**Animation / Interaction**

### Lecture 15

**Hand Animation**

- Physics Driven Animation

**Goal Driven Animation**

**Historical Development**

**Scripting Systems**

- Luxo animated by John Lasseter used the new 3-D computer graphics and applied the well known principles of traditional animation.

- **Squash and Stretch** — which emphasizes the rigidity and the mass of an object by distorting it as a function of certain actions.

- **Secondary Action** — the action of an object resulting from another action.

- ** Appeal** — creating a design or action that the audience enjoys watching.

**Synopsis**

- Grounded in the basics of traditional cel animation, Digital Character Animation provides the essential information needed to create convincing computer-generated characters in 2D and 3D, applying conventional character animation techniques such as walk cycles and lip sync to computer animation. Through carefully designed case studies, this book teaches you how to create characters that audiences enjoy watching and brings your characters to life.

- The book includes tools and techniques that are commonly used in all major animation programs.

- Digital Character Animation ensures that your skills will be applicable no matter what the job!
Control Hierarchy

To animate just one rigid object with 6 degrees of freedom over 5 seconds, at 30 frames per second, requires 9000 numbers.

Blobby man had 23 rotational degrees of freedom plus the 6 degrees from above create a major animation task.

The purpose of control hierarchy is to reduce these numbers and provide the artist with tools that relate to his method of thinking.

Places like PIXAR build tools that allow their animators to work in a natural way.

• Procedural animation: control over motion specifications is achieved through the use of procedures. Like those talked about in the texturing lecture.

• Representational animation: Extends the field of animation beyond that of specifying how a rigid object is to move in space by allowing the object itself to change shape and by animating the shape change.

• Representational animation (continued)
  This is generally broken into two subsections
  • The animation of articulated objects
  • Soft object animation

• Stochastic animation
  Use stochastic processes to generate large amounts of low level detail. Particle systems use this.

• Behavioral animation
  Define how objects behave or interact with their environments. Bird flocking is an example of this.

Motion Control:

• Keyframing:
  This system takes its name from the traditional hierarchical production system first developed by Walt Disney.
  Carefully set up key frames and then interpolate between them.

• Spline-driven animation:
  This method uses splines to control position, velocity, and acceleration.
  It can also control color, transparency, and any other things you can think of.

Soft Object Animation:

• Soft object animation extends the degrees of freedom by allowing shapes to distort to highlight dynamic action.

• This type of animation blurs the traditional distinction between modeling and animation.

• What ever method is use to perform soft object animation two separate processes can be identified:
  • The method or mechanism that allows the objects to be deformed
  • The method that animates the nature of the deformation as a function of time

• The two may or may not be separable depending on the particular method used.
Deformation and Representation:
- The modeling method or representation places restrictions on the nature and extent of possible deformations.

Deforming a Polyhedral Object
- Vertices in a polygon mesh cannot be treated as a set of independent particles because they have an implicit connectivity that must be respected by the deformation process.
- Polygonal resolution can create problems.
- This can sometimes be overcome by subdividing polygons.

Deformation and Representation:
- Deforming a parametric object
  - The major advantage of the parametric representation is that complex deformations still result in smooth and continuous surfaces.
  - Deformations cannot be localized unless the parametric surface is subdivided.
  - Deforming parametric surfaces to a specific shape can be difficult.
  - The main restriction for parametric surfaces arises from the properties of the basis functions used to maintain continuity across patches.

Procedural Animation:
- In its most basic form, procedural animation means building an object and then using a process to control or animate some attribute of the object.
- This is where computer graphics comes into its own.
- It can involve shape change, but in this case it controls the process.

Examples:
- Particle set animations:
  - Genesis Planet
  - Andre’ and Wally Bee Forest and Grass
- Behavioral animations:
  - Bird or Fish Flocking
- Analytical animations:
  - Animating the shape and reaction of cloth
  - Water waves
  - Animal movements