Procedural Techniques for Interactive CG
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What do I mean by a “procedural technique?”

• Any description that is not explicit
  – triangle meshes are explicit
  – motion capture animation is explicit

• Procedural techniques
  – modify a description via an algorithm
  – change with the state of the simulation
  – are calculated on the fly
PROS of Procedural Techniques

- Interactivity
- Scalability
- Variety
- Cost
- Storage and bandwidth
CONS of Procedural Techniques

- Not suited to everything
- Not as good as Art and Capture
  - (in a fixed situation)
- Can use lots of processor power
- Can be complex and unpredictable
Modeling with Procedural Techniques

- Generally Good For
  - Plants
  - Terrain
  - Biological forms

- Generally Bad For
  - man made objects
  - precise representation
Animation with Procedural Techniques

- The goal is interaction
- Simulating the Physical World
  - dynamics, cloth, fluids, smoke, fire, fracture
- Modified Animation
  - I.K. , motion blending etc.
- Behavior and Autonomous Characters
- Controllers
Modified Animation

• Using key frame artist generated or motion capture data as basis
  – interactivity requires procedural modification of the animation
  – motion blending
  – inverse kinematics
  – physical modeling
Physical Simulation

• Makes interaction look real
• Computationally very intensive
• Difficult to make robust
• Can be inconsistent in performance
• Lots of research still to be done!
Autonomous Characters

- The goal is life like character behavior
- Simple scripting and FSM
- Cognitive modeling
- Steering behaviors and path finding
- Learning algorithms
  - neural nets, genetic algorithms
  - off line vs. real time learning
Controllers

- Where behavior meets physics
  - How an ‘action’ becomes a ‘motion’
  - “Walk Forward” through an arbitrary environment
  - Avoid obstacles, balance
  - Look natural
Examples

• Lifeforms :- Latham and Todd
  – an example of procedural modeling

• Bird-Fish-Mouse
  – autonomous characters
  – modified animation
  – procedural water