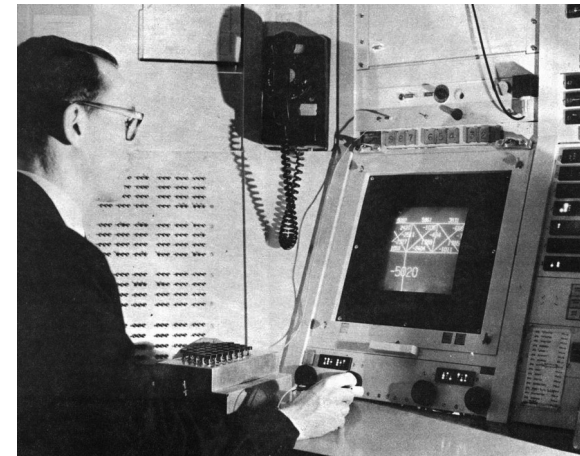


Introduction to Computer Graphics

Hendrik Speleers

Introduction to Computer Graphics

- What is computer graphics?
 - Creation, storage, manipulation and rendering of models and images
 - Models come from various sources
 - Art, mathematics, biology, physics, ...
 - Two basic paradigms
 - 2D images and 3D graphics
 - SKETCHPAD (Ivan Sutherland, 1963)
 - First (interactive) graphics system
 - Ancestor of modern CAD systems (Computer-Aided Design)
 - Ancestor of modern OOP (Object-Oriented Programming)



Introduction to Computer Graphics

- **2D images**
 - Discrete samples (= pixels, picture elements) describe virtual information
 - Pixels are created by
 - Paint programs, scanners, cameras, ...
 - Images can be manipulated once the pixels are known
 - Recoloring, contrast, superposition, restoration, ...
 - Some disadvantages
 - No depth
 - No different viewpoints



Introduction to Computer Graphics

- 2D images
 - Painterly rendering
 - How to make a painting from a photograph?
 - Examine neighborhood of each pixel
 - Define brushstroke for pixel
 - Length, thickness, direction
 - Apply strokes in random order

- Example
(Aaron Hertzmann)



Introduction to Computer Graphics

- 2D images
 - Painterly rendering: change the painting style by changing the parameters

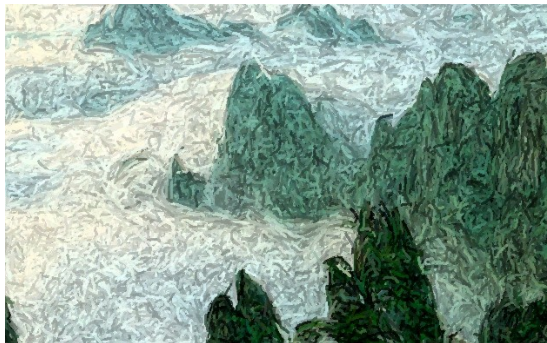
source



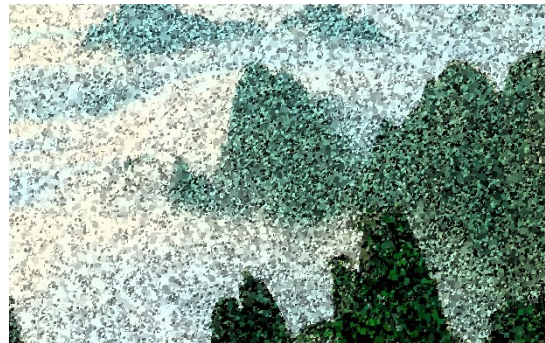
“impressionist”



“expressionist”



“pointillist”



Introduction to Computer Graphics

- **3D graphics**
 - Modeling
 - Creation of a geometric model (= scene)
 - Rendering
 - Creation of a 2D image of the scene
 - Different viewpoints possible
 - Animating
 - Creation of movement



Introduction to Computer Graphics

- **3D graphics**
 - Modeling of the scene
 - How to represent real environments?
 - Geometry: modeling of surfaces and volumes
 - Photometry: light, color, reflectance
 - How to build these representations?
 - Manual in CAD software
 - Sculpting a small physical model (e.g., clay model)
 - ...
 - Geometric building blocks
 - Polygons (hardware supported)
 - Advanced CAD tools: spline surfaces, subdivision surfaces, ...

Introduction to Computer Graphics

- 3D graphics
 - Behind the scenes of short animation movie “One more beer!” (Pedro Conti)



Introduction to Computer Graphics

- 3D graphics
 - Behind the scenes of short animation movie “One more beer!” (Pedro Conti)



Introduction to Computer Graphics

- 3D graphics

- Animation of the scene
 - Different techniques
 - Manual update of models
 - Physics-based model generation (following some physical laws)
 - Motion capture (recording actions of human actors)
- Graphics hardware
 - Development started in 70s
 - Efficient transformation of a polygon-based model into an image
 - Matrix operations in homogeneous coordinates

