Introduction to Course & Maya

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About the course

- Computational approaches for producing:
  - 3D computer models and
  - 3D computer animations.
- NOT focusing on:
  - Production issues in the actual commercial exercise of producing a finished piece of animation.
  - Technical details of computer-assisted animation which primarily deals with only multiple 2D planes.

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Our Focus

- 3D Modeling + 3D computer animation + useful techniques to move objects in interesting ways
- A brief overview of the basic theory of animation or animation production issues
- General techniques and approaches used in computer-generated animation.

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Tools to be used

- Primary tool
  - Maya
- Secondary tools:
  - Production tools such as Adobe Premiere Pro, Final Cut Pro, Sony Vegas, etc. - primarily to put the rendered sequence of images together to build a movie.
  - Image manipulations tools such as Adobe Photoshop or GIMP - primarily for touch up, etc.
  - Sound tools such as Audacity, Cool Edit, etc. to manipulate or edit audio for incorporation in final movie.

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Modeling

- What is object modeling?
  - In traditional sense, it is a combination of Sculpting, Architecture, Drafting, and Painting.
- What is computer modeling?
  - Creating a representation of a shape in computer memory
  - The core component of computer animation.

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Modeling (contd.)

Modeling also includes:

- Shading / Texturing
  - Process of assigning surface characteristics to the object. It includes:
    - color, specular highlights, luminance, diffuse, etc.
  - Tactile characteristics like bumps.
- Lighting:
  - Illuminating a scene to create different effects
- Rendering
  - taking an object or a scene made using a computer program and changing it so that it can be viewed without any interpolation.

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What is animation?

- 'animate' == 'to give life to'.
- Moving something, which cannot move by itself.
- Adds to graphics the dimension of time which vastly increases the amount of information which can be transmitted.
- The animator should be able to specify, either directly or indirectly, how 'thing' is moved through time and space.

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Computer Animation

- Computer Animation ➔ using computers
- Techniques:
  - "artistic" animation
    - key frames & interpolation, motion path, driven-key
  - data-driven animation - mocap
  - procedural animation - physics, behavioral

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Animation Categories

- Computer-Assisted Animation
- Computer-Generated Animation

- Computer-Assisted Animation
  - 2D and 2 ½ D systems that computerize the traditional hand-drawn animation process.
  - Algorithmic uses:
    - Interpolation between key shapes
    - Inking
    - virtual camera stand
    - shuffling paper
    - managing data

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Computer-Generated Animation

- Motion specification:
  - low level techniques (techniques that aid the animator in precisely specifying motion)
    - Shape interpolation (in-between)
    - Need to know what you want.

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Computer-Generated Animation

- Motion specification (contd.):
  - high level techniques (techniques used to describe general motion behavior)
    - Generate motion with some set of rules
    - The animator sets up the rules of the model or chooses an appropriate algorithm and selects initial values and/or the boundary values.
  - The motion of the objects is controlled by the algorithm or model.
    - Fairly sophisticated computation
    - Physically based animations.

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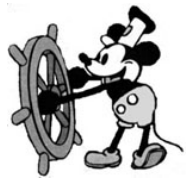
Disney: Animation as an art form

- Innovations
  - Story board to review story
  - Pencil sketch to review motion
  - Multi-plane camera stand
  - Color (not first to use color)
  - Sound!
    - Steamboat Willie (1928)



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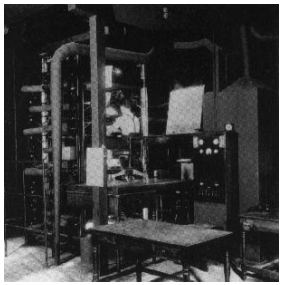
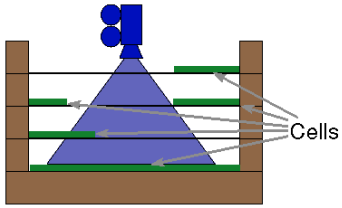
Multiplane Camera

- Move scene layers independently of camera





http://www.geocities.com/SunsetStrip/Club/9199/Animation/Disney_Multiplane.html

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Storyboard

- The film in the outline form
  - specify the key scenes
  - specify the camera moves and edits
  - specify character gross motion
- Typically paper and pencil sketches of individual
- Sheets taped on a wall/table …
- Still not very many computers…

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Storyboard

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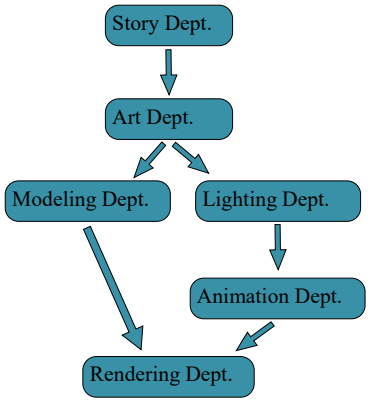
Computer Animation Production Tasks



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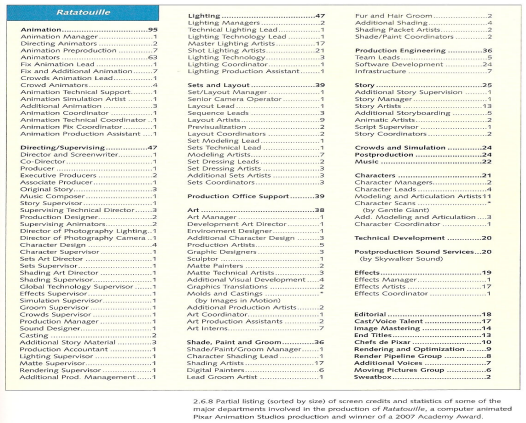

Ratatouille

Animation 95	**Lighting** 47	Fur and Hair Groom 2
Animation Manager 1	Lighting Managers 2	Additional Shading 4
Directing Animators 2	Technical Lighting Lead 1	Shading Packet Artists 2
Animation Preproduction 7	Lighting Technology Lead 1	Shade/Paint Coordinators 2
Animators 60	Master Lighting Artists 17	
Fix Animation Lead 1	Shot Lighting Artists 21	**Production Engineering** 36
Fix and Additional Animation 7	Lighting Technologist 3	Team Leads 5
Crowds Animation Lead 1	Lighting Coordinator 1	Software Development 24
Crowd Animators 4	Lighting Production Assistant 1	Infrastructure 7
Animation Technical Support 1		
Animation Simulation Artist 1	**Sets and Layout** 39	**Story** 35
Additional Animation 3	Set/Layout Manager 1	Additional Story Supervision 1
Animation Coordinator 1	Senior Camera Operator 1	Story Manager 1
Animation Technical Coordinator 1	Layout Lead 1	Story Artists 13
Animation Pix Coordinator 1	Sequence Leads 3	Additional Storyboarding 5
Animation Production Assistant 1	Layout Artists 9	Animatic Artists 2
	Previsualization 2	Script Supervisor 1
Directing/Supervising 47	Layout Coordinators 2	Story Coordinators 2
Director and Screenwriter 1	Set Modeling Lead 1	
Co-Director 1	Sets Technical Lead 1	**Crowds and Simulation** 24
Producer 1	Modeling Artists 7	**Postproduction** 24
Executive Producers 2	Set Dressing Leads 2	**Music** 22
Associate Producer 1	Set Dressing Artists 3	
Original Story 3	Additional Sets Artists 3	**Characters** 21
Music Composer 1	Sets Coordinators 3	Character Managers 2
Story Supervisor 1		Character Leads 4
Supervising Technical Director 3	**Production Office Support** 39	Modeling and Articulation Artists 11
Production Designer 2		Character Scans ..... *
Supervising Animators 2	**Art** 38	(by Gentle Giant)
Director of Photography: Lighting 1	Art Manager 1	Add. Modeling and Articulation 3
Director of Photography: Camera 1	Development Art Director 1	Character Coordinator 1
Character Design 4	Environment Designer 1	
Character Supervisor 1	Additional Character Design 3	**Technical Development** 20
Sets Art Director 1	Production Artists 5	
Sets Supervisor 1	Graphic Designers 3	**Postproduction Sound Services** 20
Shading Art Director 1	Sculptor 1	(by Skywalker Sound)
Shading Supervisor 1	Matte Painters 2	
Global Technology Supervisor 1	Matte Technical Artists 3	**Effects** 19
Effects Supervisor 1	Additional Visual Development 4	Effects Manager 1
Simulation Supervisor 1	Graphics Translations 2	Effects Artists 17
Groom Supervisor 1	Molds and Castings ..... *	Effects Coordinator 1
Crowds Supervisor 1	(by Images in Motion)	
Production Manager 1	Additional Production Artists 2	**Editorial** 18
Sound Designer 1	Art Coordinator 1	**Cast/Voice Talent** 17
Casting 2	Art Production Assistants 2	**Image Mastering** 14
Additional Story Material 3	Art Interns 7	**End Titles** 13
Production Accountant 1		**Chefs de Pixar** 10
Lighting Supervisor 1	**Shade, Paint and Groom** 36	**Rendering and Optimization** 9
Matte Supervisor 1	Shade/Paint/Groom Manager 1	**Render Pipeline Group** 8
Rendering Supervisor 1	Character Shading Lead 1	**Additional Voices** 7
Additional Prod. Management 1	Shading Artists 17	**Moving Pictures Group** 6
	Digital Painters 6	**Sweatbox** 2
	Lead Groom Artist 1	

2.6.8 Partial listing (sorted by size) of screen credits and statistics of some of the major departments involved in the production of *Ratatouille*, a computer animated Pixar Animation Studios production and winner of a 2007 Academy Award.

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Jobs

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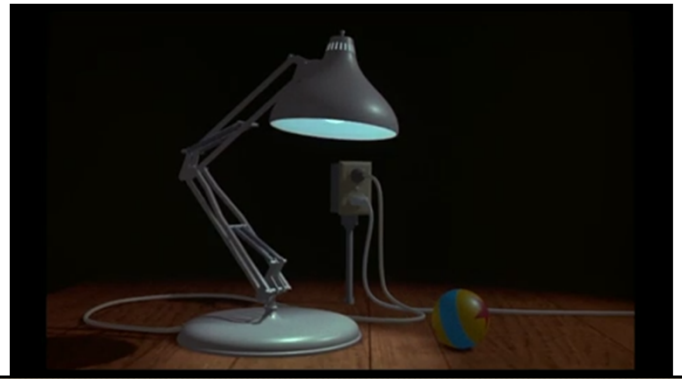
Animations that paved the way

- Luxo Jr. (1986 - Pixar): 1st computer animation to be nominated for an Academy Award



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Animations that paved the way

- Red's Dream (1987)

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Animations that paved the way

- Tin Toy (1988) - first computer animation to win an Academy Award

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Animations that paved the way

- Knick Knack (1989)

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Some Animation Studios/Companies

- Pixar
- Disney
- Sony Pictures
- Industrial Light and Magic (ILM)
- Pacific Data Images (PDI)
- Xaos
- Rhythm & Hues
- Digital Domain
- Boss Film Studios
- Blue Sky Productions
- Cinesite
- Lamb & Company
- Metrolight Studios
- Imageworks
- …

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What is Maya?

- Maya is a 3D modeling animation and rendering software.
  - A package used by artists to make 3D models and animations
  - Many of the world's leading films, TV programs, and commercials feature Maya-created 3D animations.
    - *South Park, Twister* and *Stuart Little, Avatar, Finding Nimo, UP, Monster, Frozen, etc.*

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Maya's Strengths

- 3D Modeling
- 3D Character Animation
- Film and television special effects
  - Lighting, explosion, simulating liquids & gases
- Particle and object dynamics simulations
- 3D Game Animation
- 3D Painting
- 3D Rendering

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How to obtain Maya?

- Maya – a commercial software.
- Free for educational community.
  - Need to register as a student.
  - Download and install.
  - Most of the basic work can be done on regular laptops/desktop computers.
  - Rendering requires good GPU capabilities.

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Maya Terminology

- Scene – the entire scene, what you are animating. Your work gets stored in a scene file.
  - ASCII or binary
- Project – a way to collect resources together, including multiple scene files.
- The Dependency Graph/Scene Graph
- Attributes
  - a position associated with a node that can hold a value or a connection to another node
- Nodes

Maya is built around nodes (a collection of entities/attributes/values)

- Transform Node - how the object is moved, rotated, and scaled
- Shape Node - stores the positions of the spheres control points
- Input Node – contain input attributes, e.g., for circle, radius, center

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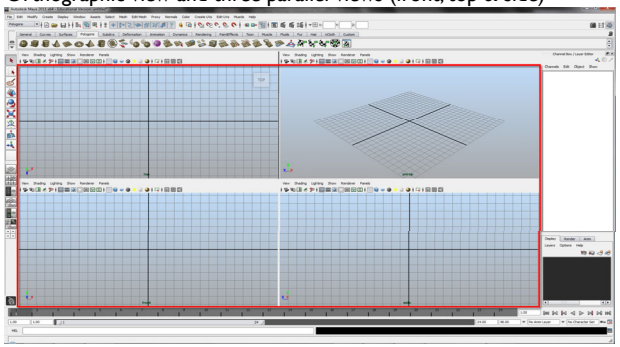
Maya - Layout

Panels display a view of the scene

Orthographic view and three parallel views (front, top & side)



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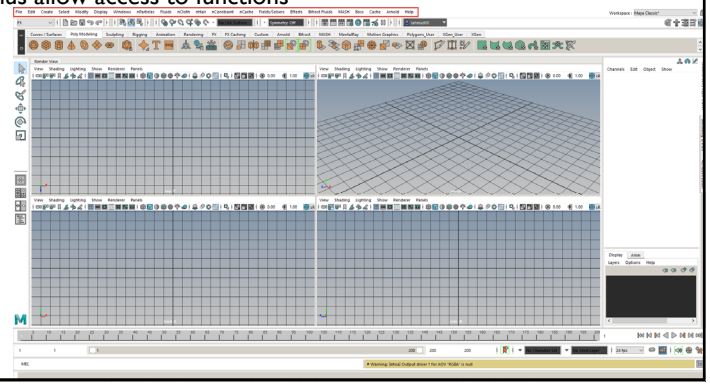
Maya - Layout

Menus allow access to functions



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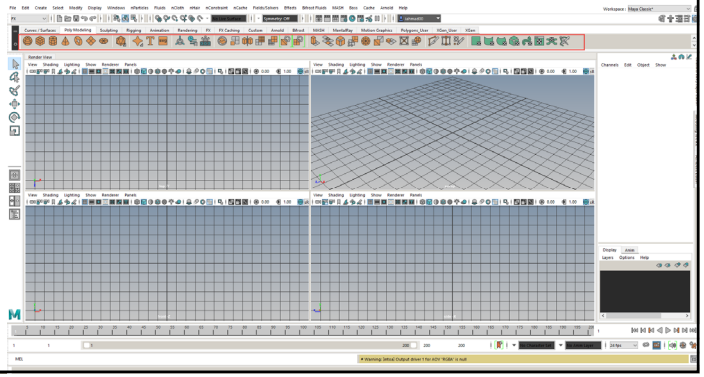
Maya - Layout

Shelves allow access to functions



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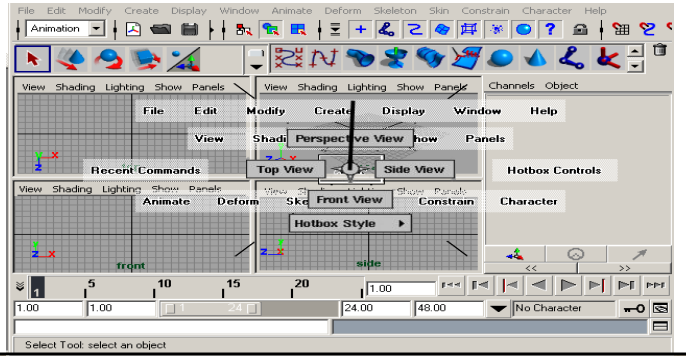
Maya - Layout

Marking menus allow quick, directional access



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Maya Dependency Graph

- The Dependency Graph/Scene Graph
  - Nodes
  - Attributes
  - Transform Node
  - Shape Node
  - Input Node

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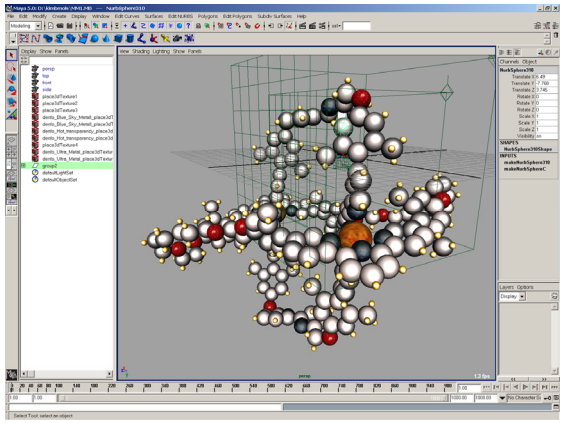

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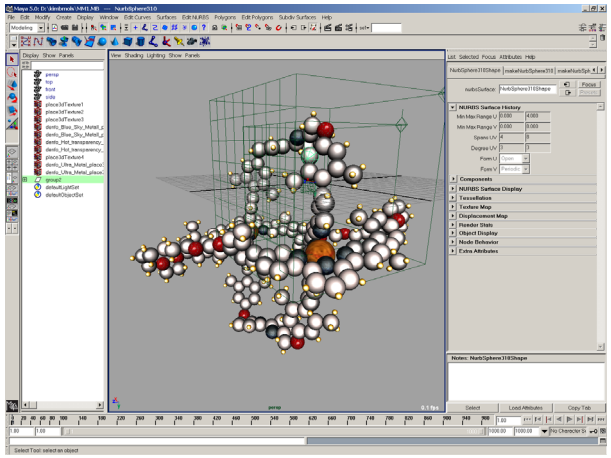

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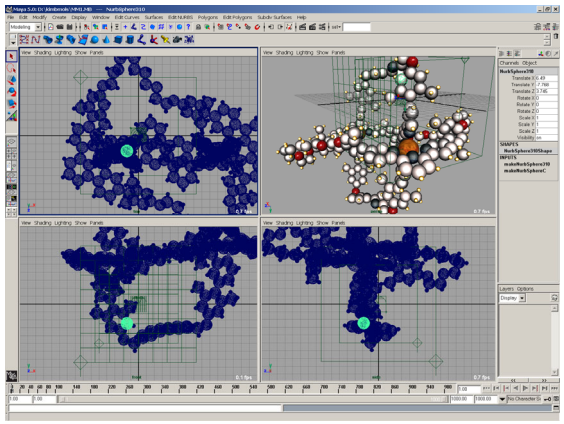

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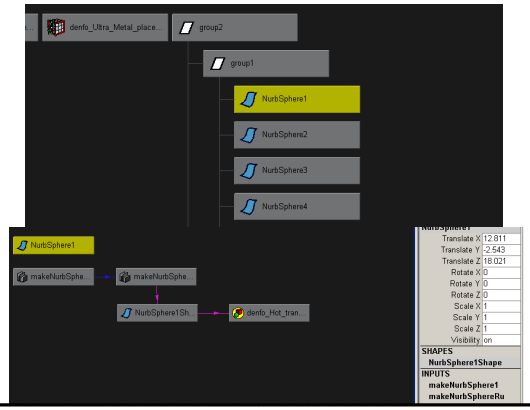
Maya Dependency Graph



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Important Dependency Graph Nodes

- Transform Nodes – Store location information.
- Shape Nodes – hold geometry information.
- Input Nodes – hold information that "drives" other node attributes, e.g., makeSphereNode has radius information.
- Material Nodes – hold coloring information.

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