Graphics 2

06-02408

Level 2
10 credits in Semester 2

Professor Ela Claridge

1. INTRODUCTION

The art of 3D graphics is the art of fooling the brain into thinking that it sees a 3D scene painted on a flat screen.

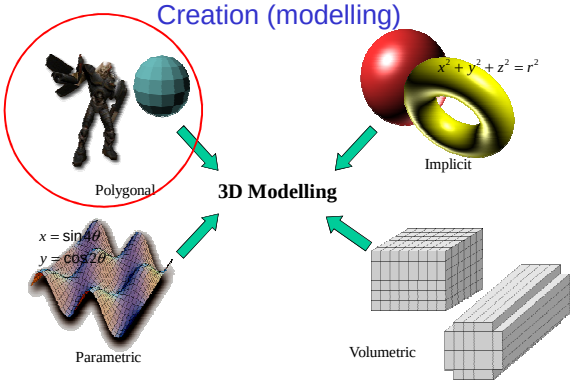
What is computer graphics?

Computer graphics is concerned

with the **creation** and **manipulation**

of **graphics images** by **computer**

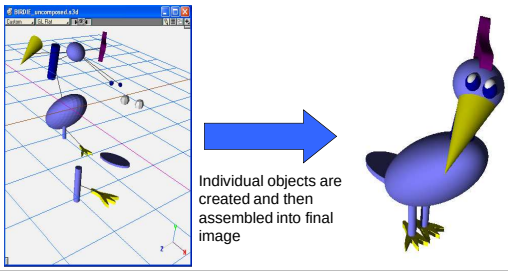
Creation (modelling)



3-dimensional graphics objects created in an abstract “object space”

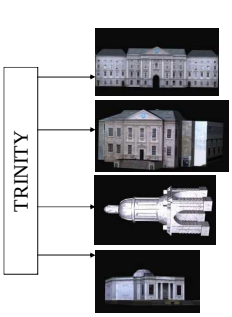
Manipulation

- Manipulation of abstract representations of objects and their parts



Individual objects are created and then assembled into final image

Manipulation



Individual object geometries are first modelled. These are then linked using positional / orientational relationships (via transforms)

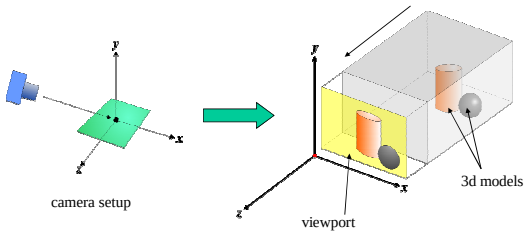
Manipulation

- Manipulation of graphics objects
  - Through interactive devices (user)
  - Application program (hard-wired)
  - Application program (AI techniques)
- Animation

Graphics images

- "Projections" of 3-dimensional graphics objects from an abstract object space to a computer screen
- Similar to taking a photograph
  - locate the object
  - compose a view
  - press the button to record the image on a 2D surface

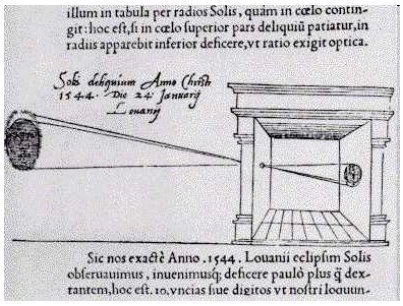
Graphics images: Viewing and Projection



Graphics images: Camera Positioning

Different views of a 3D model

Projection - a simulation of a simple "pinhole" camera



http://photo.net/learn/pinhole/frisius.htm

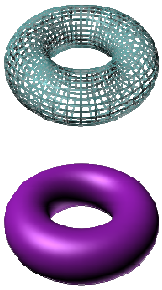
Graphics images: Projection

Representing three dimensions on two dimensional media

Graphics images: Rendering

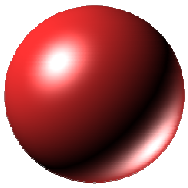
- Display of images on the screen
- Advanced rendering techniques
  - surfaces
  - colours
  - shading
  - textures

Graphics images: Rendering: Surfaces



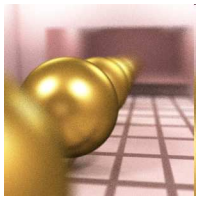
Furnish a 3D wireframe model with a surface

Graphics images: Rendering: Colours

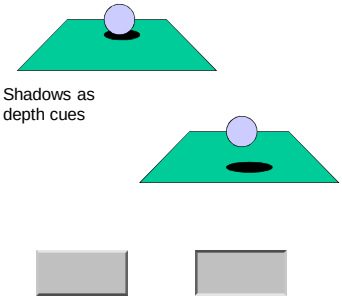


Light and shadow: colour of different parts of an object suggests its three - dimensional nature

Graphics images: Rendering: Depth Cues



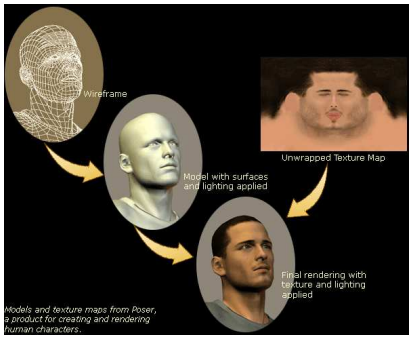
Perspective and Depth of Field



Shadows as depth cues

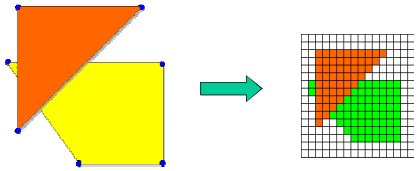
Highlight/Shadow

Graphics images: Rendering: Texture mapping



http://radoff.com/images/MMOAnatomy3.gif

Graphics images: Rendering: Rasterisation



Although the images are flattened to 2D, depth knowledge is required to order them correctly

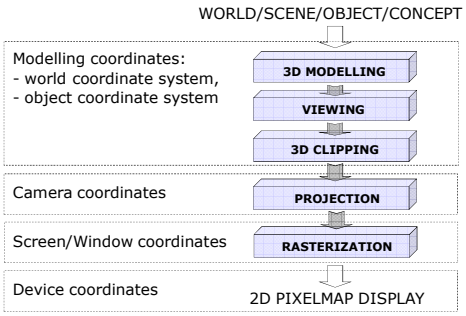
Computer

- Hardware and software components specifically designed for graphics
  - Memory
  - Interactive devices
  - Displays and hard-copy devices

Computer graphics

- **Creation and manipulation of graphics images by computer**
- Other areas of computing dealing with images
  - image processing
  - computer vision

3D graphics pipeline



3D Graphics Applications

- Games
- Entertainment
- Computer Assisted Drafting (CAD)
- Medicine
- Security
- Commerce

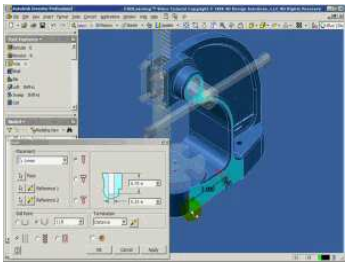
Games

- Most recognizable 3D application
- Requires a number of types of skills
  - Graphics
  - Physics
  - Sound
  - Artificial Intelligence (AI)
  - User Interface (UI)

Entertainment

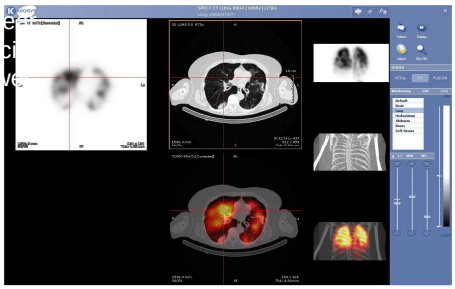
- Animated movies are a popular form of 3D entertainment
- Combines movement with 3D graphics
- Movement can be achieved through motion capture or avars
  - Motion capture – actual person or object performs movements with markers tracked by a video camera
  - Avar- Animation Variable - a variable that controls object movement

Computer Assisted Drafting / Design - CAD

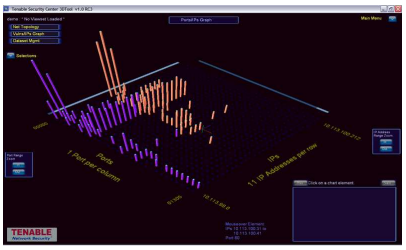


Tools used by engineers and designers to assist in design and documentation of new products

Medicine



Visualisation



3D graphic security tool that can help computer system administrators identify weaknesses in network security.

http://blog.tenablesecurity.com/2006/07/3d_tool_screens.html

Commerce

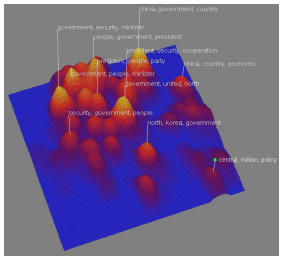
- Property
- Business Intelligence
- E-retail
- Maintenance, Training, Documentation

Property

3D graphics can be used by a a user to view a specific location in 3D. Note that the tool displayed here permits the user to navigate through a city in 3D but also has a 2D map displayed as a reference.

http://www.geosimcities.com/sol_RealEstate.htm

Business Intelligence



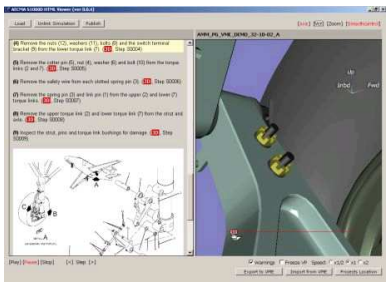
Business Intelligence is the collection of data, processed into information that managers can use to make business decisions. Displaying data in 3D helps decision makers gain insight into complex relationships.

E-Retail

http://www.virtualshowrooms.co.za

http://www.technicon.com/products_demos.html#cf

Maintenance, Training, Documentation



3D graphical application applied to a practical application of airplane maintenance, training and documentation

http://www.parallelgraphics.com

3D Graphics Benefits

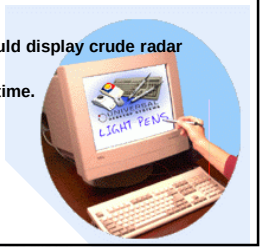
- Adds realism
- 3D images can help simplify complexity when displaying graphical relations
- User can manipulate object views for a full 360 degree perspective
- Adding a third dimension to data can improve pattern recognition and increase business decision speeds

History

- First use of computer graphics?

History

- 1950
  - **A CRT tube connected to a computer at MIT to investigate aircraft stability and control.**
- early 1950s
  - **SAGE air-defence system could display crude radar images.**
  - **A light pen used for the first time.**



Credits

- These slides contain material from the following sources:
  - isg.cs.tcd.ie/dingliaj/notes/MM112_7_Modelling.ppt
  - mcli.maricopa.edu/files/dvl/3D%20Graphics_v2009.ppt
  - http://hof.povray.org/