Point-Based Computer Graphics

Eurographics 2002 Tutorial T6

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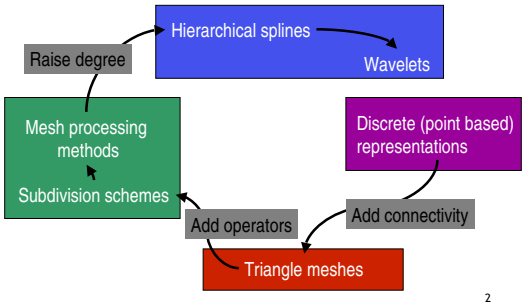
Surf. Reps. for Graphics



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Polynomials...

- ✓ Rigorous mathematical concept
- ✓ Robust evaluation of geometric entities
- ✓ Shape control for smooth shapes
- ✓ Advanced physically-based modeling
- × Require parameterization
- × Discontinuity modeling
- × Topological flexibility

Refine h rather than p !

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Polynomials -> Triangles

- Piecewise linear approximations
- Irregular sampling of the surface
- Forget about parameterization

Triangle meshes

- Multiresolution modeling
- Compression
- Geometric signal processing

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Triangles...

- ✓ Simple and efficient representation
- ✓ Hardware pipelines support Δ
- ✓ Advanced geometric processing is being in sight
- ✓ The widely accepted queen of graphics primitives
- × Sophisticated modeling is difficult
- × (Local) parameterizations still needed
- × Complex LOD management
- × Compression and streaming is highly non-trivial

Remove connectivity !

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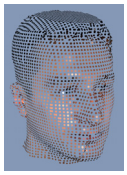
Triangles -> Points

- From piecewise linear functions to Delta distributions
- Forget about connectivity

Point clouds



- Points are natural representations within 3D acquisition systems
- Meshes provide an artificial enhancement of the acquired point samples

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History of Points in Graphics

- Particle systems [Reeves 1983]
- Points as a display primitive [Whitted, Levoy 1985]
- Oriented particles [Szeliski, Tonnesen 1992]
- Particles and implicit surfaces [Witkin, Heckbert 1994]
- Digital Michelangelo [Levoy et al. 2000]
- Image based visual hulls [Matusik 2000]
- Surfels [Pfister et al. 2000]
- QSplat [Rusinkiewicz, Levoy 2000]
- Point set surfaces [Alexa et al. 2001]
- Radial basis functions [Carr et al. 2001]
- Surface splatting [Zwicker et al. 2001]
- Randomized z-buffer [Wand et al. 2001]
- Sampling [Stamminger, Drettakis 2001]
- Opacity hulls [Matusik et al. 2002]
- Pointshop3D [Zwicker, Pauly, Knoll, Gross 2002]...?

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The Purpose of our Course is …

I) …to introduce points as a versatile and powerful graphics primitive

II) …to present state of the art concepts for acquisition, representation, processing and rendering of point sampled geometry

III) …to stimulate YOU to help us to further develop Point Based Graphics

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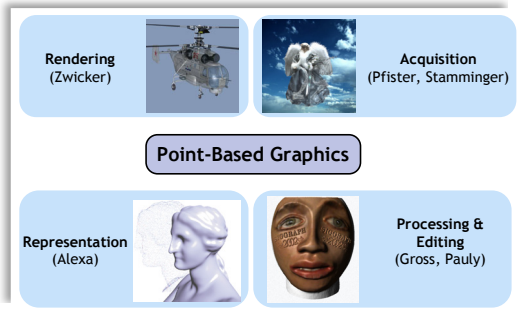
Taxonomy



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Morning Schedule

8:30-8:45	Introduction (M. Gross)
8:45-9:45	Point Rendering (M. Zwicker)
9:45-10:00	Acquisition of Point-Sampled Geometry and Appearance I (H. Pfister)
10:00-10:30	Coffee Break
10:30-11:15	Acquisition of Point-Sampled Geometry and Appearance II (H. Pfister)
11:15-12:00	Dynamic Point Sampling (M. Stamminger)

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Afternoon Schedule

14:00-15:00	Point-Based Surface Representations (M. Alexa)
15:00-15:30	Spectral Processing of Point-Sampled Geometry (M. Gross)
15:30-16:00	Coffee Break
16:00-16:30	Efficient Simplification of Point-Sampled Geometry (M. Pauly)
16:30-17:15	Pointshop3D: An Interactive System for Point-Based Surface Editing (M. Pauly)
17:15-17:30	Discussion (all)

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