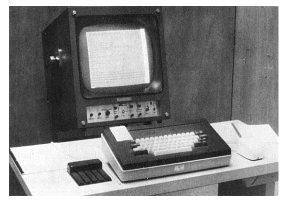
Motivation

Interactive Graphical User Interfaces

- **Desktop metaphor**
  - Input: Mouse, keyboard
  - Output: CRT
- **Immersive interfaces**
  - Input: Gloves, 3D tracking
  - Ouput: HMD, RWB

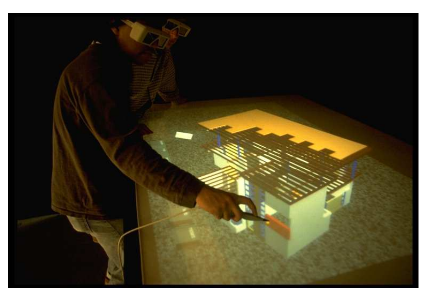
Sutherland's Sketchpad
1960's



Xerox Alto
1970's

Immersive Interfaces

Head-Mounted Display
Glove
From W. Krueger



Responsive Workbench
3D Stylus

Motivation

Digital Media Technologies

Traditional media (analog to digital transition)

- **Printing (done)**
- **Television and video (underway)**
- **Cameras and Film (underway)**
- **Movies?**

New media

- **Multimedia personal computer**
- **Networked graphics and the www**

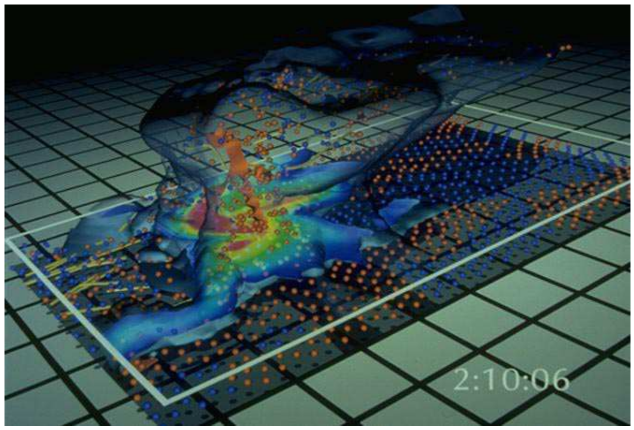
Motivation

Visualization

Examples

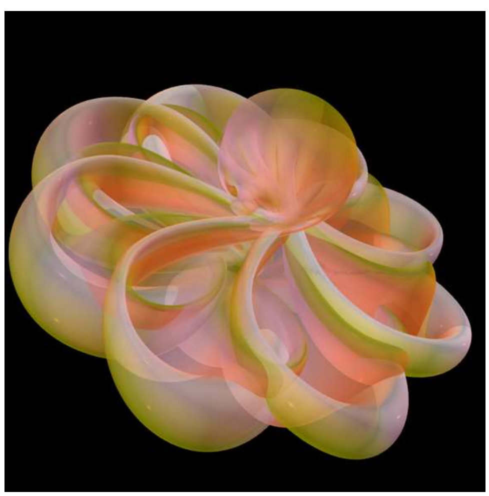
- **Science: Thunderstorm simulation**
- **Mathematics: Sphere eversion**
- **Engineering: Computation fluid dynamics**
- **Medicine: Visible human**
- **Computer Science: Software system**

Visualization: *Thunderstorm Simulation*



Numerical model of a thunderstorm
Bob Wilhelmson, Univ. Illinois

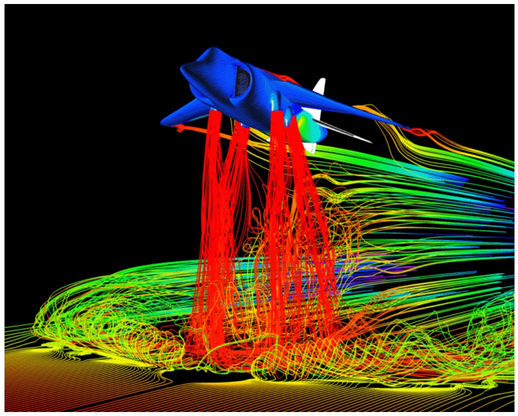
Visualization: *Outside In*



Sphere Eversion from *Outside In*

S. Levy,
D. Maxwell,
T. Munzner,
Geometry Center
Univ. Minnesota

Visualization: NASA's FAST



Airflow around a Harrier Jet
FAST System

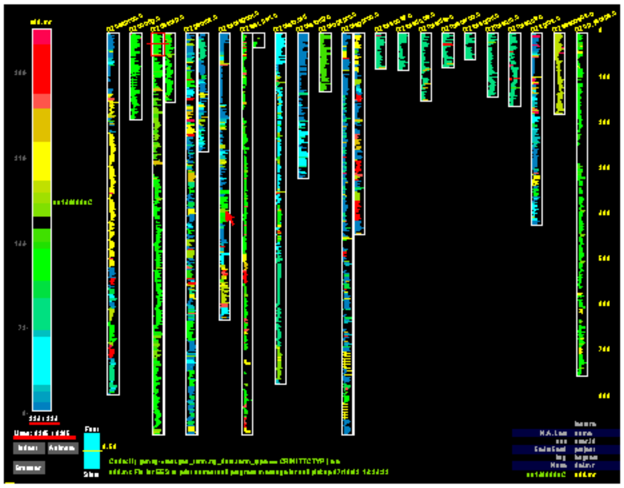
Nasa Ames

Visualization: *Visible Human*

The Visible Man

K. H. Hoehne
Univ. Hamburg, GE

Visualization: *SeeSoft*



SeeSoft

S. Eick
Lucent

Shows code age:
new -> red
old -> blue

Motivation

Art and Design
- **"Electronic Art"**
- **Drawings, Paintings, Blueprints**
- **Mechanical CAD**

Entertainment
- **Movies: *Jurassic Park* and *Toy Story***
- **Games and CDROM Titles**

Visual Simulation and Training
- **Airplane, ship, automobile simulators**

Interdisciplinary: Theory and Practice

Science

- Physics of light, color and appearance
- Projective geometry and perspective
- Mathematics of curves and surfaces

Engineering

- Hardware: Graphics and media processors, displays
- Software: Graphics libraries, window systems

Art and Perception

- Color: harmony and perception
- Composition, lighting, ...

Graphics

Bike Shop from *Red's Dream*
E. Ostby, B. Reeves, J. Lasseter
PIXAR

Animation: time

Modeling: shapes

Shading: reflection and lighting

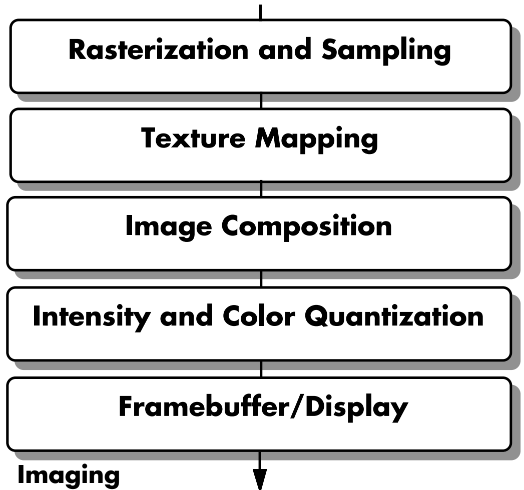
Transformation: viewing

Hidden Surface Elimination

Geometry Pipeline

Imaging

Scenes from *Titanic*



Imaging Pipeline

Graphics Software Architecture

See *Programming OpenGL for the X Window System*, M. Kilgard