

Modelling and Animation COM3404

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<http://www.secamlocal.ex.ac.uk/studyres/COM304>

What and when

1	Introduction	Object modelling
2	Polygonal models	Polygonal models
3	Solid modelling & fractals	Splines and NURBS
4	Splines and NURBS	Lighting & shading
5	No lecture	Lighting & shading
6	Surface mapping	Ray tracing
7	Ray tracing	Radiosity
8	Radiosity	Animation
9	Animation	Animation

Christmas

10	Volume visualisation	Volume visualisation
11	Advanced lighting	Advanced techniques
11	Advanced techniques	Advanced techniques

Who and when

Lectures

Richard Everson

- Mondays, 2pm. Harrison 102.
- Wednesdays, 9am. Harrison 171.

Workshops

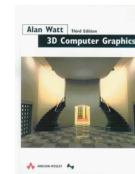
Dr Neil Sewell

- Fridays, 2-4pm in the Red Room.
- Workshops start Friday 12th October.

Assessment

- CA (30%). Exercises to write a short promotional film using Blender.
Set week 2; due week 11.
- Examination (70%).

Books



Watt,
3D Computer Graphics
Addison-Wesley, 1999.

O'Rourke

Principles of Three-Dimensional Computer Animation,
Norton. 2004



Foley, van Dam, Feiner, Hughes,
Computer Graphics: Principles and Practice,
Addison-Wesley. 1997.

Blender books



Rosendaal,
The Official Blender 2.3 Guide
No Starch Press, 2004.

Mullen
Introducing Character Animation with Blender,
Wiley, 2007.



Rosendaal,
The Essential Blender
No Starch Press, 2007.

More books

- Hearn & Baker
Computer Graphics. (Palgrave) 2001.
- E. Angel
Interactive Computer Graphics. (Addison-Wesley) 2003.
- M. Slater, A. Steed & Y. Chrysanthou
Computer Graphics and Virtual Environments. (Addison-Wesley) 2003
- A. Watt & F. Policarpo
3D Games: Animation and advanced real-time rendering.
(Addison-Wesley) 2003
- T. Strothotte and S. Schlechtweg
Non-photorealistic Computer Graphics: Modeling, Rendering and Animation (Morgan Kaufmann) 2002.

Examples: games



Examples: films



Examples: films



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Introduction

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Examples: films



Happy Feet – Warner Bros.

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Examples: architectural design



Hotel in Thailand: <http://www.3dplusstudio.com>

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Examples: architectural design



ING House: <http://www.cgarchitect.com>

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Examples: advertising



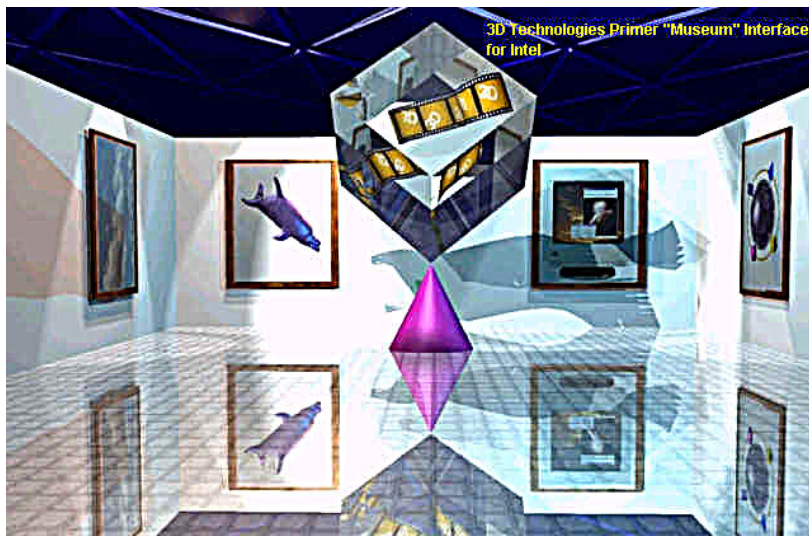
Chevrolet Vectra www.trexel.net

Examples: advertising



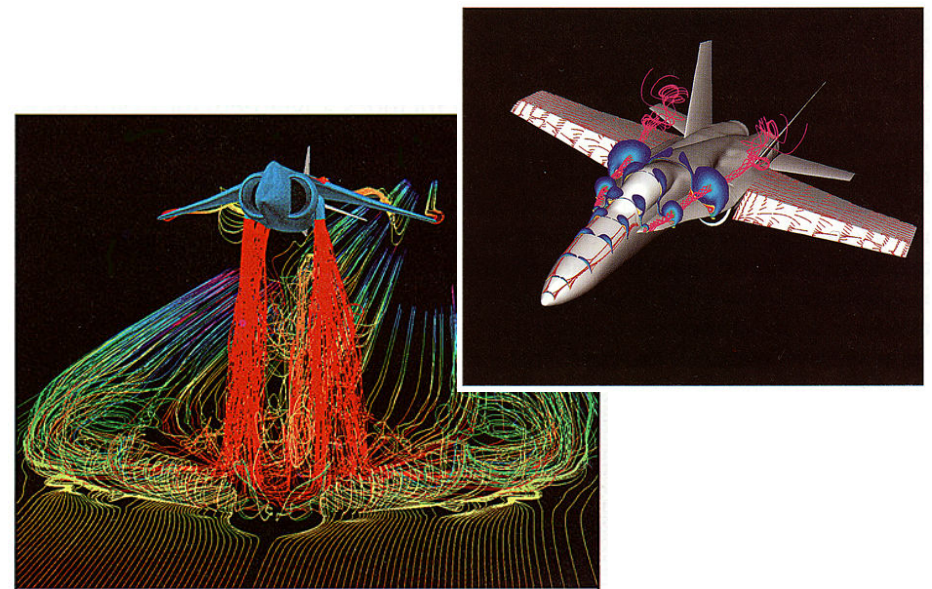
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Examples: interface design



3D Technologies Primer "Museum" Interface for Intel

Examples: Scientific visualisation



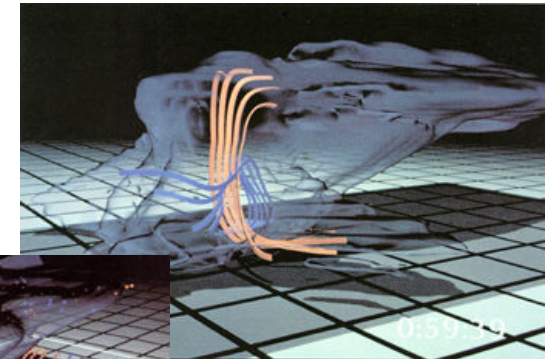
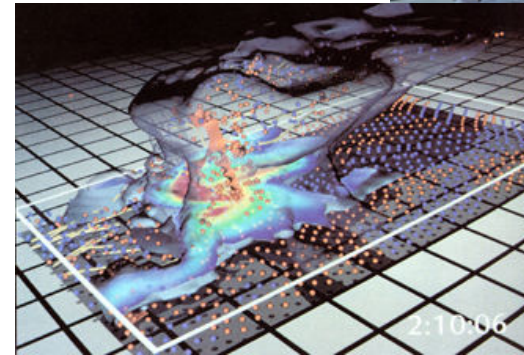
Surface and solid modelling



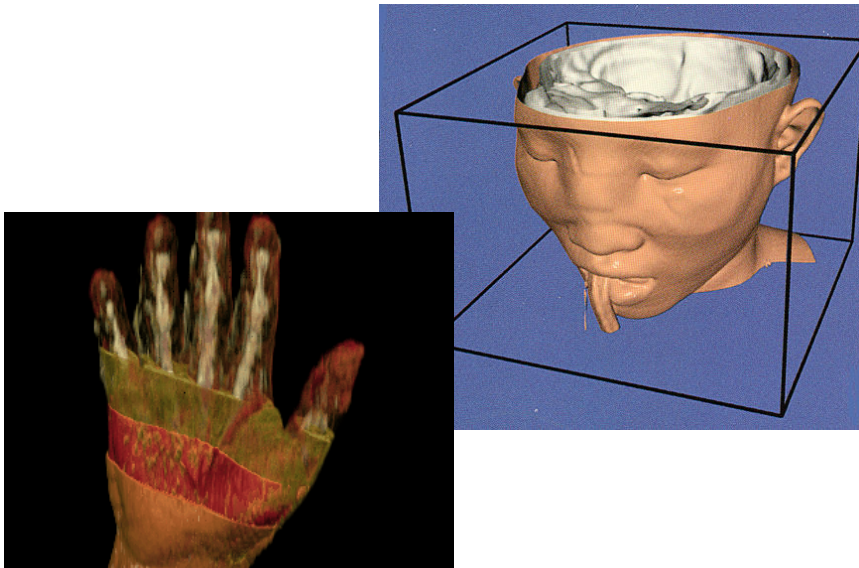
- Frequently natural to define objects in terms of surfaces
- Many phenomena to be visualised have values everywhere: visualisation defines surfaces from the global values.

Examples: Scientific visualisation

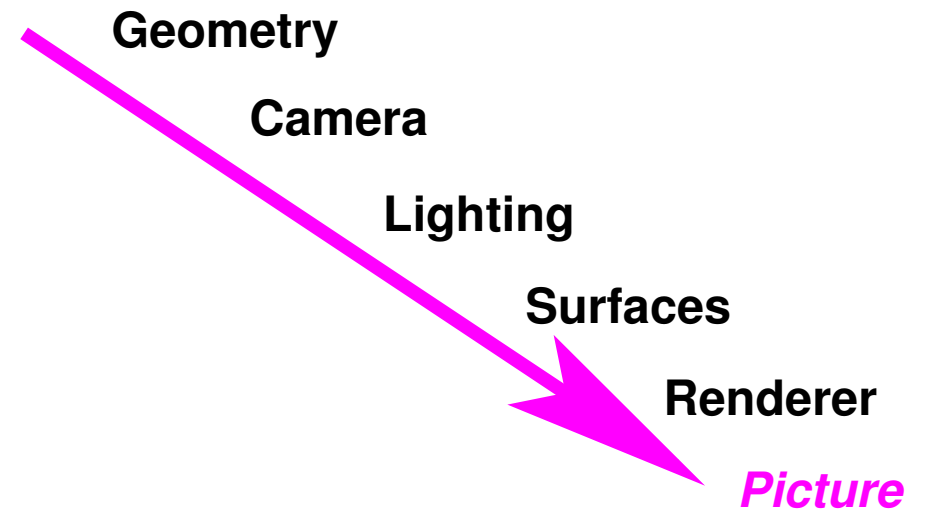
Thunderstorm simulation



Examples: Medical visualisation



Render pipeline



Geometry and object modelling

Polygonal modelling

Surfaces defined by facets

Geometric primitives

Simple primitives shapes: spheres, cylinders, blocks

Transformations

Translation, rotation, scaling, extrusion to construct complex objects

Curves and patches

Bezier, B-splines, NURBS.

Modelling hierarchies

Complex objects from simple

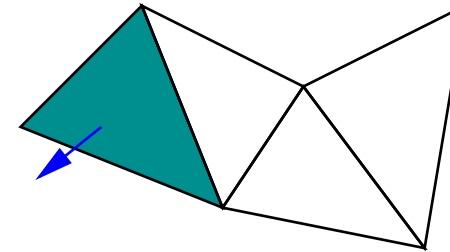
Boolean operations

Trimming, intersection, collision detection

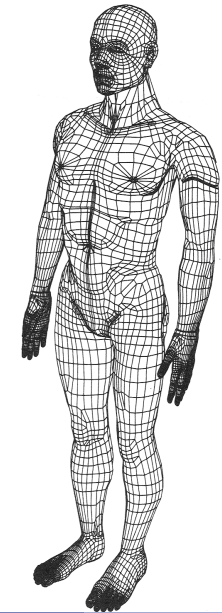
Fractal geometry

Rough, natural-looking surfaces

Polygon meshes



- Surfaces defined as a collection of *facets*
- Planar facets defined by *vertices*
- *Normal vector* points outward



Camera

Field of view

Depth of field

Perspective or orthographic

(Orthographic preserves dimensions)

Camera movement

- Panning – camera location fixed
- Tumbling (orbiting) – keeps object focus fixed
- Tracking
- Pitch, yaw and roll – rotation around x, y, z
- Dollying – Z axis movement

Perspective



Orthographic



Lighting

Type

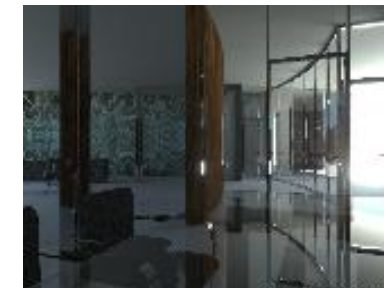
- Point (spot)
- Area
- Ambient
- Infinite (directional)

Intensity

Location

Colour

Parameters Spread, profile



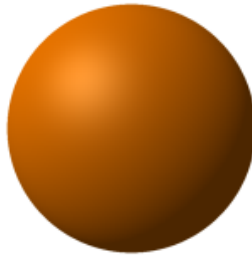
Surface modelling

Shaders

Texture mapping

Bump mapping

Smooth



Bumpy



Metal



Diffuse

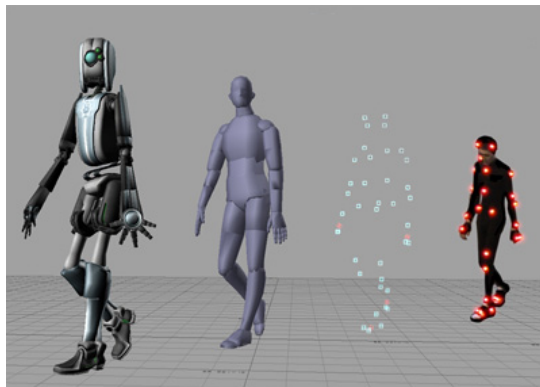


Glossy



Animation

- Key-framing
- Motion paths
- Hierarchical systems
- Forward and inverse kinematics
- Motion dynamics
- Motion capture
- Particle systems



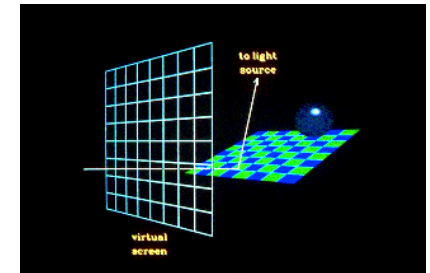
Rendering

Rendering

Producing a final two-dimensional picture from a 3D model

Fully modelling light interactions with all surfaces is computationally intractable

- Shading: local lighting model
- Ray tracing: follow individual rays from light source to viewer
- Radiosity: approximate global illumination in scene



5G pixels: <http://earth.imagico.de/5gp>



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