Computer Animation
Luiz Velho
IMPA – Instituto de Matemática Pura e Aplicada

Outline
• Wireframe Animation
• Motion Graphics
• Procedural Animation
• Motion Capture
• Facial Animation
• Ray Tracing
• Blobby Shapes
• 3D Cartoon Shading

Wireframe Animation
• My First Steps (1976-1979)
  Newman and Sproull, 1973
  "Principles of Interactive Computer Graphics"
  – Plotter
  – IBM 1130
  – Fortran
• Undergraduate Final Project - ESDI, 1979
  First Computer Generated Film Made in Brazil
  – Simple Graphics Package
  – Plotted Frame-by-Frame
  – Shot on Animation Stand

“A Imagem no Computador”

Motion Control
Montreal, 1981-1982
• National Film Board
  – Brazil / Canada Cooperation
  – French Animation Group (La Faim)
• Computer Controlled Animation
  – Oxberry 35 mm Animation Stand
  – Motion Control Computer
• Graphics Experiments

“Graphisms”
• NFB, 1982
Procedural Animation System

MS. MIT Media Lab 1984

• Animation Abstractions
  – Scripts / Tracks

• System Architecture
  – Extension Language
  – Multiple Windows (X11)

• Different Levels
  – Authoring
  – Interaction

“Scripts”

• (inverse kinematics, forward dynamics, collision detection)
  MIT Media Lab, 1984 - with David Zeltzer

Motion Capture

MS. UFRJ, 1998
(supervisor of Fernando Wagner)

• MOCAP Animation System
  – Intuitive Interface
  – Signal Processing Approach

• Thesis Award
  – XII CTD - SBC, 1999
  – VI CLEI - UNESCO, 1999

• paper SIBGRAPI, 1997

“Animação por Movimento Capturado”

Facial Animation

MS. PUC-Rio, 2002
(supervisor of Paula Lucena)

• Real-Time Facial Animation
  – Lip Synch + Facial Expressions
  – Annotated Text Input
  – Client / Server JAVA Implementation

• Potential Applications
  – Internet, Entertainment
  – Education, Tele-Collaboration

• Collaboration with Ken Perlin

• paper WTDCGPI, 2002

“Expressive Talking Heads”
“Expressive Talking Heads”

The Ultimate Renderer

Fantastic Animation Machine, 1985

- Designed the “in-house” 3D System
  - Modeler
  - Renderer (It’s all about the look…)
  - Animation

- Multi-modal Visualization
  - Wire / Hidden Line
  - A-Buffer, Phong Shading
  - Distributed Ray Tracing
  - Texturing, Special Effects

“F.A.M. Demo”

2D Texturing Implicit Objects

IMPA, 1995

(joint work with Zonenschein, Figueiredo, Wyvill)

- Texture Mapping Implicit Surfaces
  - 3D textures: Trivial, (Embedding Space)
  - 2D textures: Hard, (Lack of Natural Parameterization)

- Extrinsic Projection Method
  - Transfer Texture from a Canonical Space
  - “Natural” Projection, i.e. Blended Gradient Field
  - Physically-Inspired: ODE, Particle System

“Textura com Sistema de Partículas”

Piecewise Implicit Objects

PhD. University of Toronto, 1994

(advisor: Demetri Terzopoulos)

Complete Modeling Framework (Decomposition + Adaptation)

- Smooth Implicit Model
  - Multiscale Edge Analysis / Synthesis

- Hierarchical Implicit Representation
  - Multiscale B-Spline Basis

- Adapted Simplicial Decomposition
  - Physics-Based Simulation

- Paper SIBGRAPI, 1998

* ACM-SIGGRAPH Electronic Theater, 1986

* SIBGRAPI Video Show, 1997

“Blobby Bubbles – TV Globo”

*SIBGRAPI Video Show, 1997*

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3D Shading for Cartoon Animation

- Ms. PUC-Rio (supervisor of Hedlena Almeida)

"Lumo: Illumination for cel Animation", S.F. Johnston

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Pipeline

- Digitalização
- Entrada
- Thinning
- Chain code
- Normais
- Direção
- Normalizações
- Flood Fill
- Interpolação
- Contorno

Questions?