

19CSE433 Computer Graphics & Visualization

Professional Elective 1
5th Semester, 2021-22 Odd
2019-22 Batch, BTech CSE

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19CSE433

COMPUTER GRAPHICS AND VISUALIZATION

2033

2021-2022 Odd Semester

B.Tech CSE – (2019-2023 Batch)

Semester: 5

Course Objectives

This course aims at teaching students about computer graphic application and standard algorithms involved in 2D and 3D graphics.

It gives a clear foundation of the graphic operations performed on 2D objects thereby enabling creation of animations.

19CSE433

COMPUTER GRAPHICS AND VISUALIZATION

2033

Syllabus

Unit 1

Computer graphics fundamentals –overview of CG: video displays –output primitives: points, lines –line drawing algorithms–circle generation algorithm- filled area primitives. Geometric transformations.

Unit 2

Three-dimensional (3D) object representation: geometrical transformation for 3D objects. Viewing and clipping: two-dimensional viewing clipping operations – three-dimensional viewing: viewing pipeline, viewing coordinates – projections: parallel projections, perspective projections.

Unit 3

Visible surface detection and illumination models: visible surface detection methods – illumination models and surface rendering – polygon rendering methods: constant intensity shading, Gouraud shading, Phong shading.– color models – computer animation.

Text Book(s)

Hearn D and Baker P. *Computer Graphics Open GL Version, Second Edition, Prentice Hall of India; 2013.*

Reference(s)

Plastock R A and Kalley G. *Theory and Problems of Computer Graphics, Schaum's Outline Series, TMH; 1985.*

Foley J D D, Eiener S K and Hughes J.F. *Computer Graphics Principles and Practice, Second Edition, Pearson Education; 1996.*

Course Outcomes

[illegible]

List of Tools

MSTeams for course delivery and Viva

AUMs for quiz, online exam of periodical and end semester

Lab:

2D Graphics: C

3D Graphics: Blender

Miniproject:

Indian Sign Language gesture generation

EVALUATION PATTERN : 70 + 30

Mid term assessment: 20 marks

- online: 10 marks,
- Viva: 10 marks

Continuous Assessment (Theory) (CAT) :10 marks (5 online quiz)

Continuous Assessment (Lab) (CAL): 40 marks

- 2 lab assessment in 2D graphics:10 marks (5 marks each)
- 3D animation miniproject:30 marks
- (object creation:10 marks,Animation:10,lighting and texture-10)

End Semester 30 marks

- Online:10,
- Viva:20(10+10 mini project GUI)

Applications

Display of Information

Design

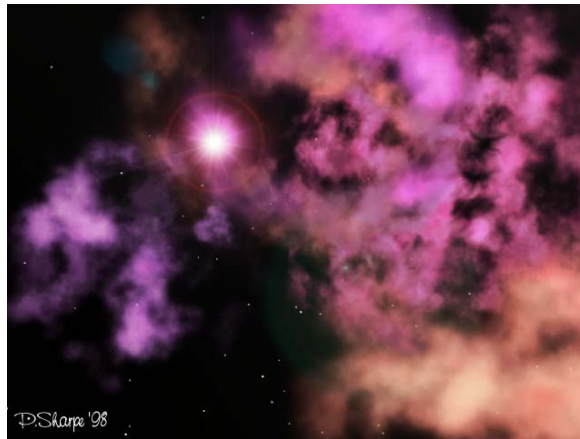
Simulation

Computer Art

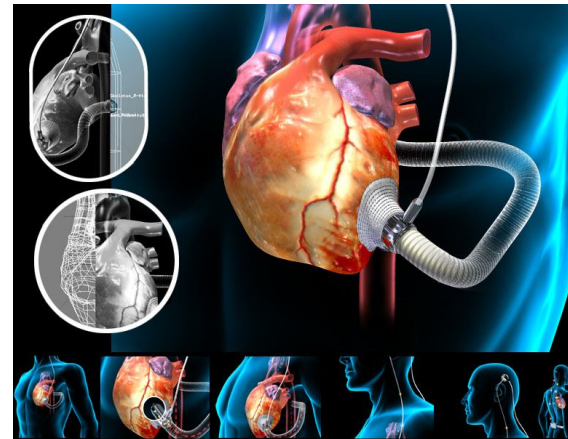
Entertainment

Display of Information

Graphics for Scientific, Engineering, and Medical Data



Nebula

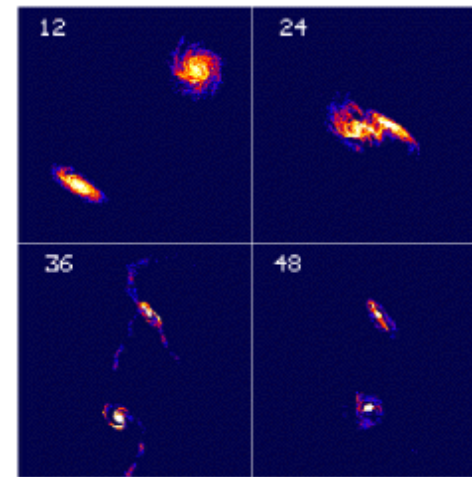
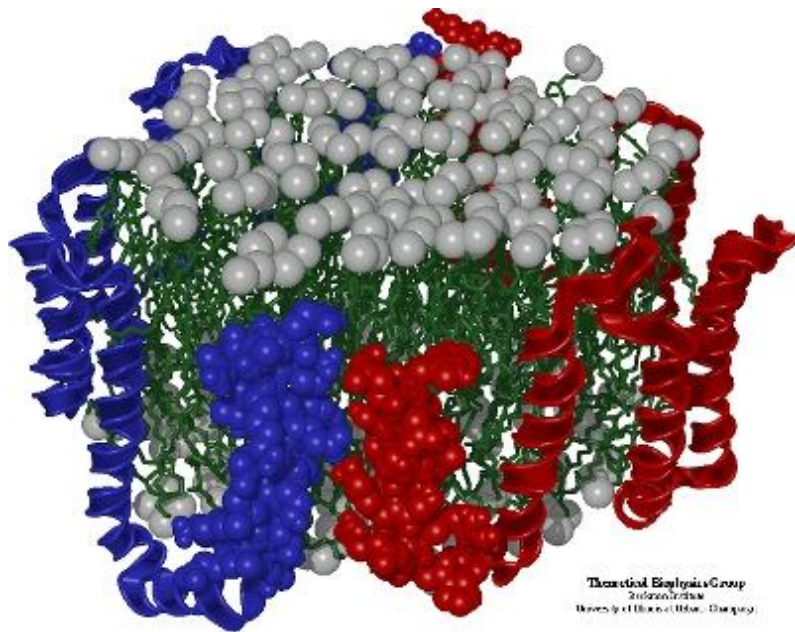


Medical Image

Medical Imaging



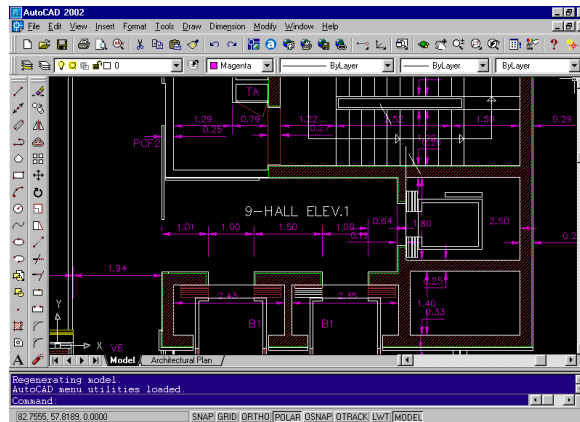
Scientific Visualisation



Design

Graphics for Engineering and Architectural System

Design of Building, Automobile, Aircraft, Machine etc.

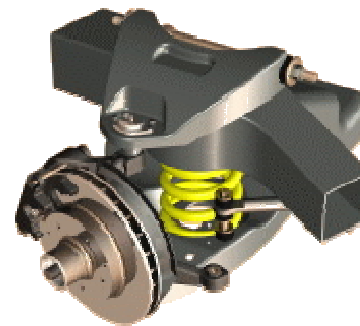
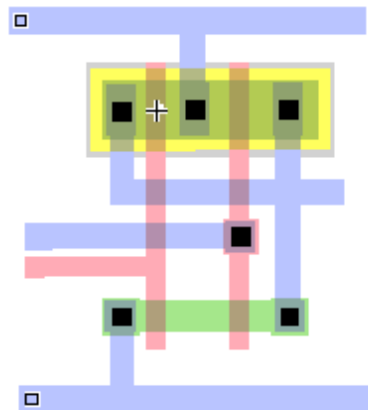


AutoCAD 2002



Interior Design

Computer Aided Design

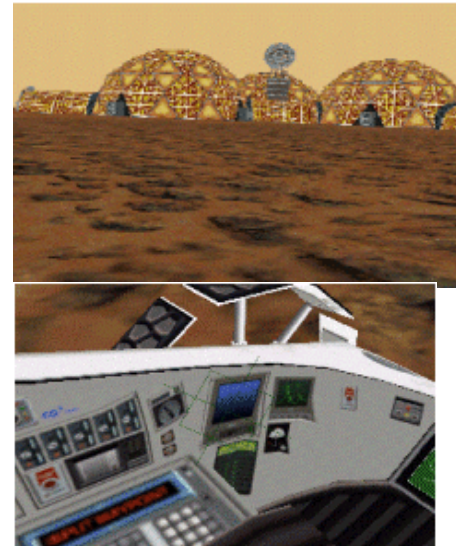


Simulation

Computer-Generated Models of Physical, Financial and Economic Systems for Educational Aids



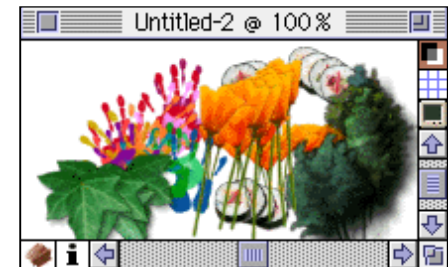
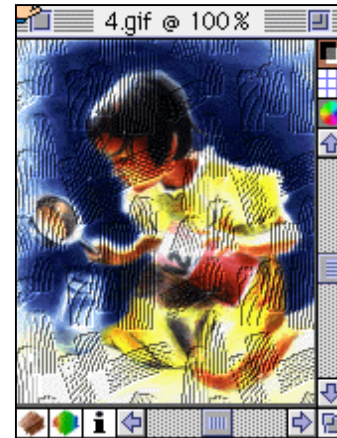
Flight Simulator



Mars Rover Simulator

Computer Art

Graphics for Artist



Metacreation Painter

Entertainment

Graphics for Movie, Game, VR etc.



Final Fantasy



Online Game

Animation (films)



Games



What is Computer Graphics?

Algorithms for Visual Simulations



Terminology in Graphics

Imaging

- Representing 2D images

Modeling

- Representing 3D objects

Rendering

- Constructing 2D images from 3D models

Animation

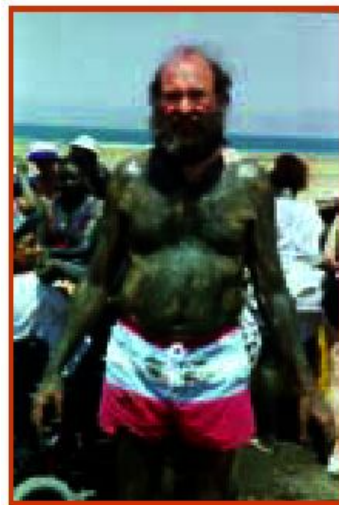
- Simulating changes over time

Imaging

Warping

Metamorphosis

Warping



Source image

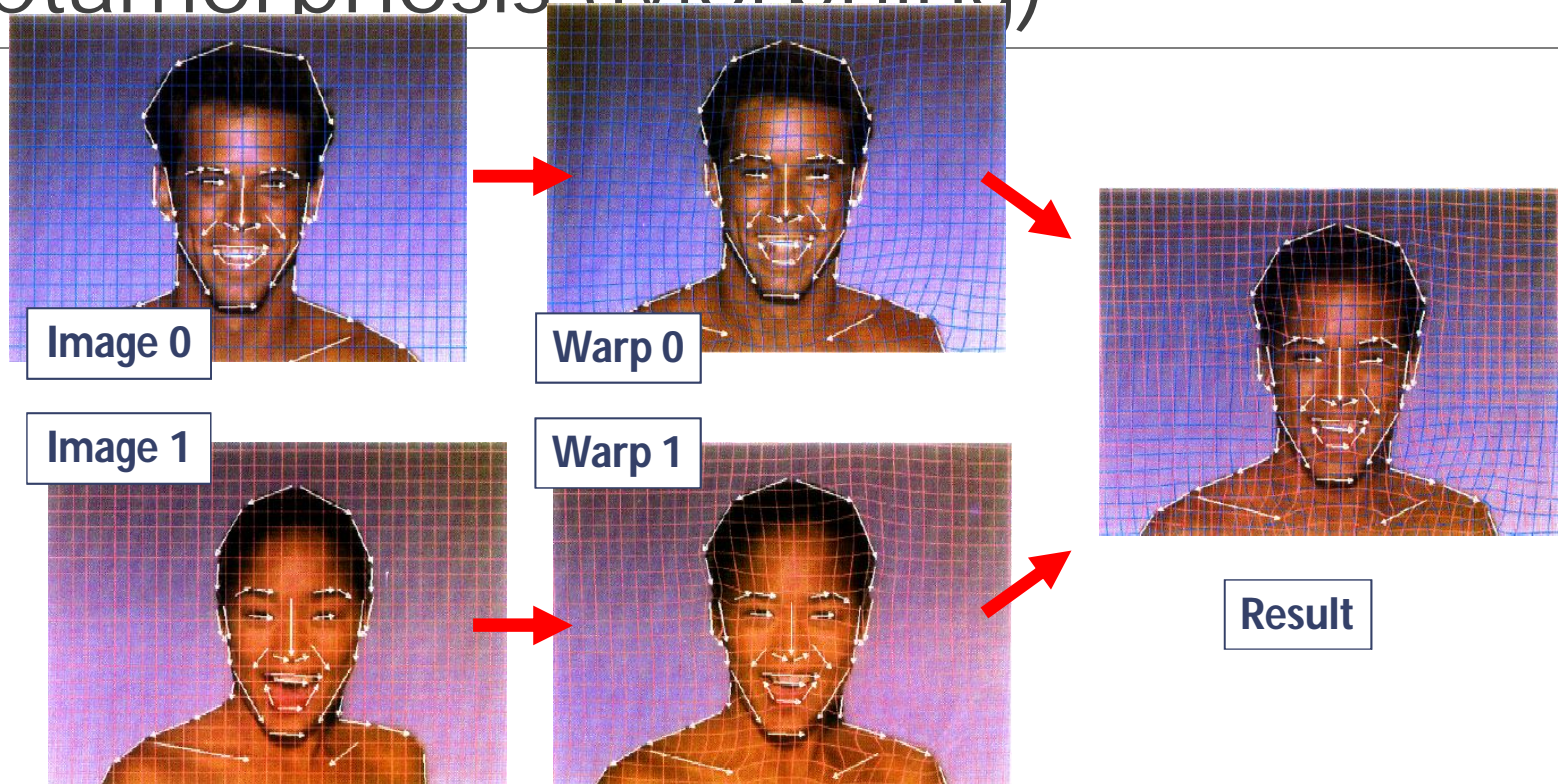
Warp



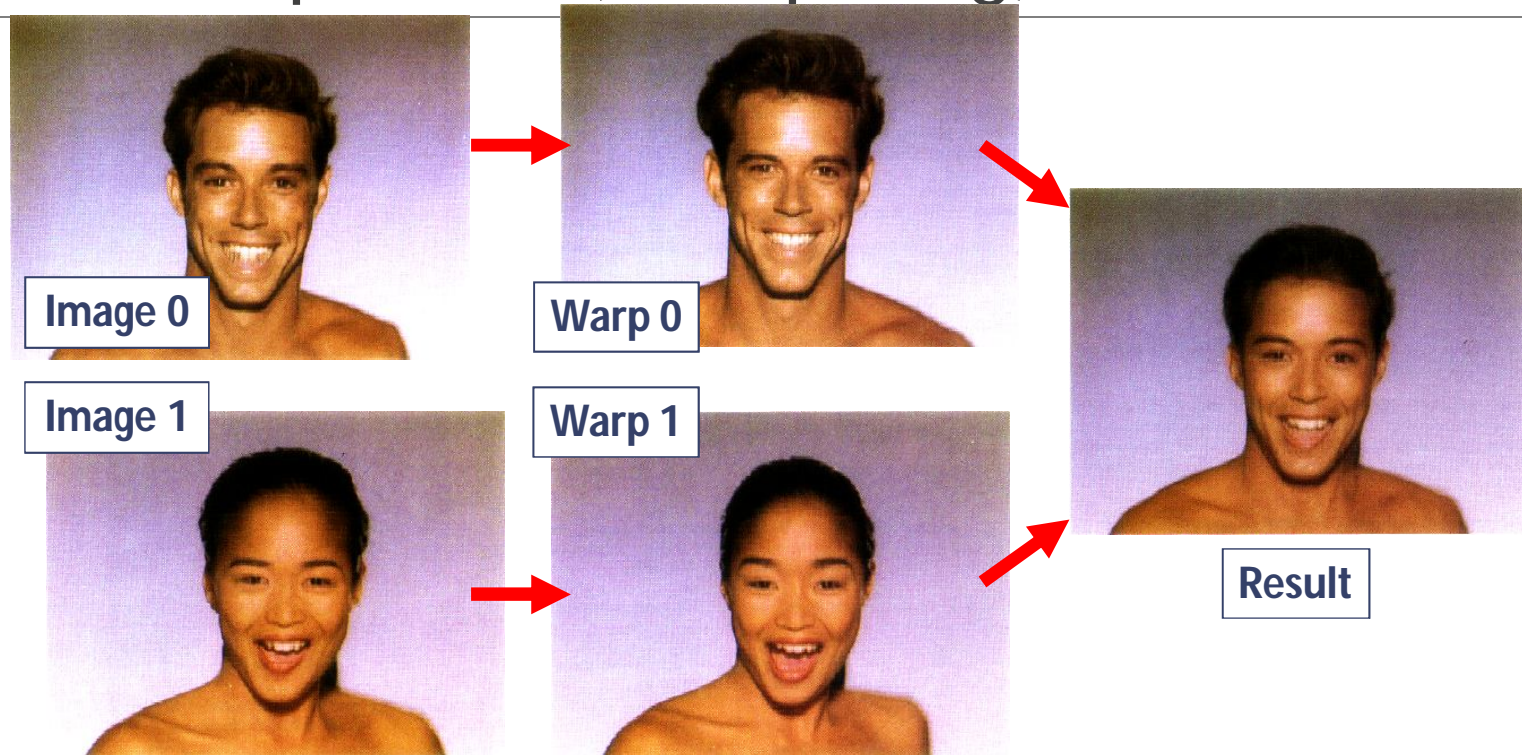
Destination image

Courtesy of Princeton Univ.

Metamorphosis (Morphing)

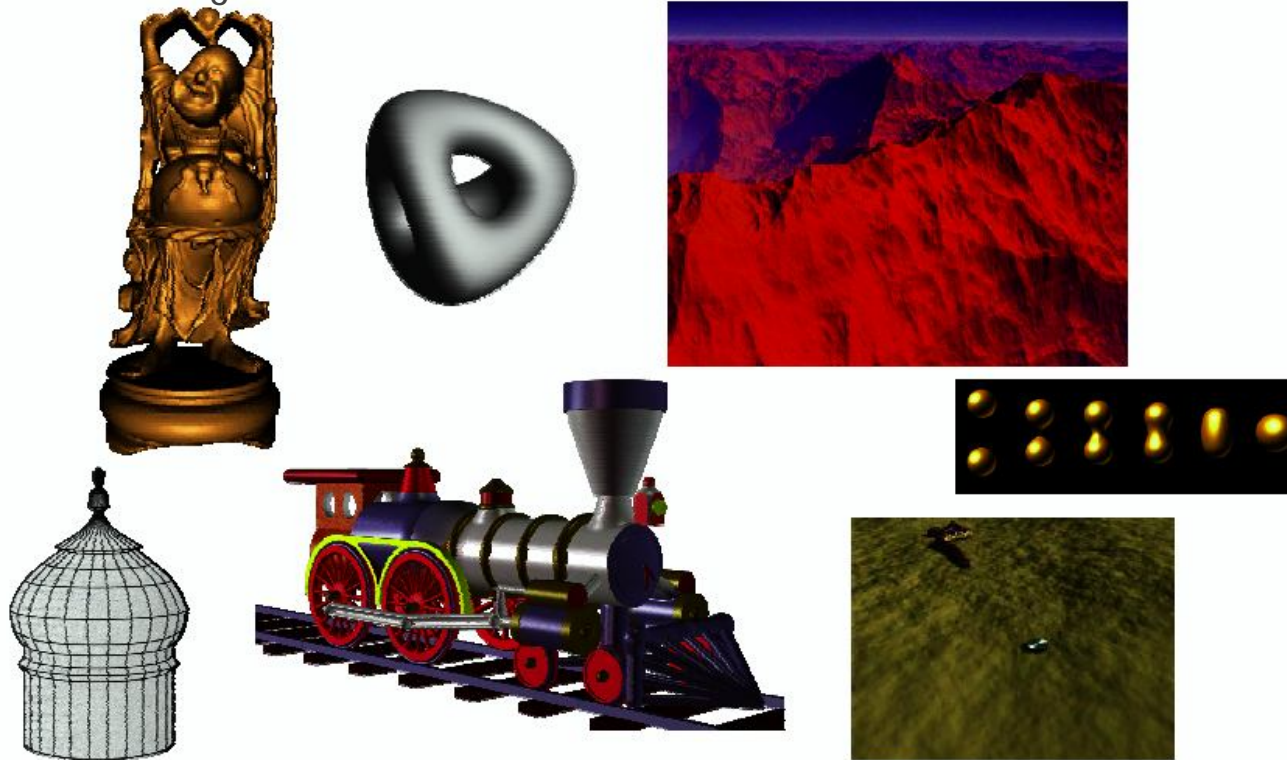


Metamorphosis (Morphing)



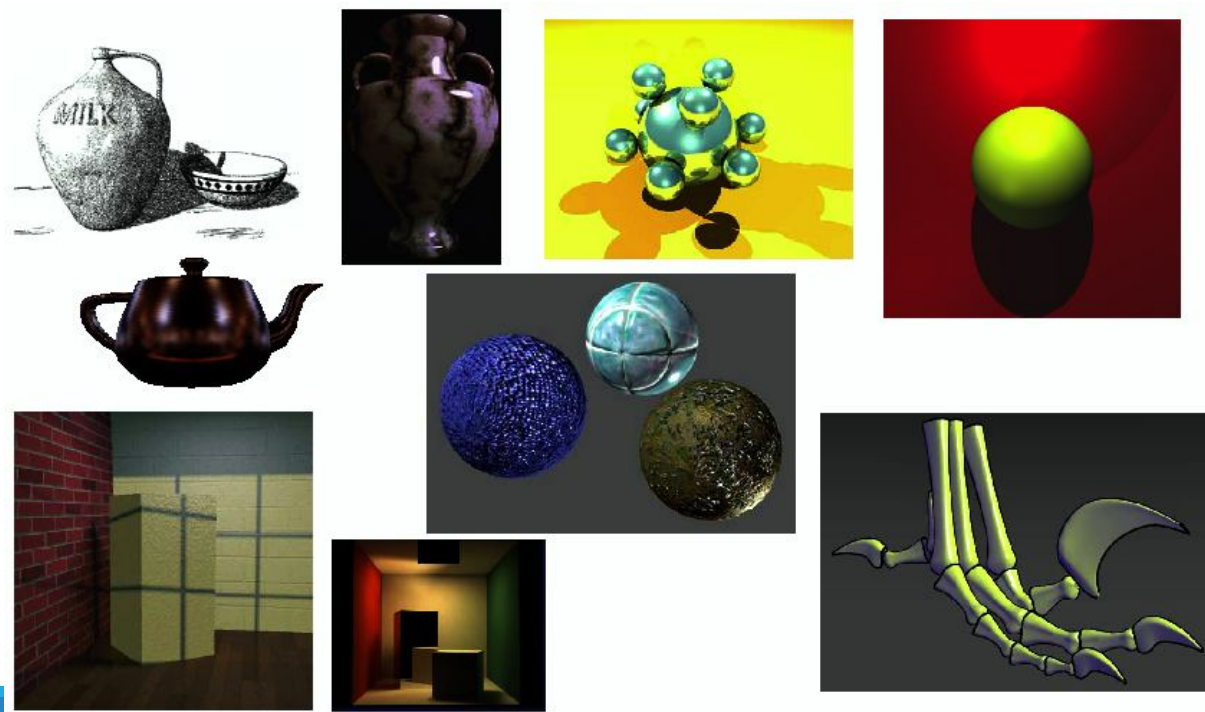
Modeling

Shape Description & Design



Rendering

Simulating Behavior of Lights & Image Formation



Animation

Motion Representation & Control

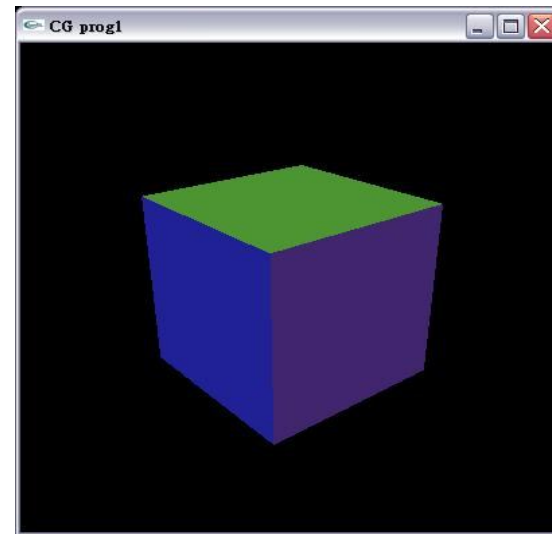
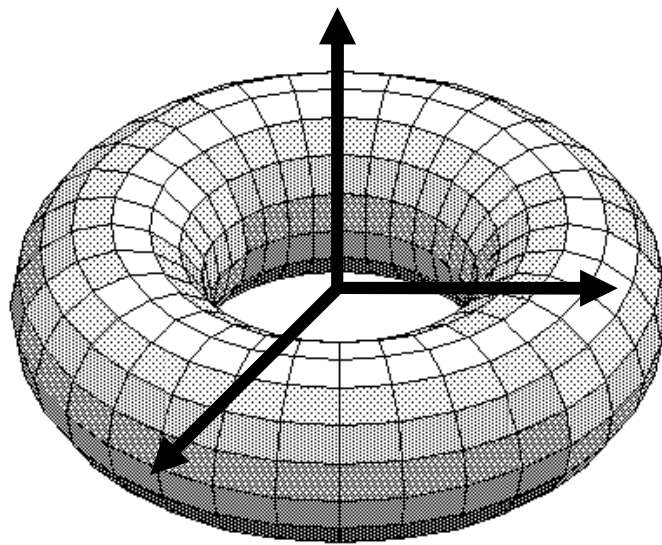


Graphics pipeline

Preparing Shape Models

Designed by polygons, parametric curves/surfaces, implicit surfaces and etc.

Defined in its own coordinate system

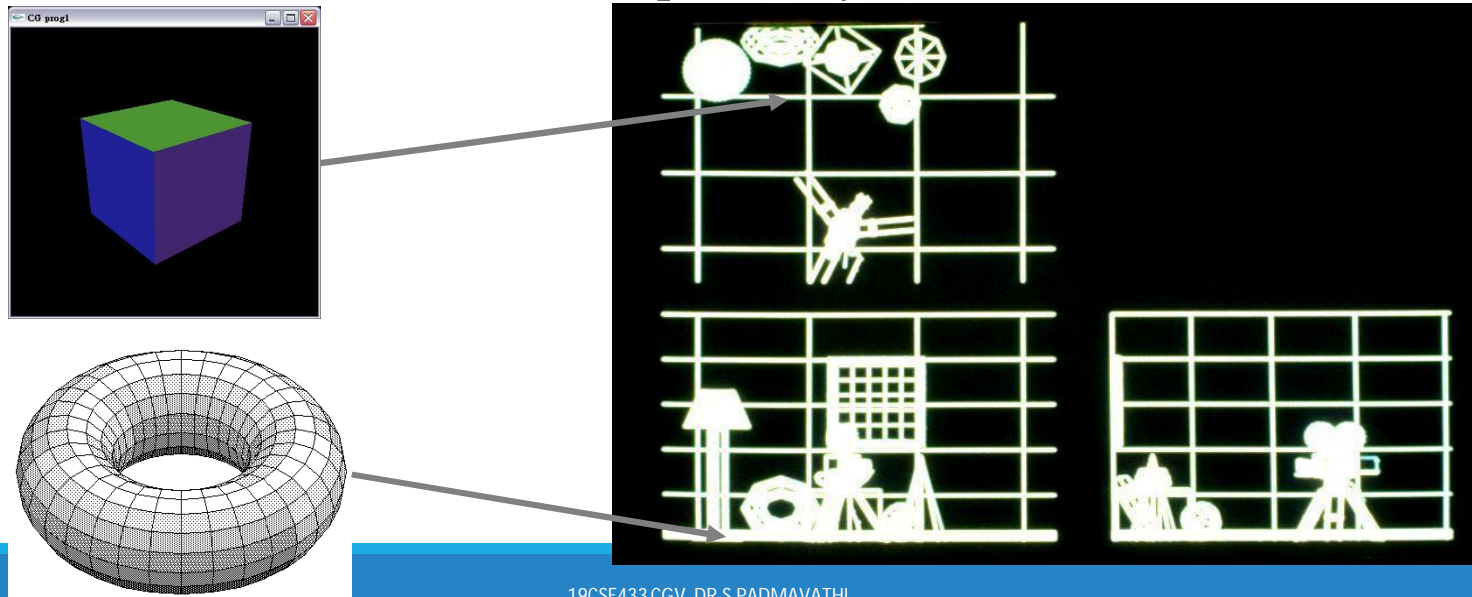


Model Transformation

Objects put into the scene by applying translation, scaling and rotation

Linear transformation called homogeneous transformation is used

The location of all the vertices are updated by this transformation

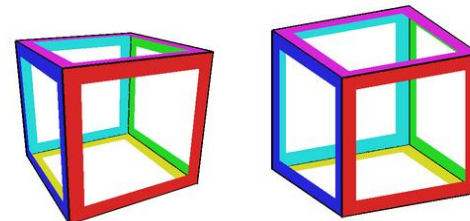
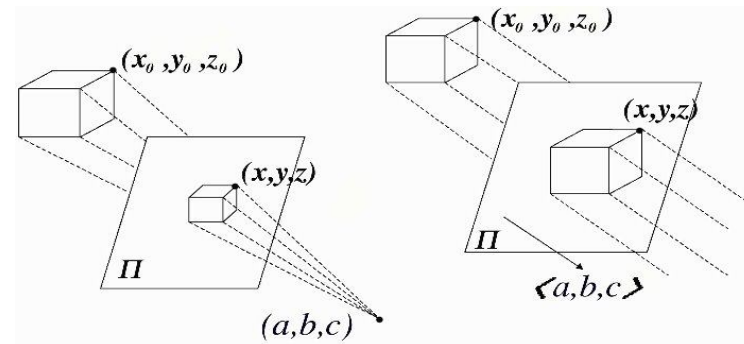
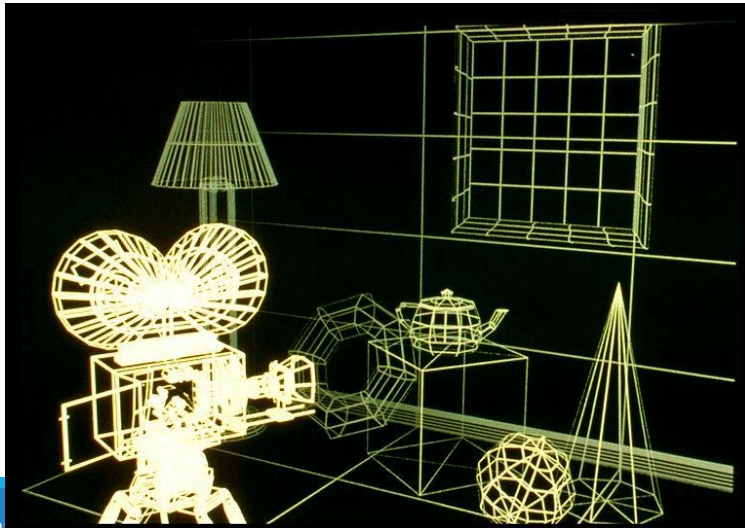


Perspective Projection

We want to create a picture of the scene viewed from the camera

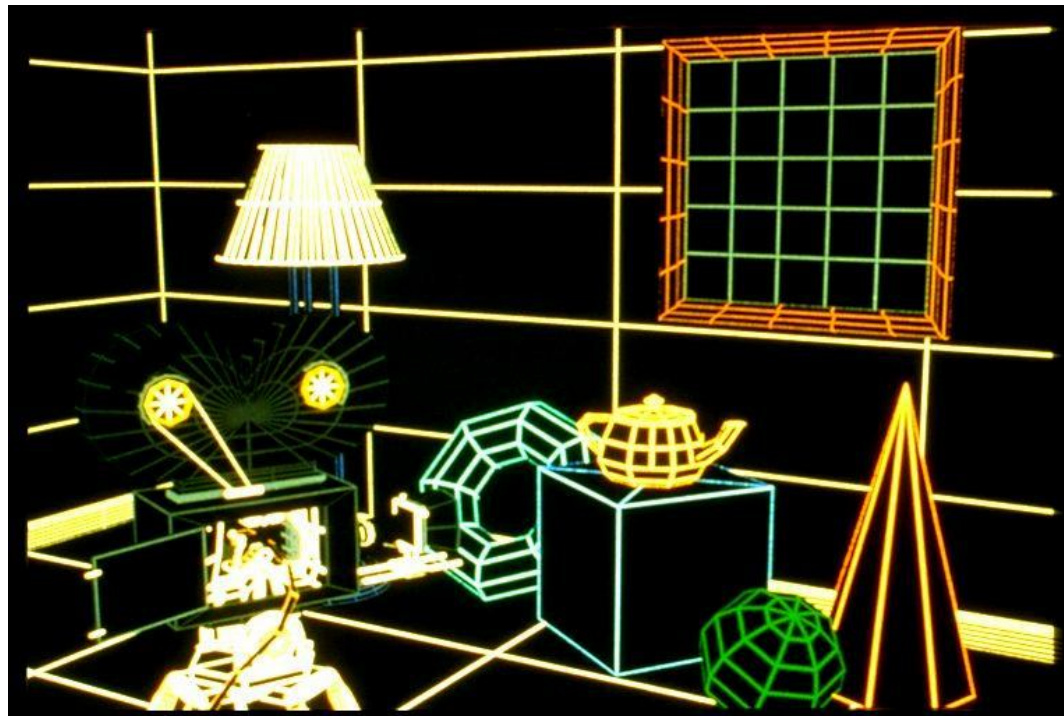
We apply a perspective transformation to convert the 3D coordinates to 2D coordinates of the screen

Objects far away appear smaller, closer objects appear bigger



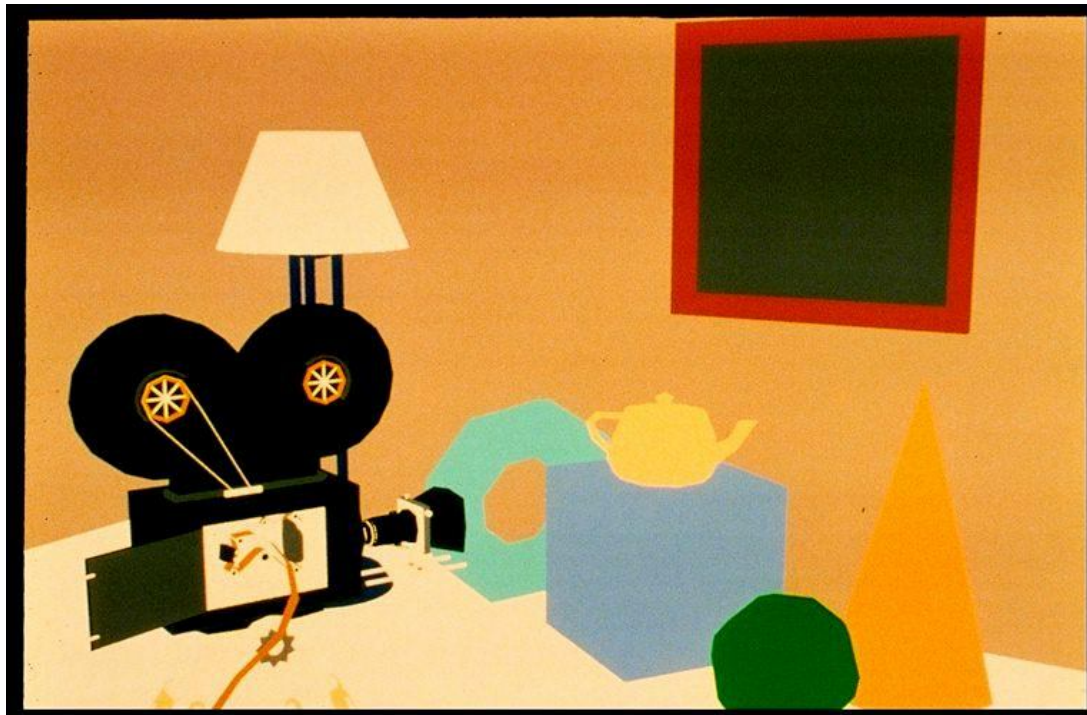
Hidden Surface Removal

Objects occluded by other objects must not be drawn



Shading : Constant Shading - Ambient

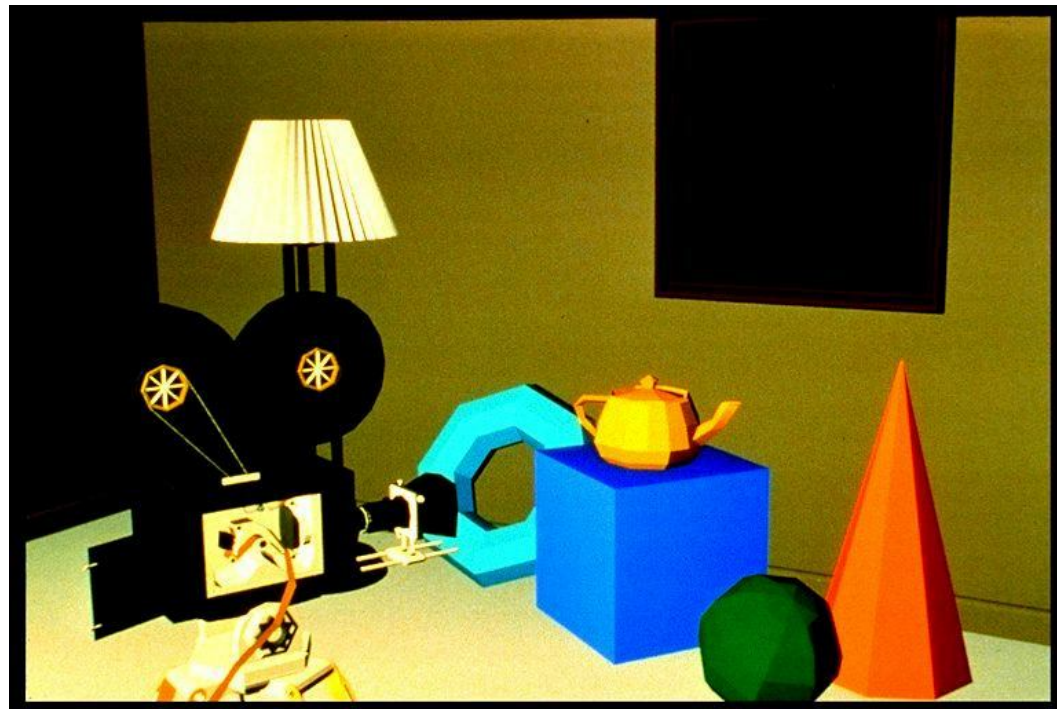
Objects colours by its own colour



Shading – Flat Shading

Objects coloured based on its own colour and the lighting condition

One colour for one face

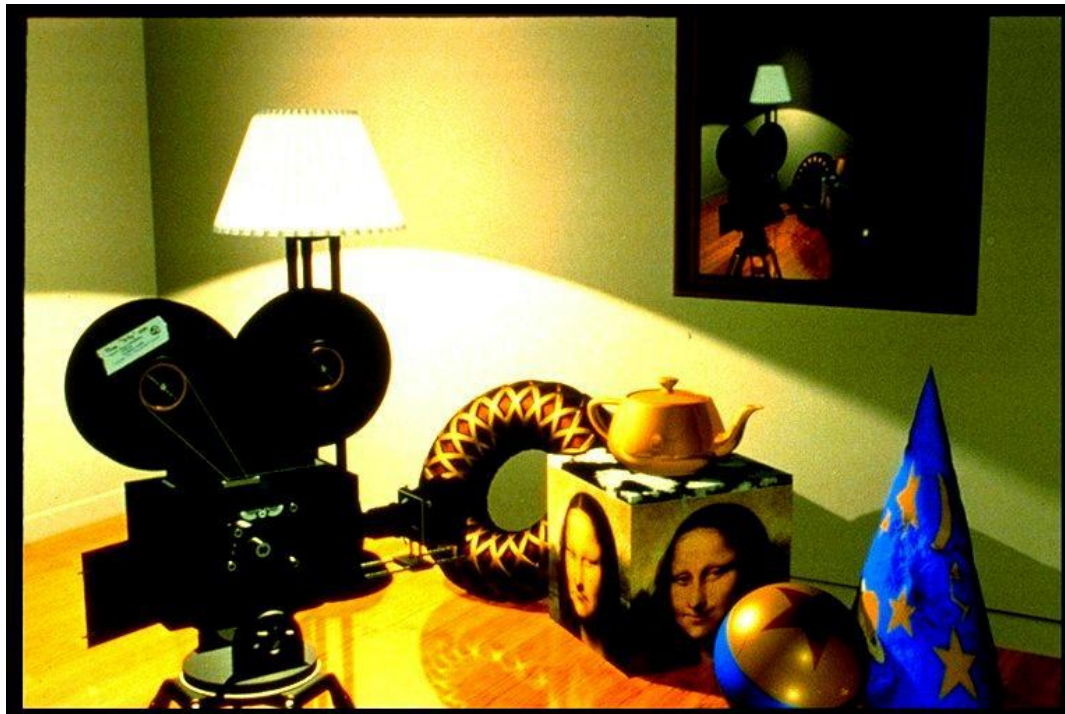


Specular highlights added

Light perfectly reflected in a mirror-like way



Other topics: Reflections, shadows & Bump mapping



Other topics: Global Illumination

