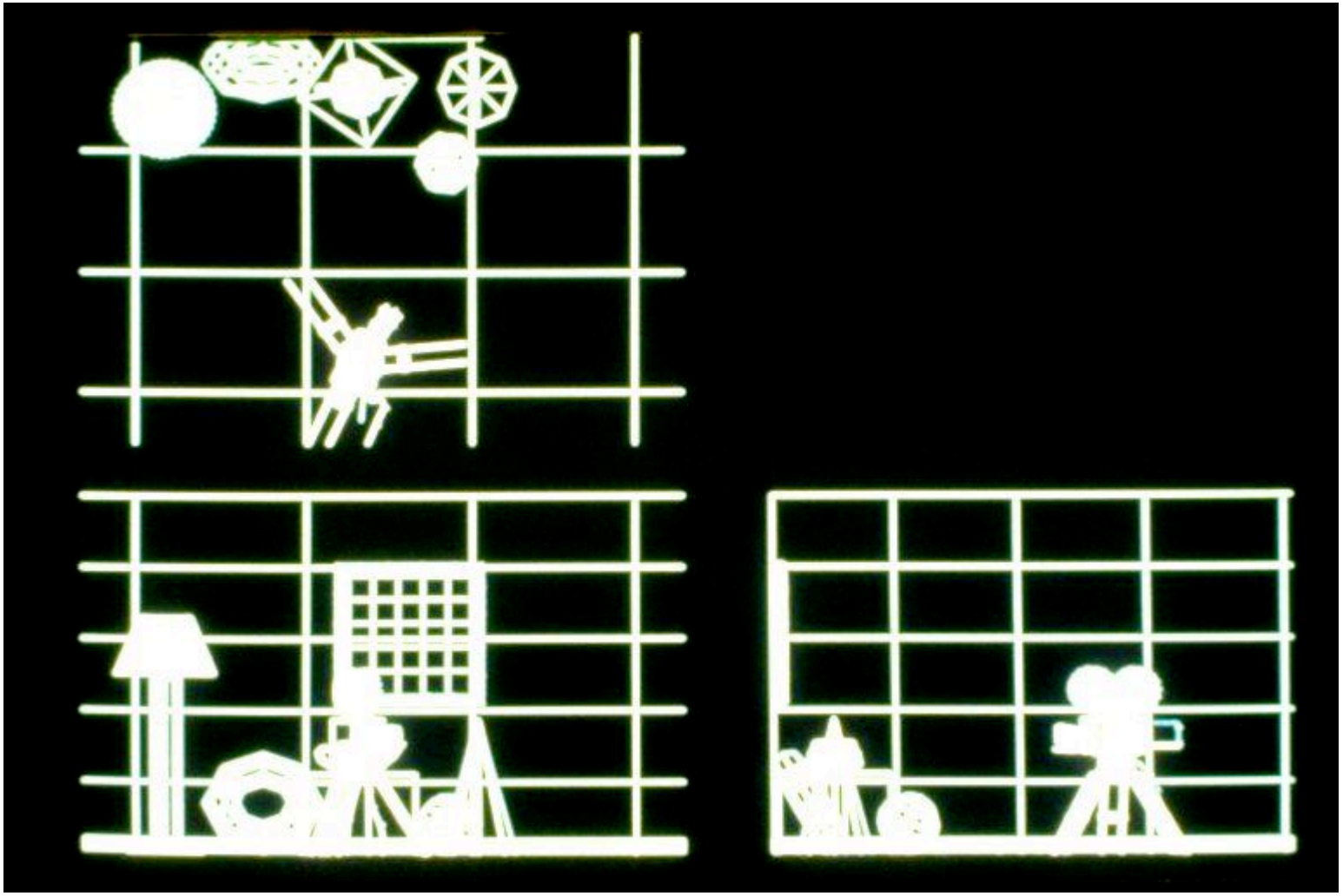
- CPSC 424: Geometric Modeling
  - offered next year
- CPSC 426: Computer Animation
  - offered this term

- CPSC 514: Image-based Modeling and Rendering
- CPSC 526: Computer Animation
- CPSC 533A: Digital Geometry
- CPSC 533B: Animation Physics
- CPSC 533C: Information Visualization
- CPSC 530P: Sensorimotor Computation

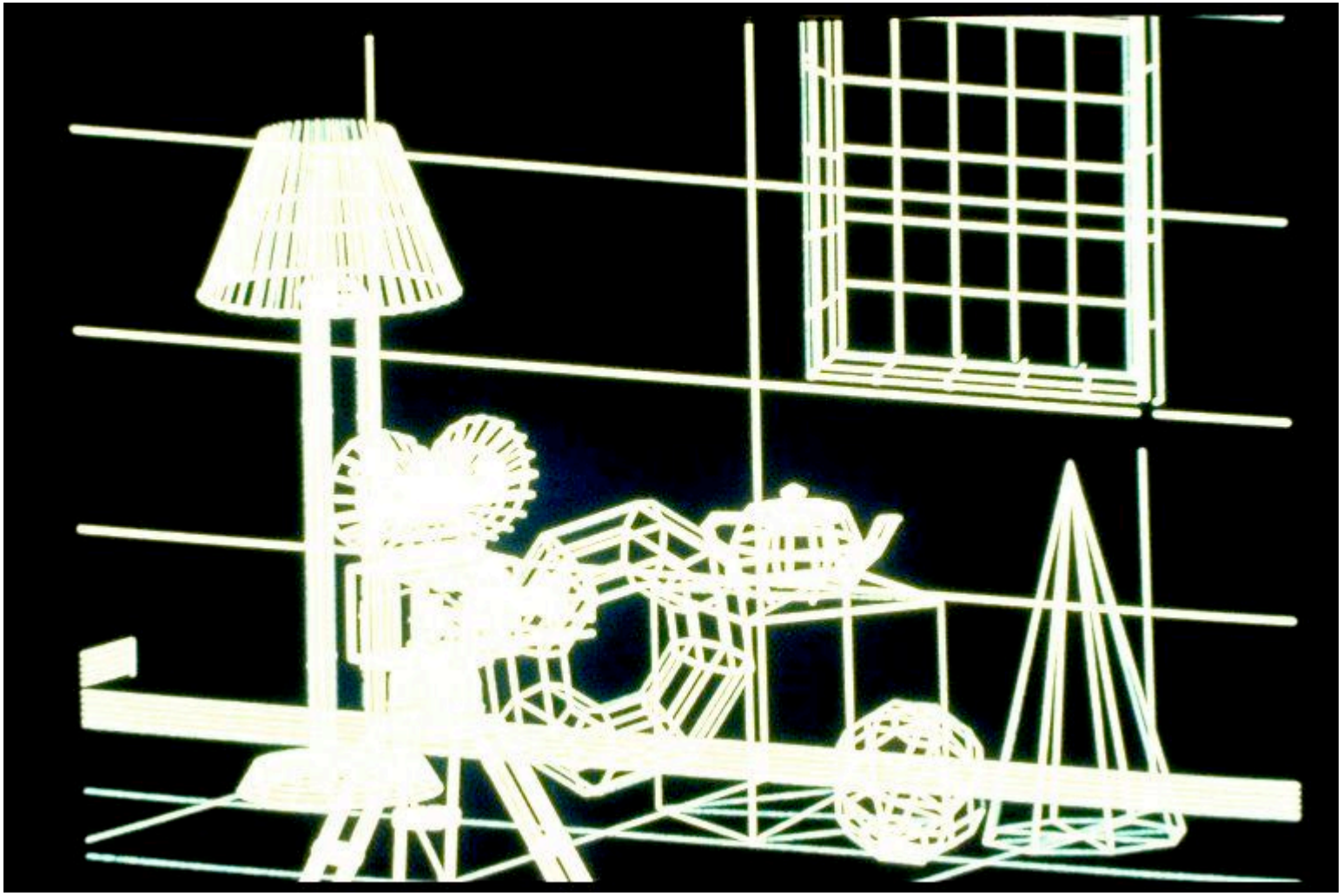
Rendering

- creating images from models
  - geometric objects
    - lines, polygons, curves, curved surfaces
  - camera
    - pinhole camera, lens systems, orthogonal
  - shading
    - light interacting with material
- illustration of rendering capabilities
  - Shutterbug series by Williams and Siegel using Pixar's Renderman
  - www.siggraph.org/education/ materials/HyperGraph/shutbug.htm

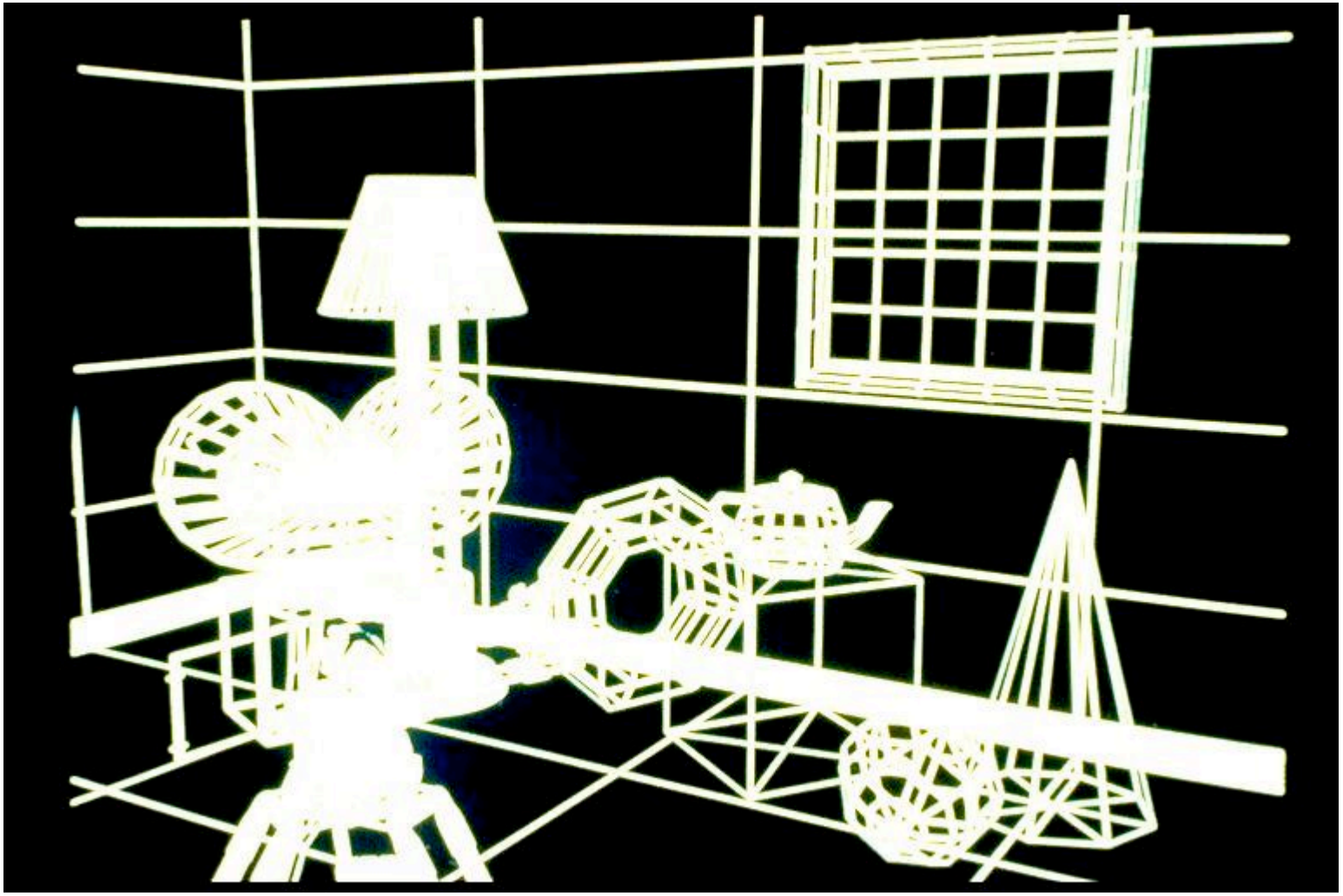
Modelling Transformation: Object Placement



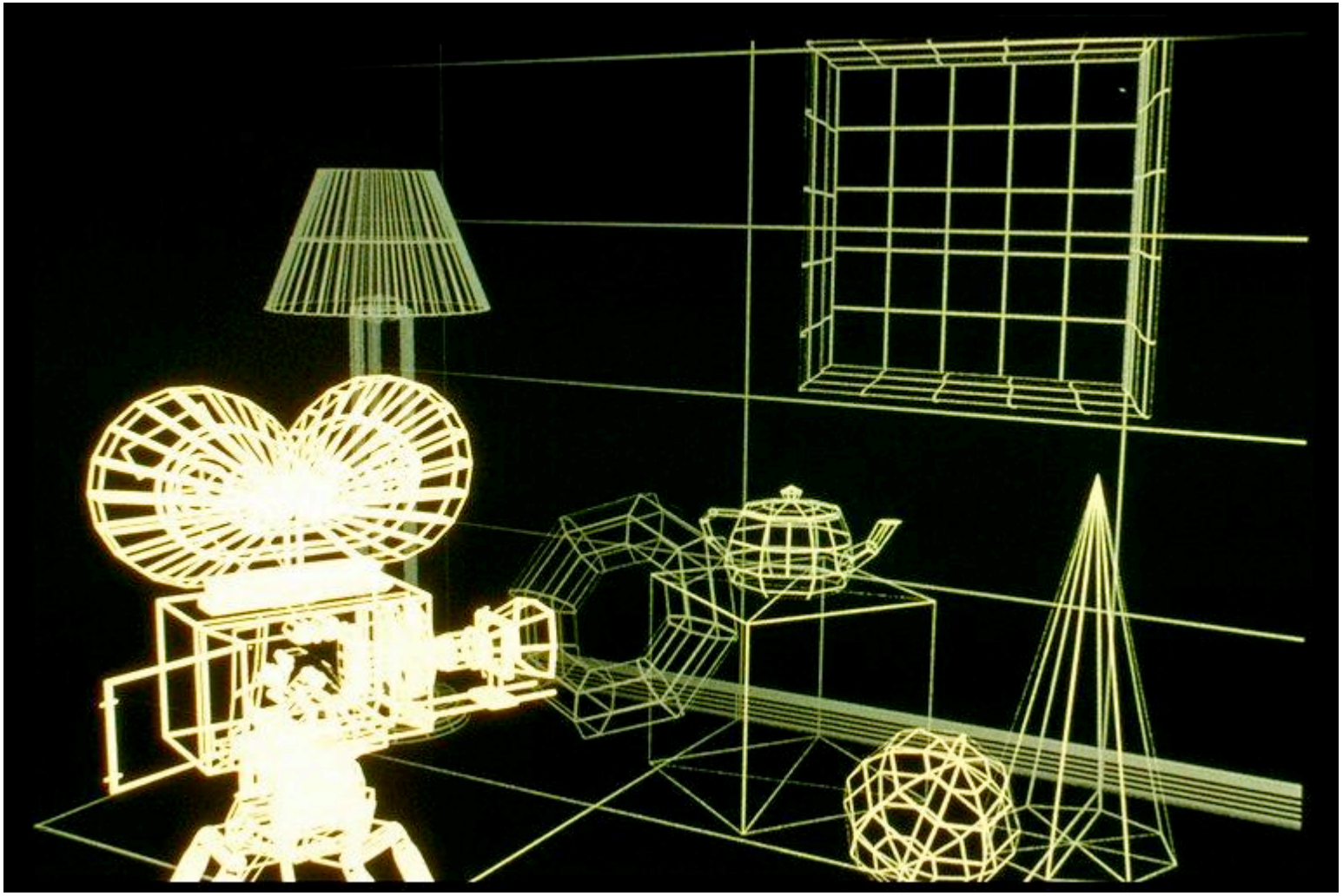
Viewing Transformation: Camera Placement



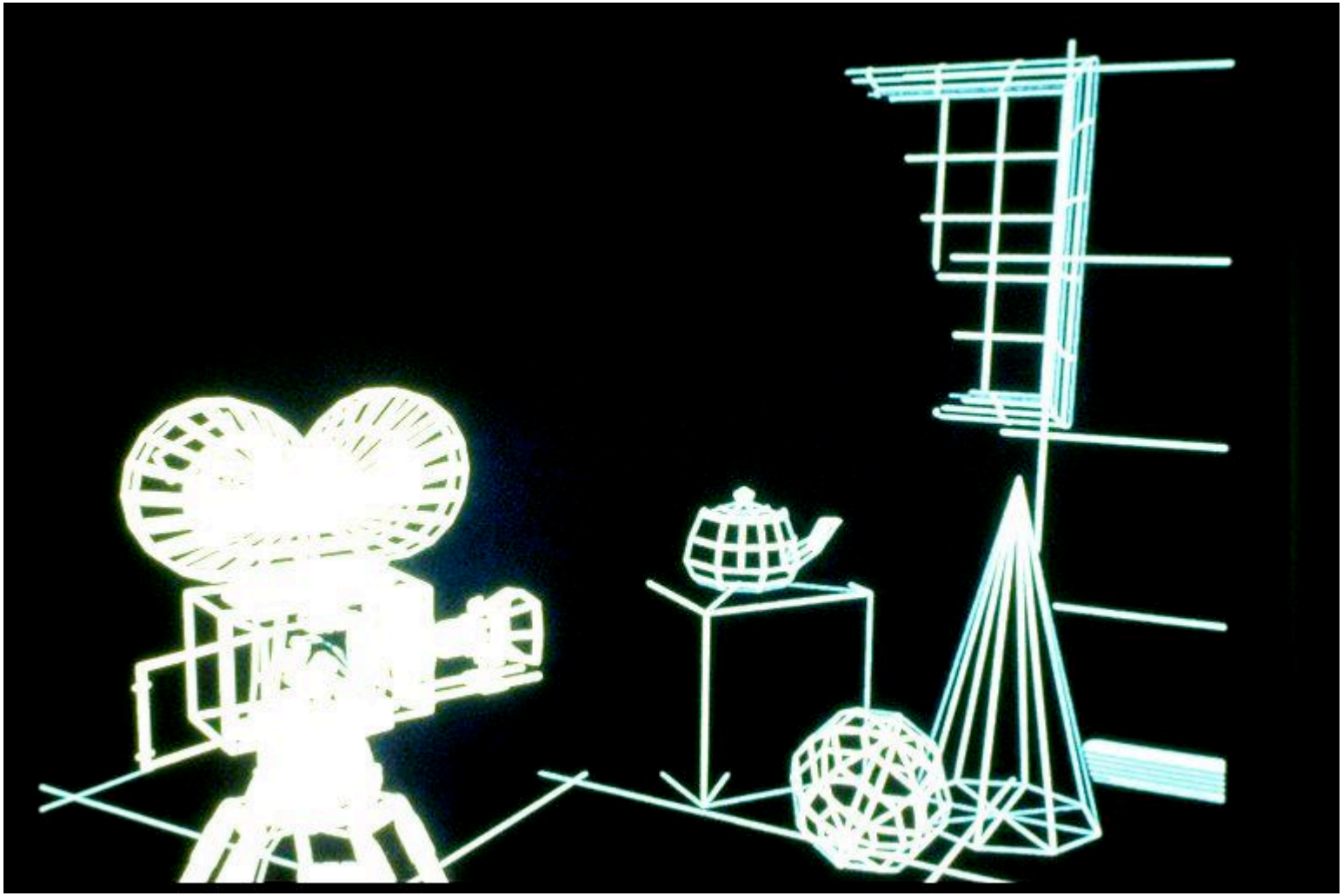
Perspective Projection



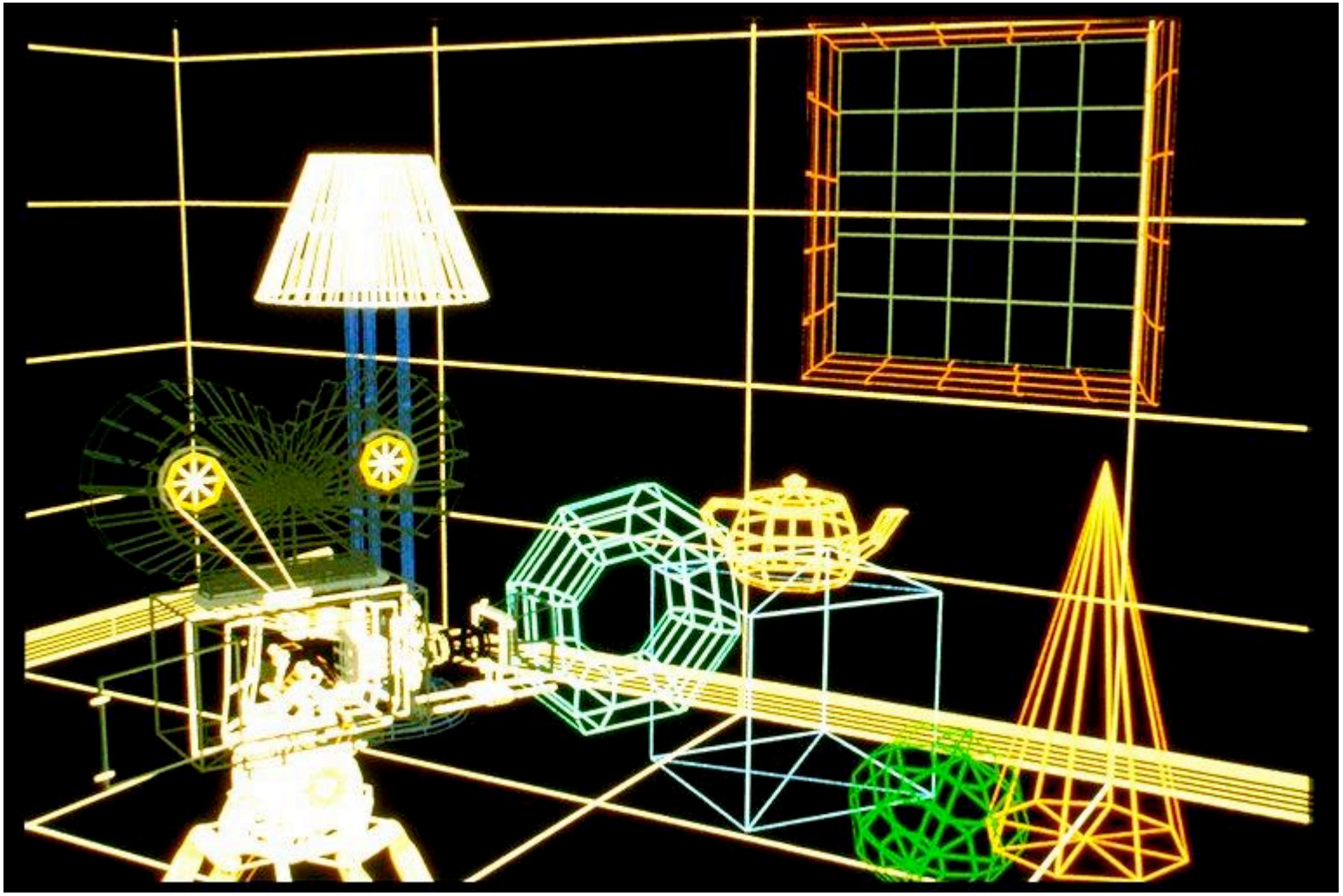
Depth Cueing



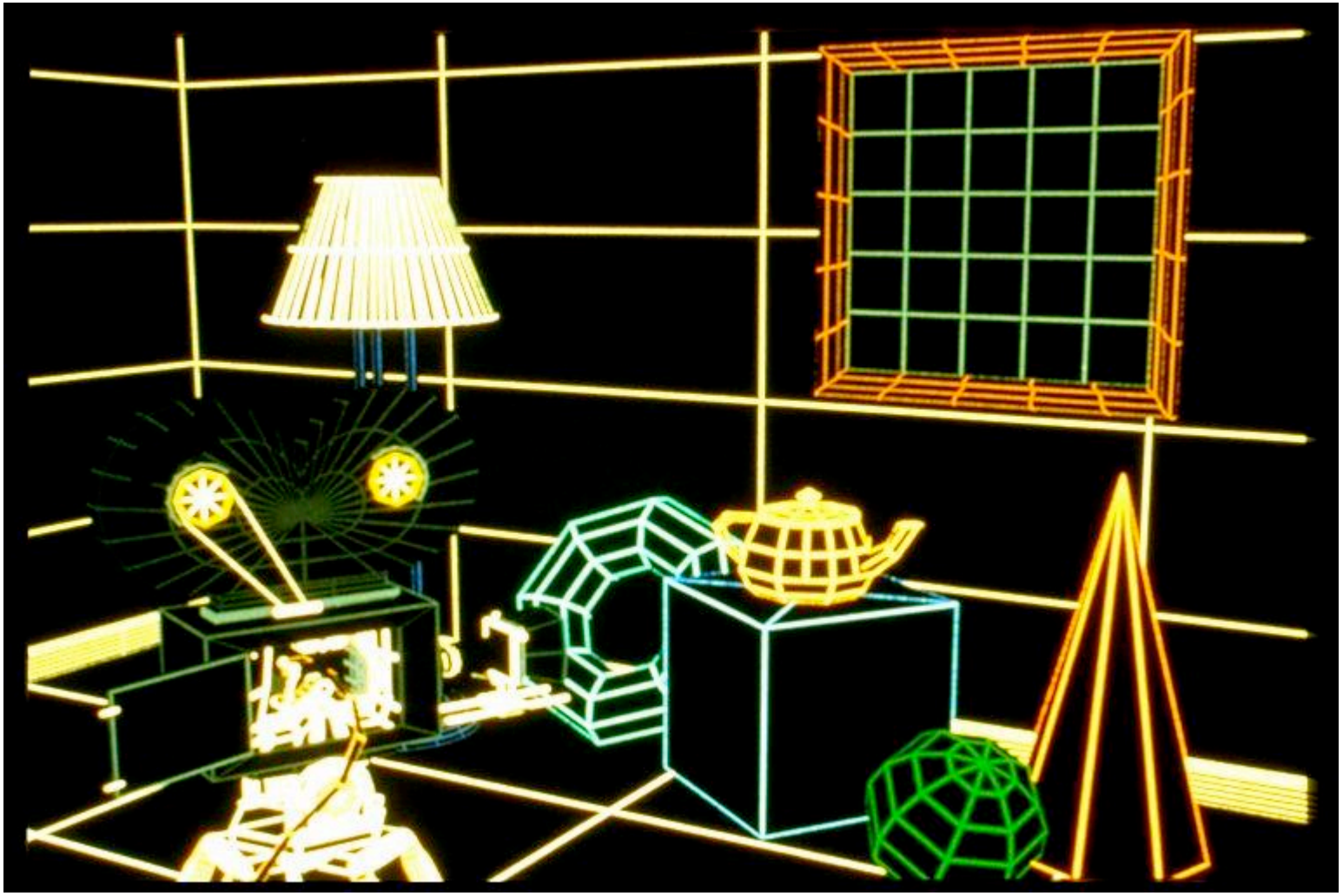
Depth Clipping



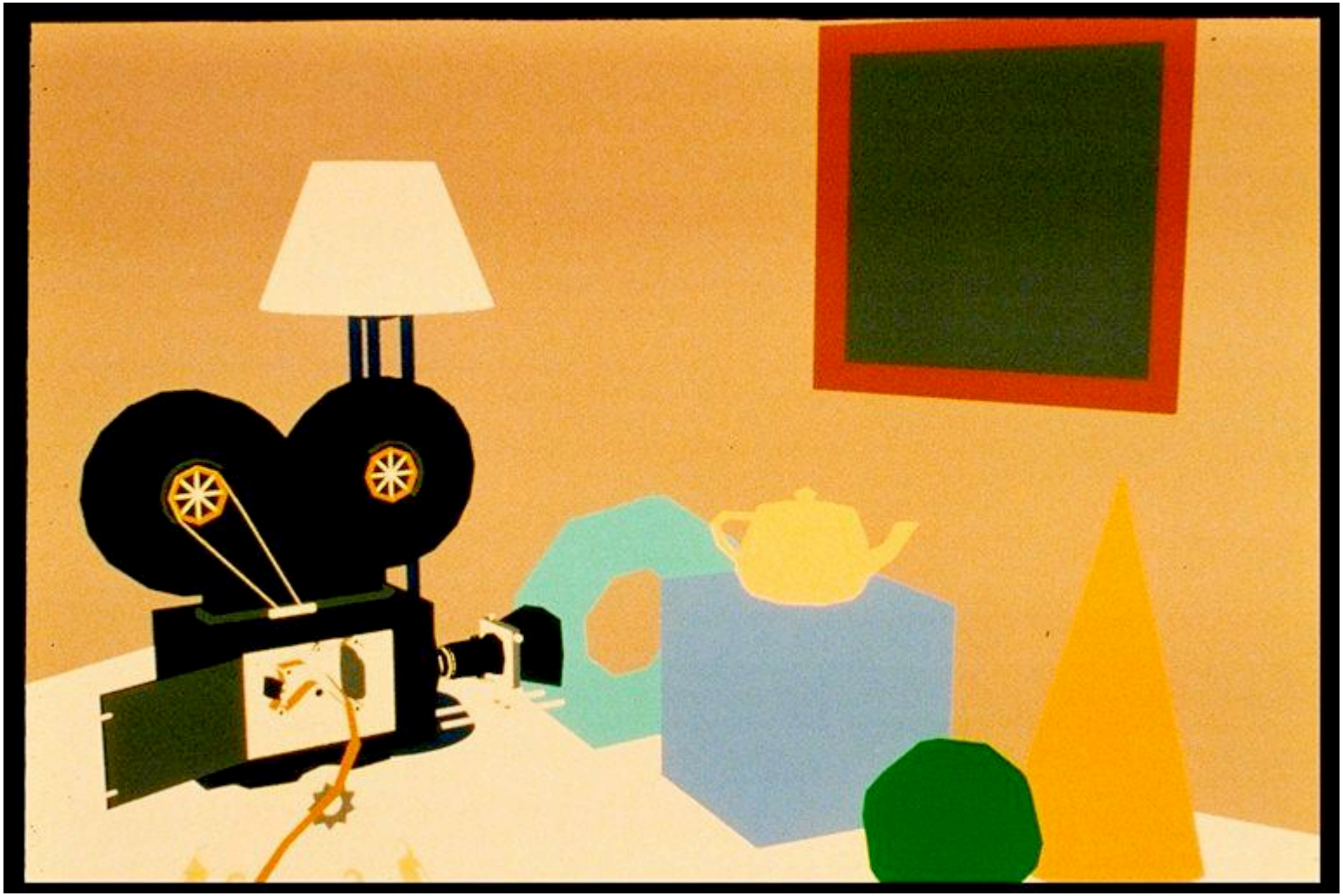
Colored Wireframes



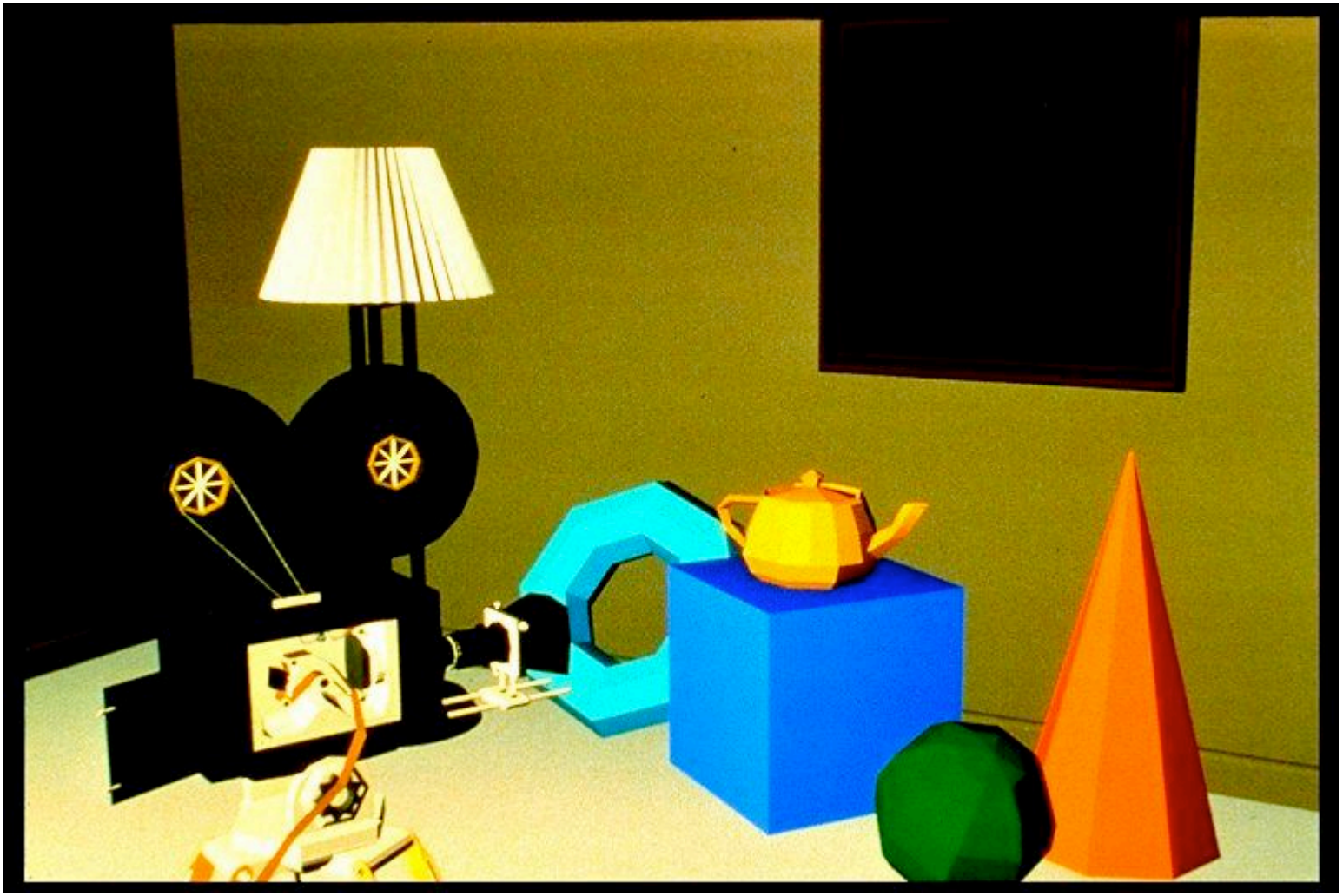
Hidden Line Removal



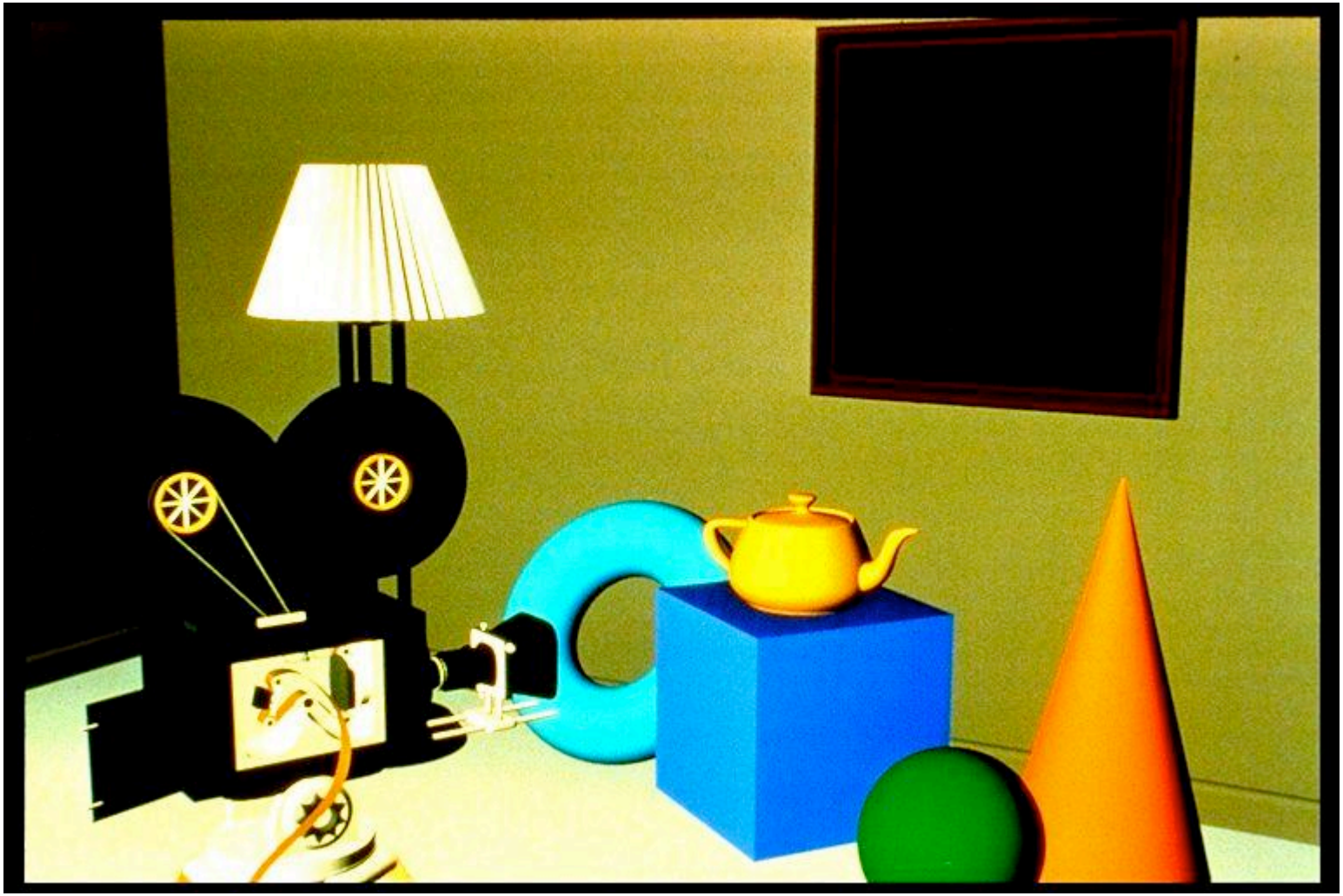
Hidden Surface Removal



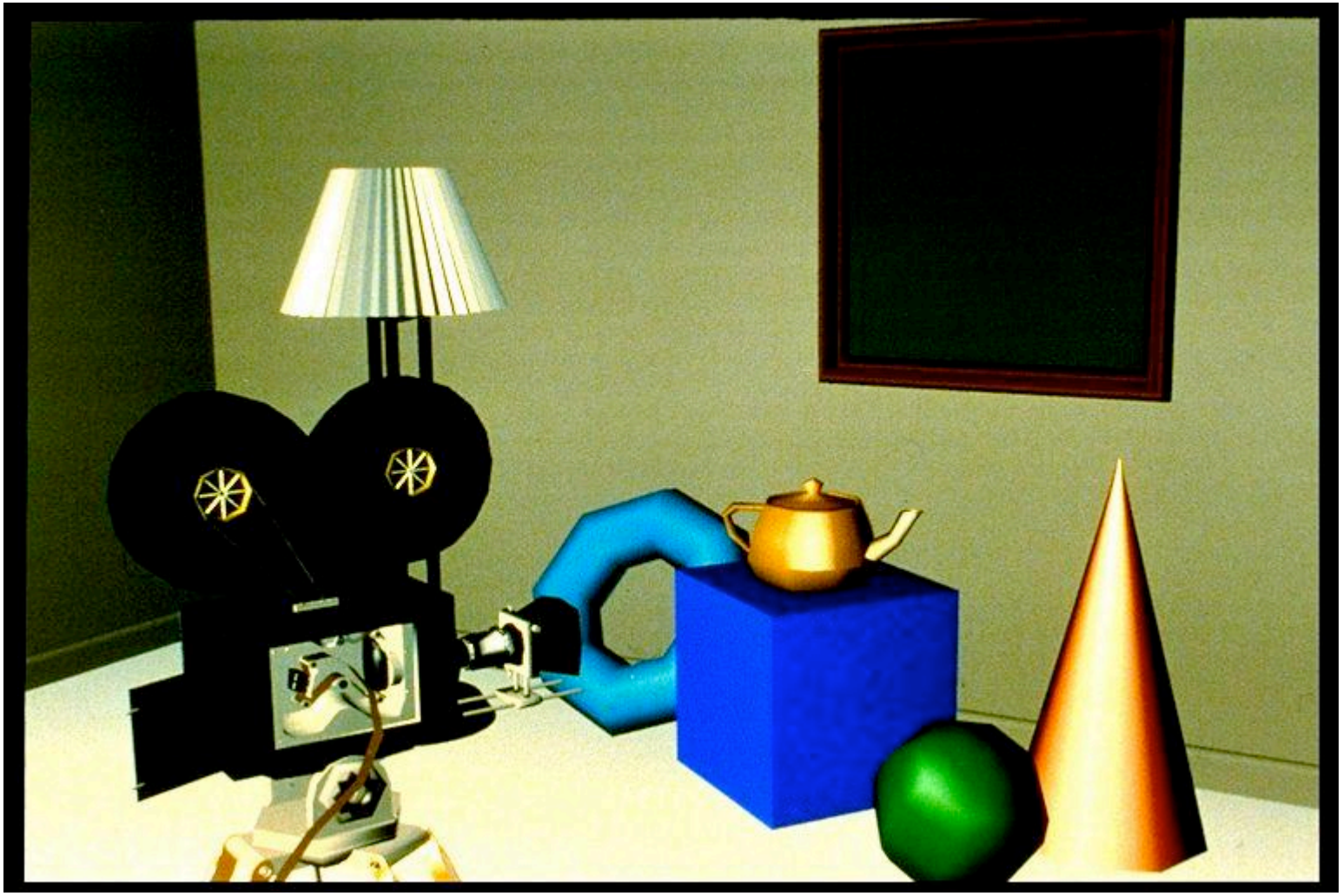
Per-Polygon Shading



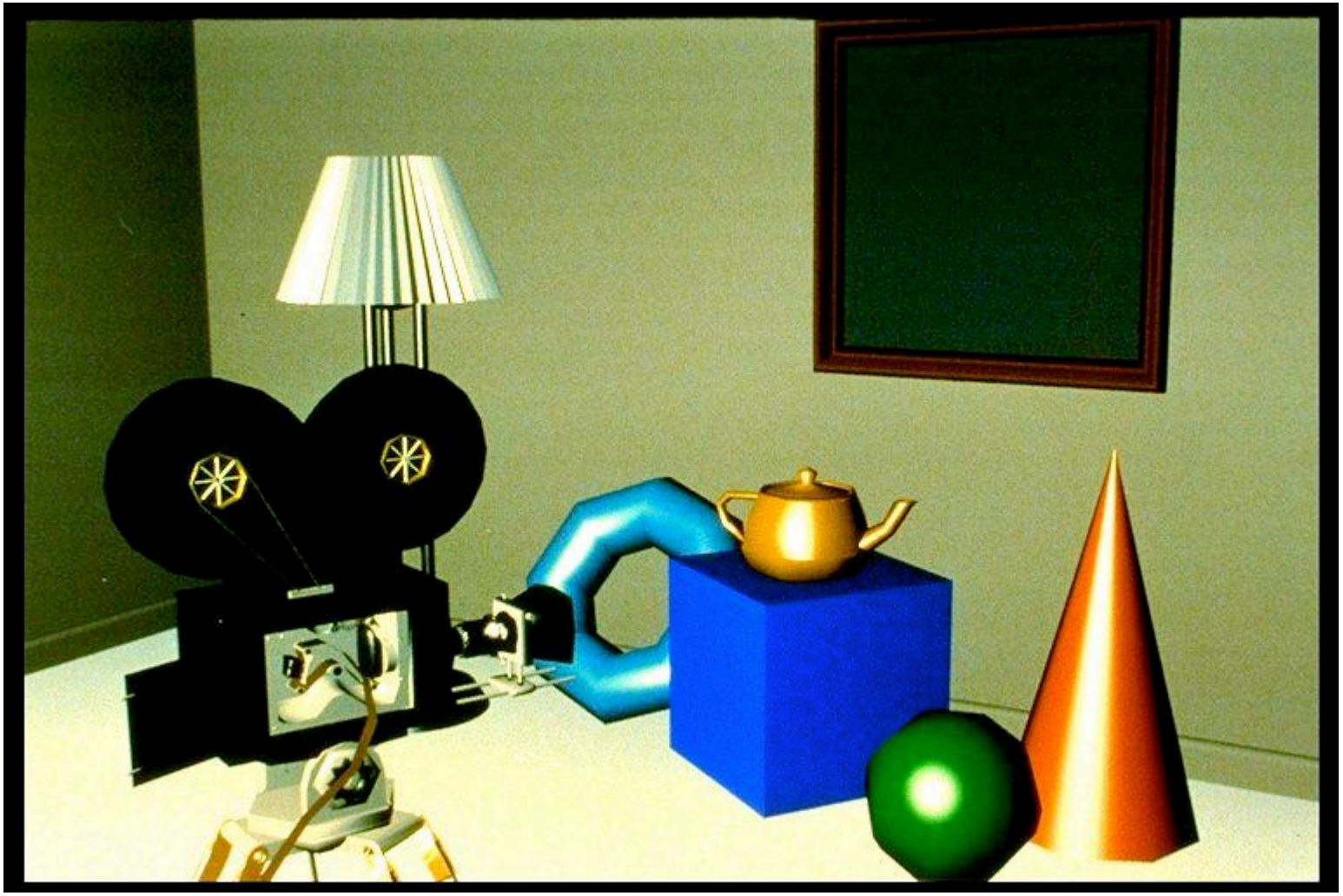
Gouraud Shading



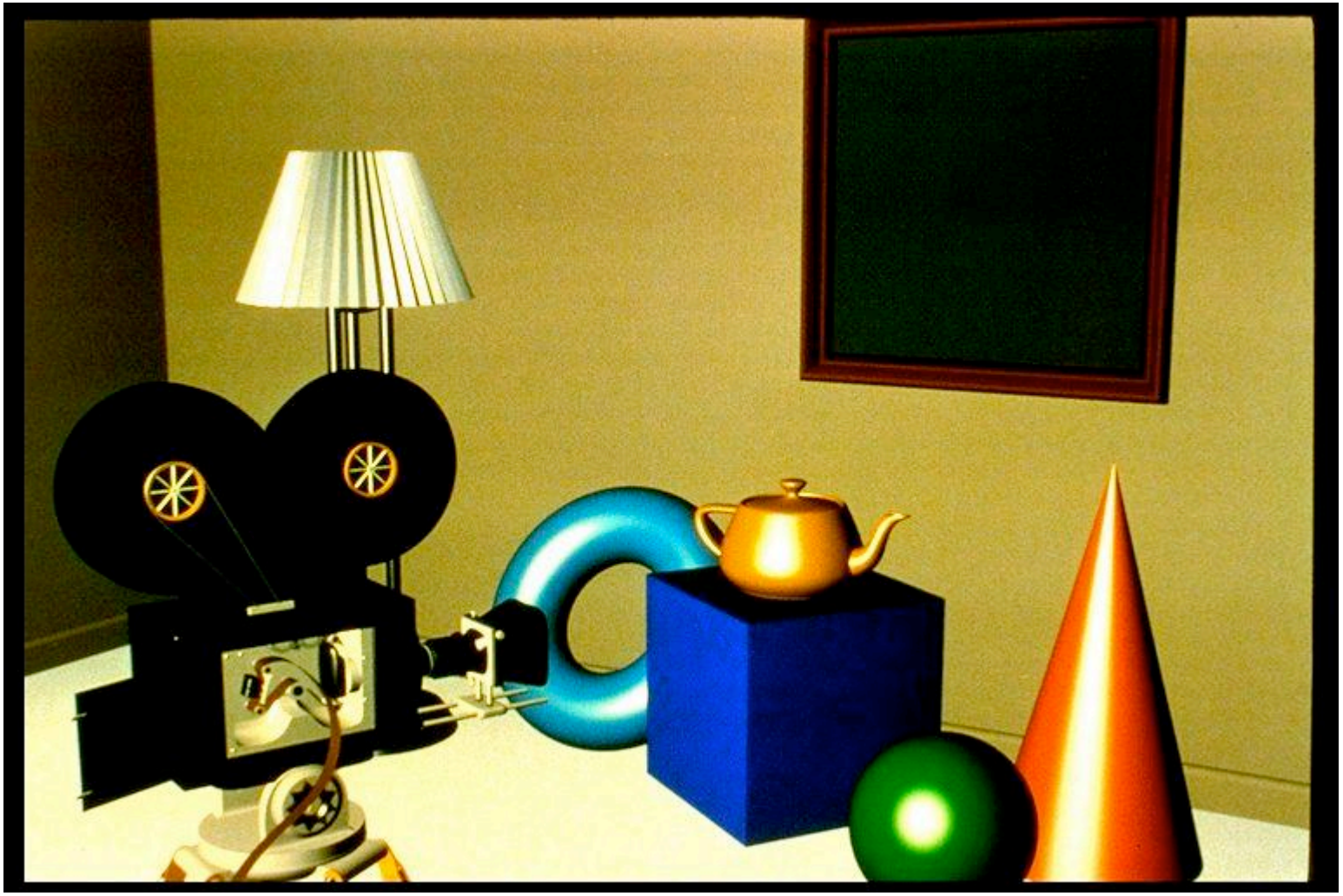
Specular Reflection



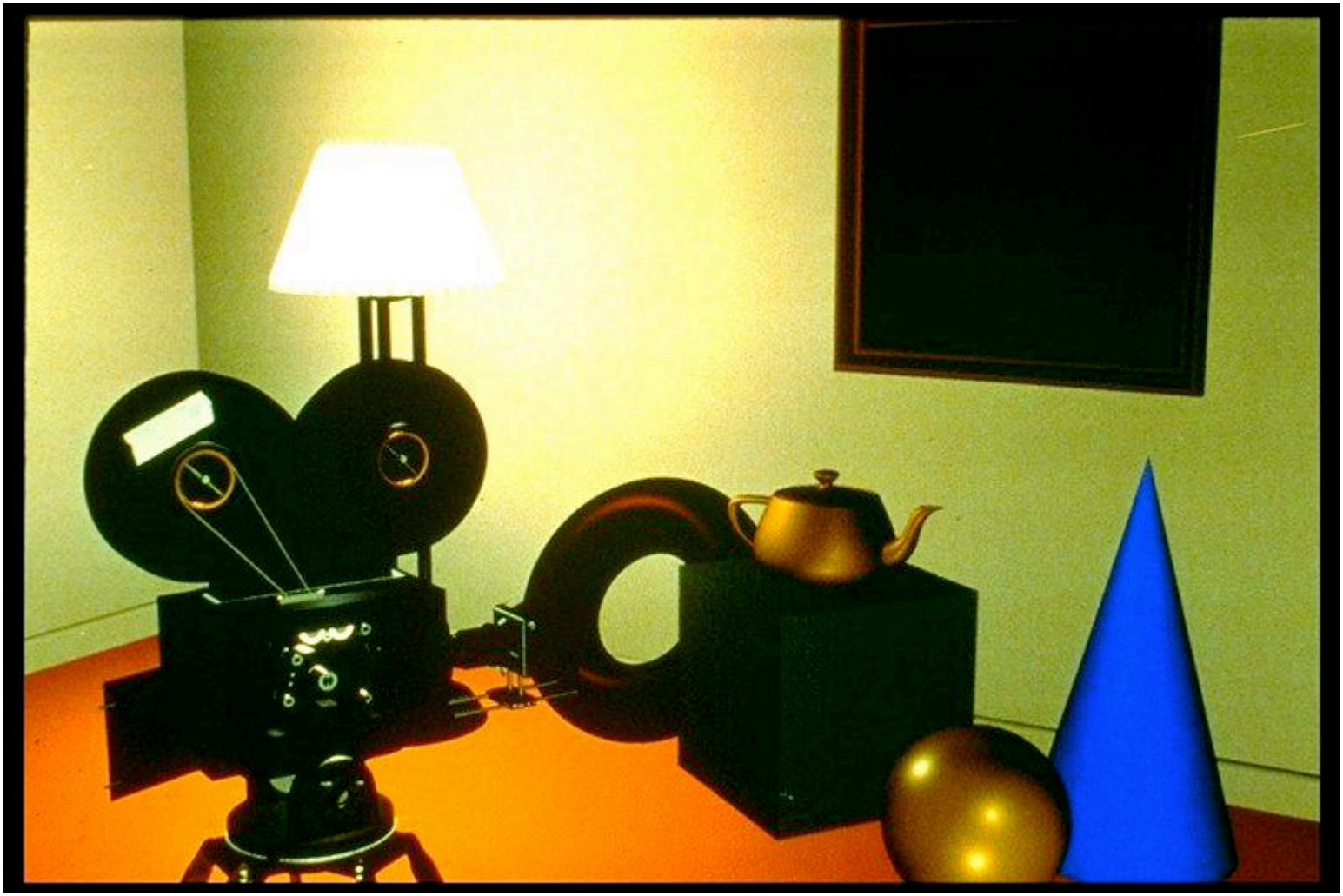
Phong Shading



Curved Surfaces

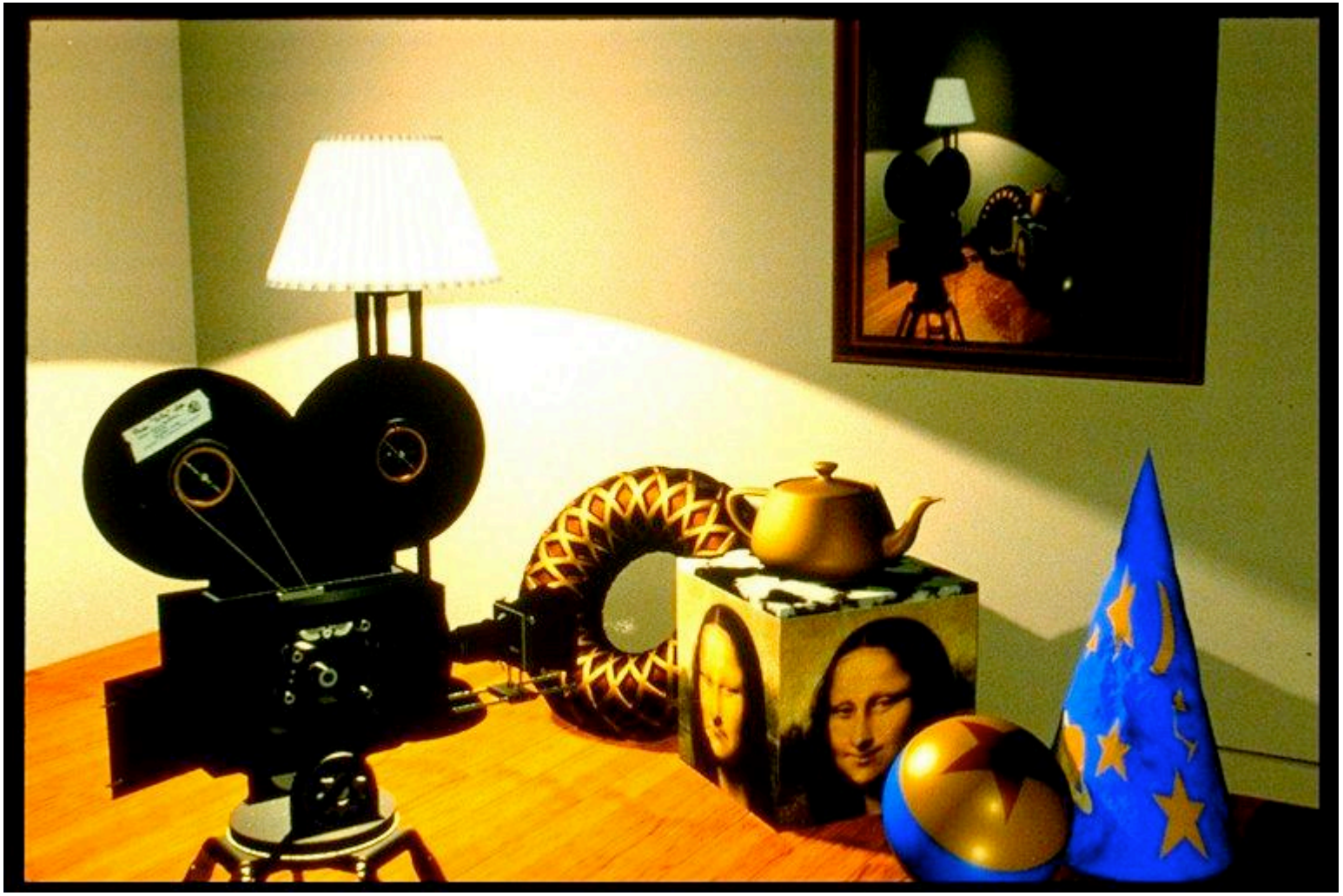


Complex Lighting and Shading

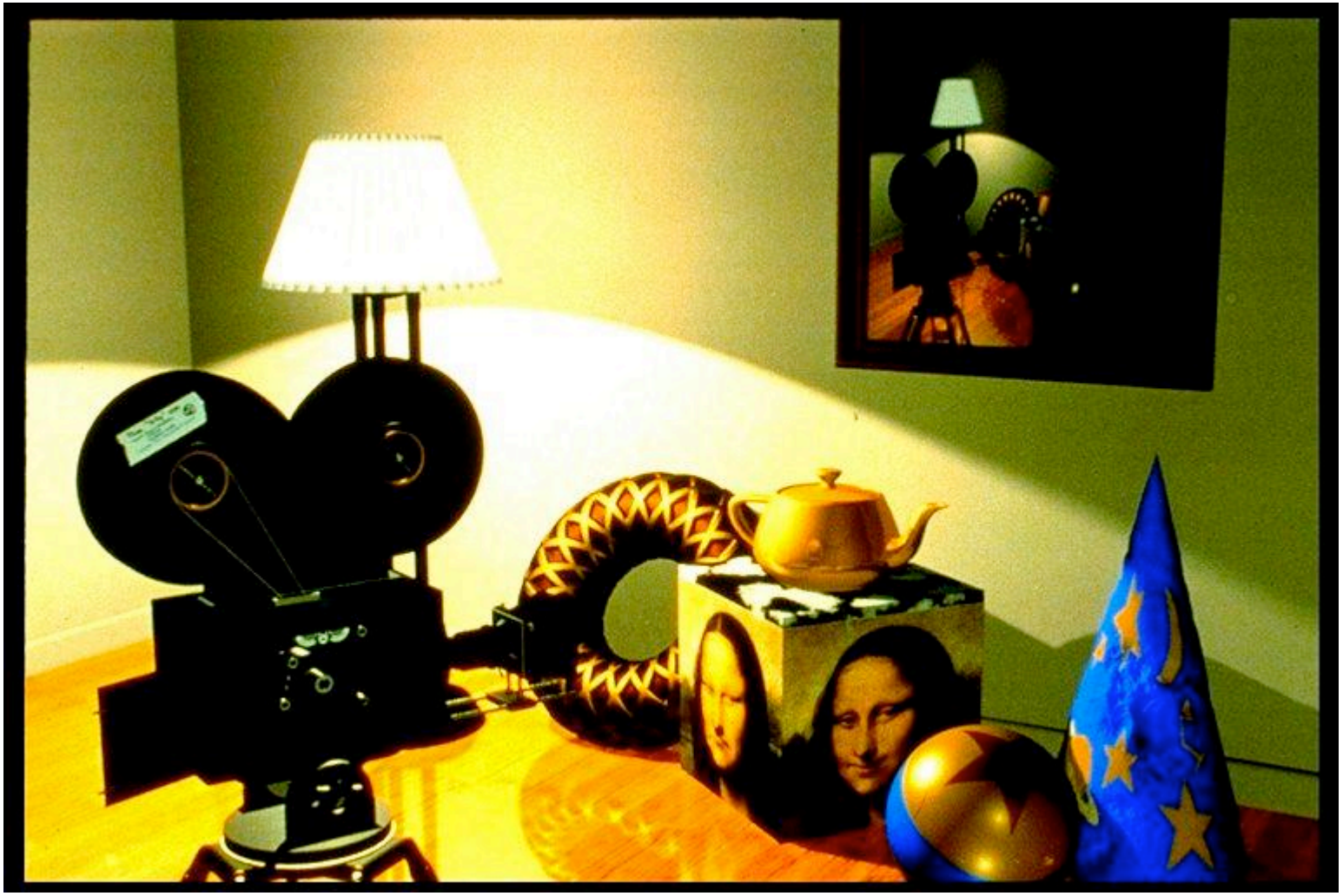


Texture Mapping

Displacement Mapping

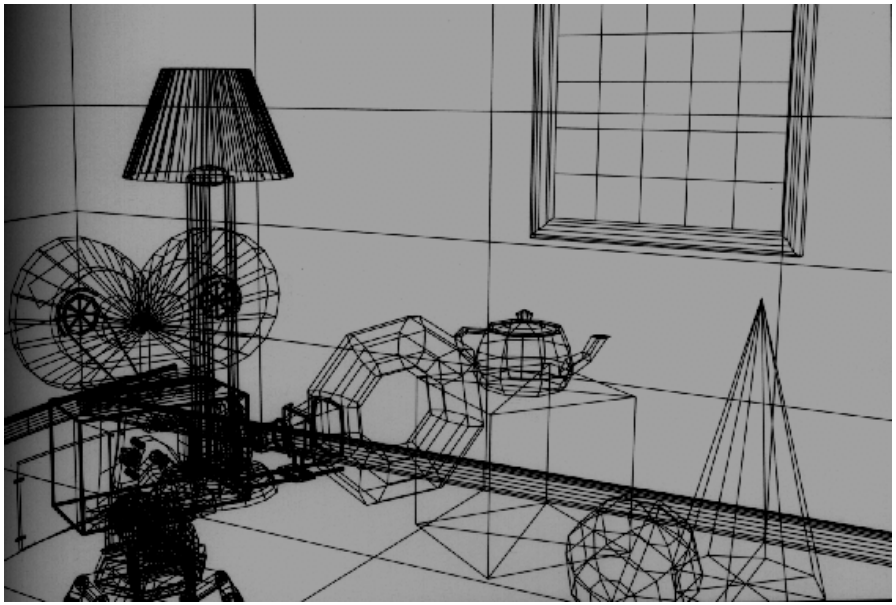


Reflection Mapping



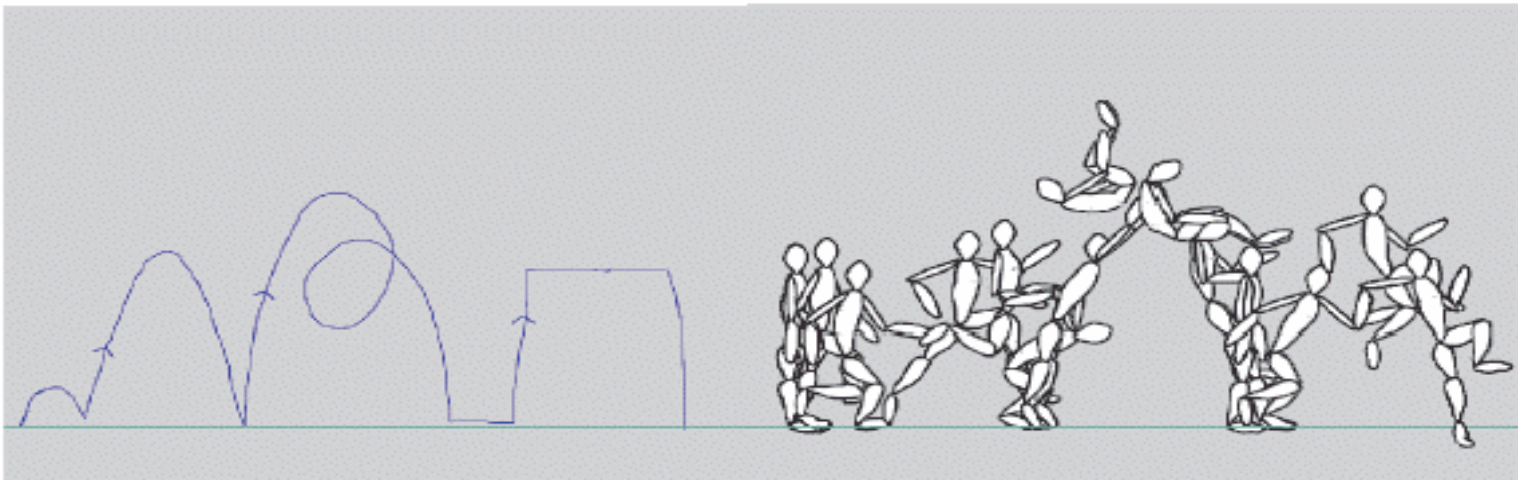
Modelling

- generating models
  - lines, curves, polygons, smooth surfaces
  - digital geometry



Animation

- generating motion
  - interpolating between frames, states



http://www.cs.ubc.ca/~van/papers/doodle.html

Readings

- today
  - FCG Chap 1
- Wed
  - FCG Chap 2
    - except 2.5.1, 2.5.3, 2.7.1, 2.7.3, 2.8, 2.9, 2.11.
  - FCG Chap 5.1-5.2.5
    - except 5.2.3, 5.2.4