

计算机影视特效技术

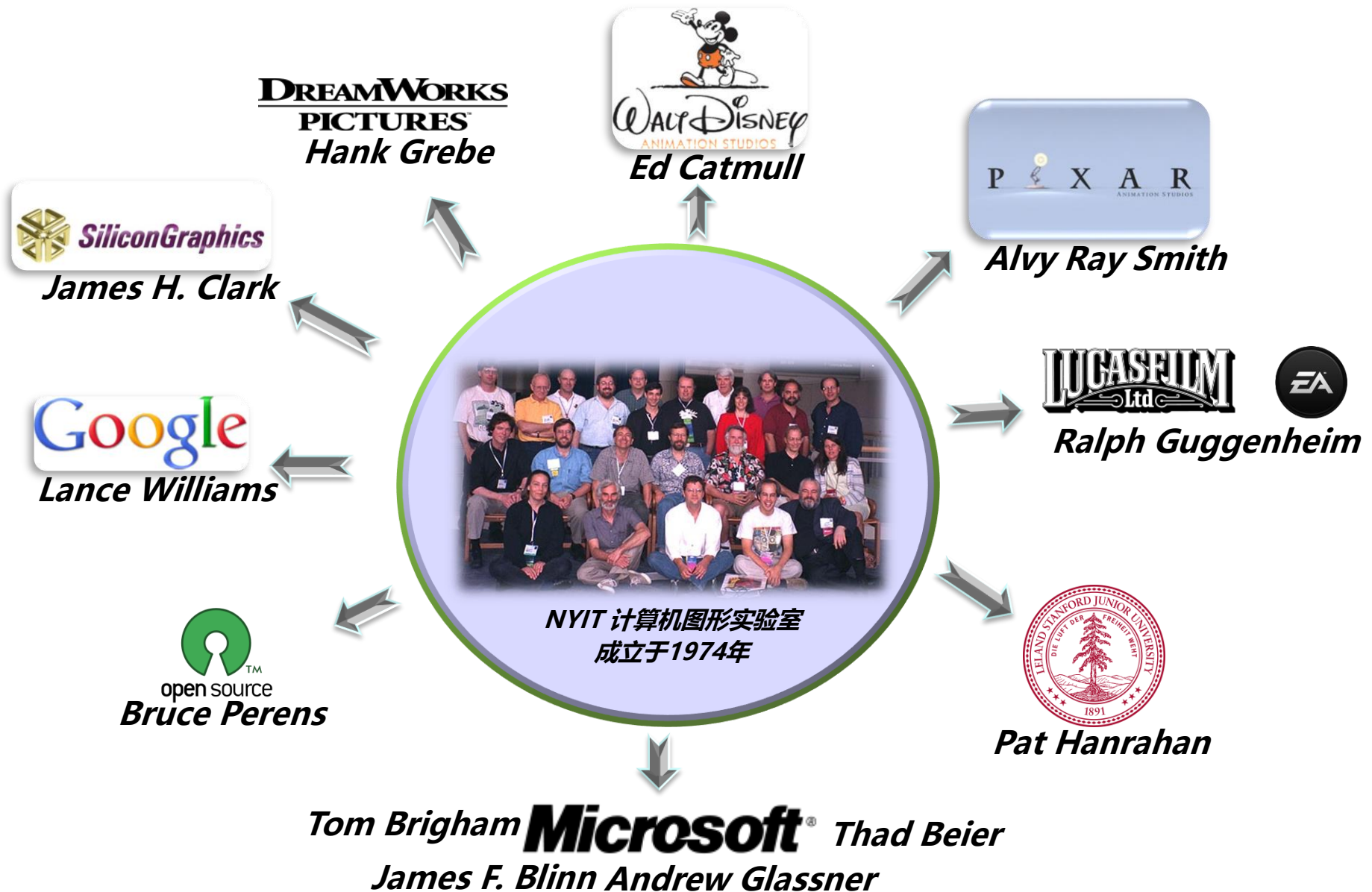
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NYIT – 图形学摇篮



Traditional Graphics



Sunday Afternoon on La Grande Jatte, by Seurat

Computer Graphics



Computer Graphics Applications

Computer Aided Design (CAD), CAM



Image generated by Marc Olano, et al.

Computer Graphics Applications

Movies



Computer Graphics Applications

Games







Computer Graphics Applications

Battlefield Visualization



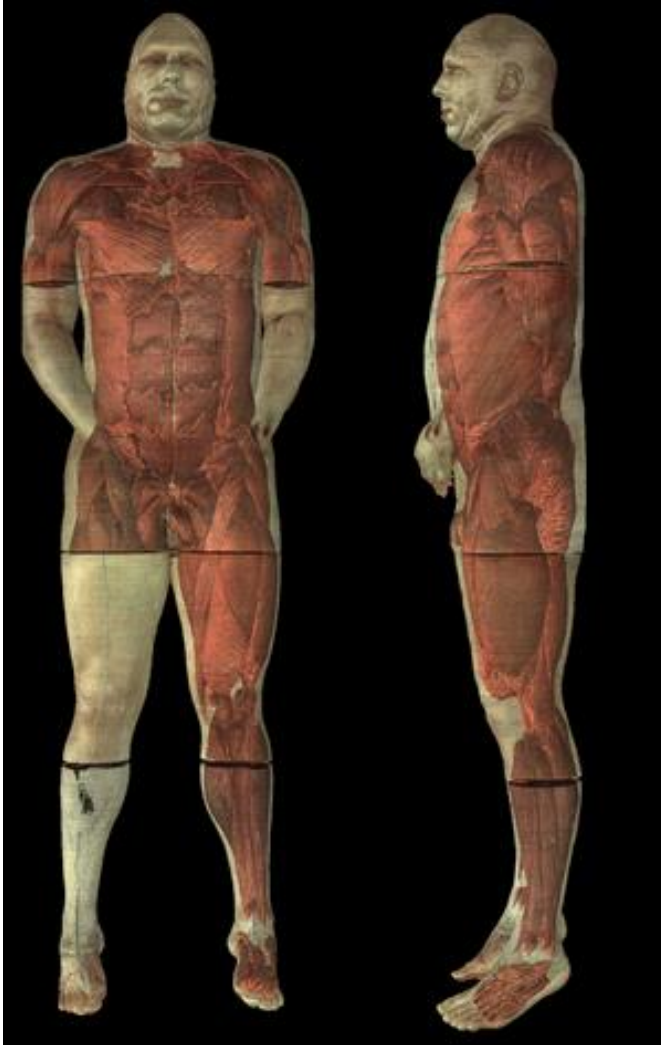
Computer Graphics Applications

Battlefield Visualization



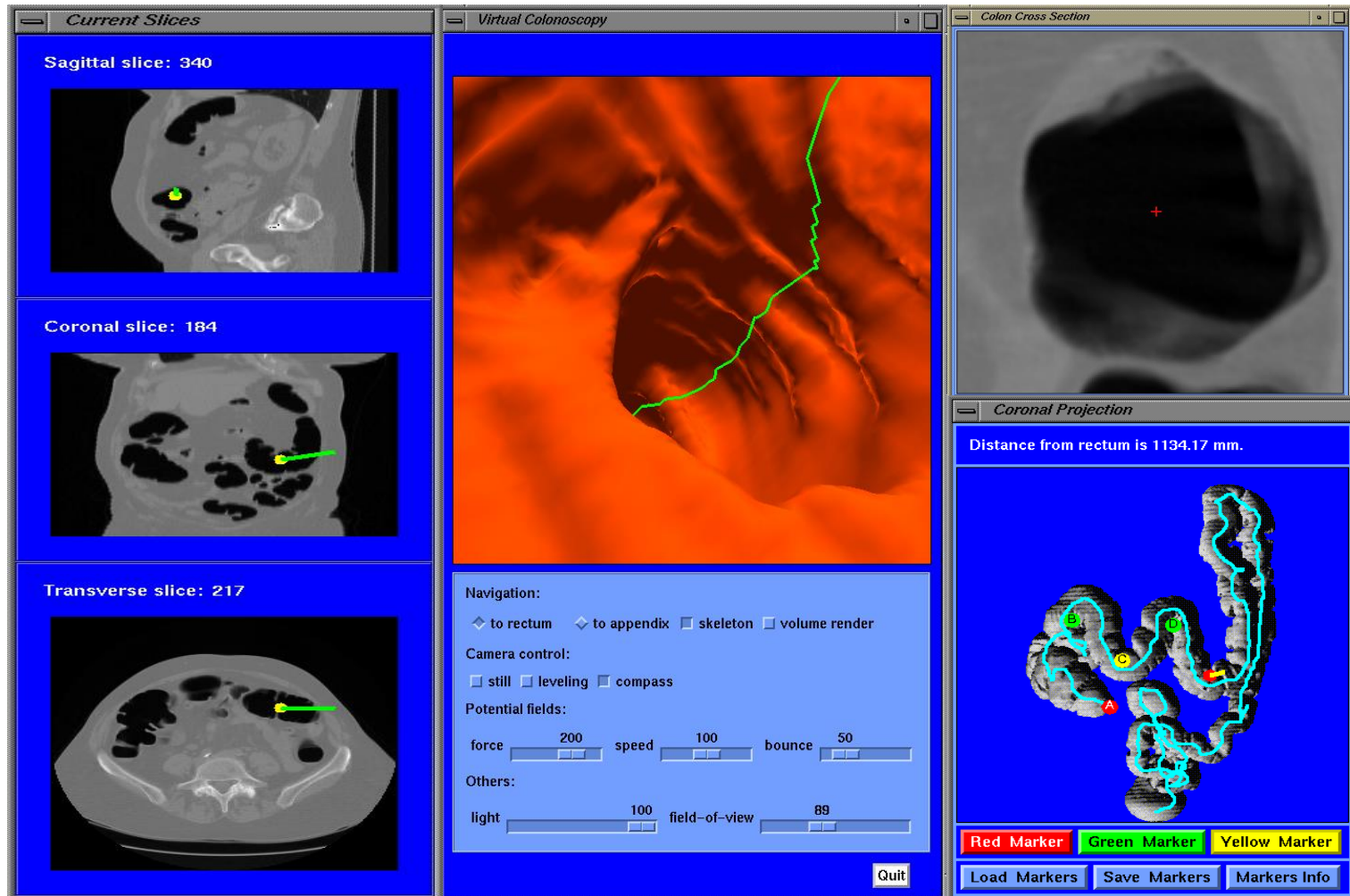
Computer Graphics Applications

Medical Visualization



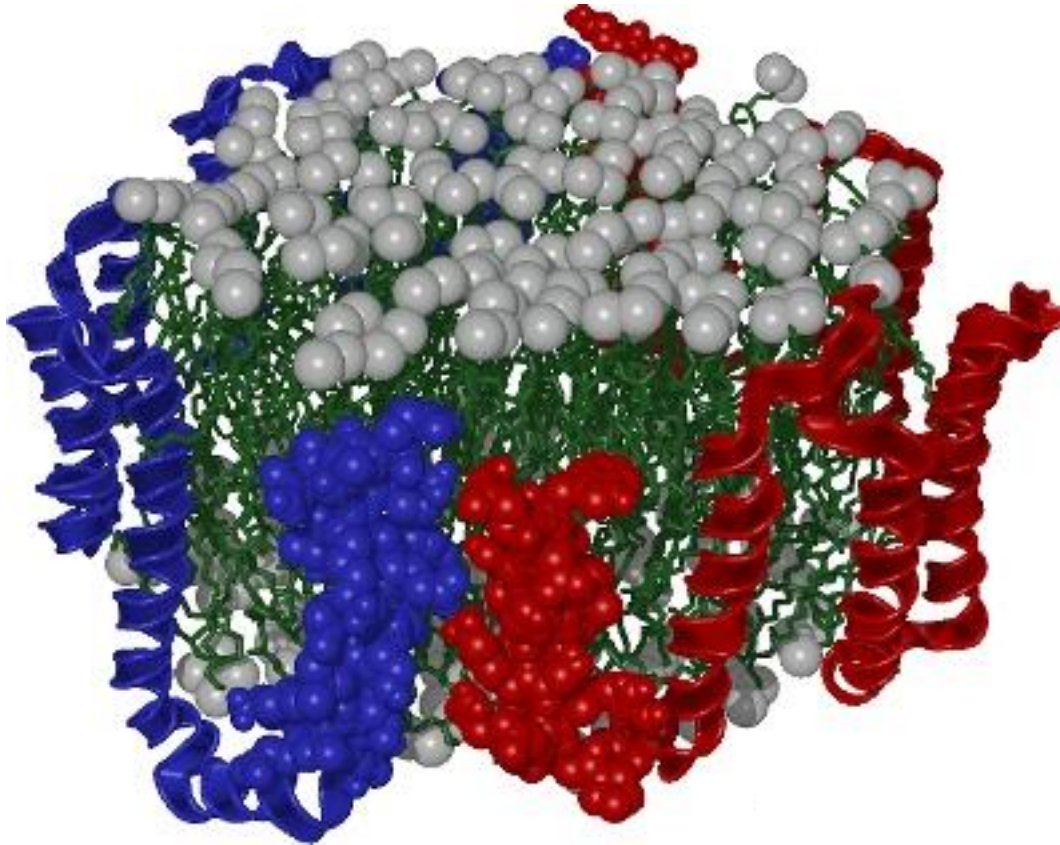
Computer Graphics Applications

Medical Visualization



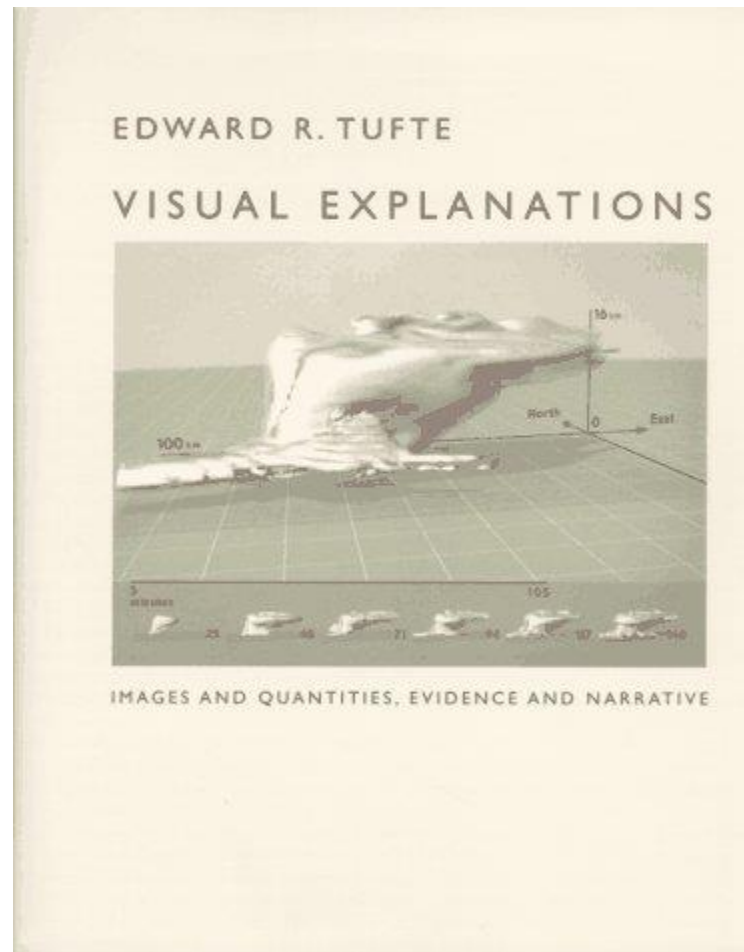
Computer Graphics Applications

Scientific Visualization



Computer Graphics Applications

Visual reasoning, explanation, and communication!



What Is Computer Graphics About?

It is about:

1. realistic and/or pretty pictures.
movies, games, ...

2. scientifically informative (not necessary pretty) pictures.
scientific visualization, CAD, ...



Three big topics form, behavior, appearance

- **Modeling**: how to represent objects; how to *build* those representations.
- **Animation**: representing/controlling the way things move.
- **Rendering**: how to simulate the image-forming process.



Modeling

- What to represent
 - geometry: modeling surfaces, volumes
 - photometry: color, reflectance
- How to *build* these representations
 - declaratively: write it down
 - programmatically: let it grow
 - interactively: edit/sculpt it
 - via 3D sensing: scan it in



Animation

- Model how things *move*
- How to represent motion
 - sequence of stills, parameter curves
- How to specify motion
 - by hand: tweak it till it looks right
 - » key-framing, constraints
 - rule-based behaviors: artificial life
 - physics: simulate Newton's laws
 - motion capture: act it out yourself



Rendering

- What's an image?
 - distribution of light energy on 2D “film”: $E(x,y,\lambda,t)$
(λ is wavelength.)
- How do we represent and store images
 - sampled array of “pixels”: $p[x,y]$
- How to generate images from scenes
 - input: 3D description of scene, lights, camera
 - solve light transport through environment
 - project to camera's viewpoint
 - light transport: ray tracing, radiosity, photon-mapping, etc.



Hot Research Topics

- **Modeling**

- model capture - getting models from the real world
- special phenomena - ‘skin-deep’, ‘hair-tangle’
- model understanding and analysis

- **Animation**

Go mobile!

- motion capture
- special phenomena - facial and body animation
- motion understanding and analysis

- **Rendering:**

- more realistic: hair, skin, etc
- less realistic: aesthetic, informative

