Computer Graphics

حسب 411

Instructor: Dr. Shereen Aly Taie

Computer Vision and Applications A Guide for Students and Practitioners - Bernd Jahne (Chapter 1)

شاشات العرض Screens (Monitors) :

إن الشاشة هي الملحق الوحيد التي عليها إظهار النتائج المرئية والمهمة الأساسية لشاشات عرض الحاسب هي عرض المعلومات القادمة من وحدة المعالجة أو من احد أوساط التخزين أو من لوحة المفاتيح .

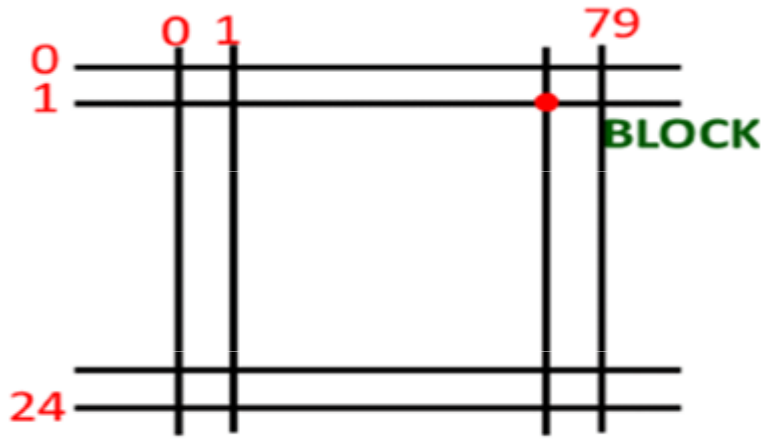
ان أداءه الشاشة عادة يتم بواسطه كرت موائمة Video display monitor Adapter العرض

والتي تصنف إلى الأنواع التالية:

١- كرت الشاشة العادي Monochrome display Adapter (MDA).
٢- كرتان الشاشة الملونة وتضم ما يلي:
   ١- كرت الموائمة للون والرسومات Color Graphics Adapter (CGA).
   ٢- كرت موائمة مصفوفة الرسومات Video Graphics Adapter (VGA).
   ٣- كرت موائمة الرسومات الفائق Super Video Graphics Adapter (SVGA).
   ٤- كرت الموائمة المحسن Enhanced Graphics Adapter (EGA) .

عادة يحتوي الشاشة على مجموعة من الدوائر الإلكترونية وكذلك يحتوي على Video Memory من نوع RAM واخرى من نوع ROM والتي تعمل على استقبال المعلومات من وحدة المعالجة المركزية CPU. أو من أوساط التخزين المختلفة لإظهارها على الشاشة يمكن تصنيف المعلومات التي تظهر على الشاشة إلى نوعين:

١- النصوص **Text:** وهنا يقوم كرت الموائمة بتقسم الشاشة منطقيا وهميا Logical إلى خطوط طولية Columns وخطوط أفقية Rows ونتيجة لذلك تتشكل شبكة الإحداثيات والتي تُسمى باسم نمط Mode ومن الأنماط الشائعة في معظم الموائمات النمط الذي يُقسم الشاشة إلى 80 عمودا و25سطرا.



وبناء على هذا النمط فإنه على الشاشة يمكن الحصول على 25*80= 200 موقع وكل موقع خصص لحرف واحد.

إن الموقع الواحد يُطلق علية اسم كتلة Block وكل كتلة بدورها تُقسم وهمياً إلى مجموعة صفوف وأعمدة وتقاطع هذه الصفوف والأعمدة يُطلق عليها اسم Pixels من الطبيعي هذه الأنماط وتقسيماتها تختلف من كرت موائمة إلى كرت أخر حسب نوعه.

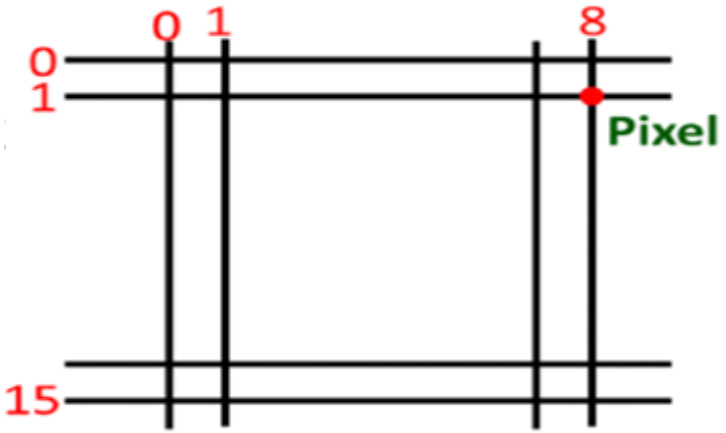
٢- **الرسومات Graphics:** ان دقة الرسومات ووضوحها يجب أن يكون عالي جدا ولذلك فإن كرتات الشاشة تختلف من حيث دقة تشكيل (تقسيم) الشاشة إلى نمط الرسومات فمثلا في كرت VGAيستطيع تشكيل 22 نمطا فعلى سبيل المثال نمط رقم 16 يتكون 200 صف و640 عمود أي (640*200) وتقاطع كل صف مع عمود في نمط الرسومات يسمى Pixel حيث إن مفهوم الكتلة في نمط الرسومات Block يتغيب.

- بناء عليه فإننا نستخدم مفهوم الدقة Resolution لوصف مدى وضوح المعلومات وعليه فإن :

دقة نمط الرسم على سبيل المثال نمط رقم 16هو

Resolution=640*200 pixel

أي دقة النص Resolution=80*25character.



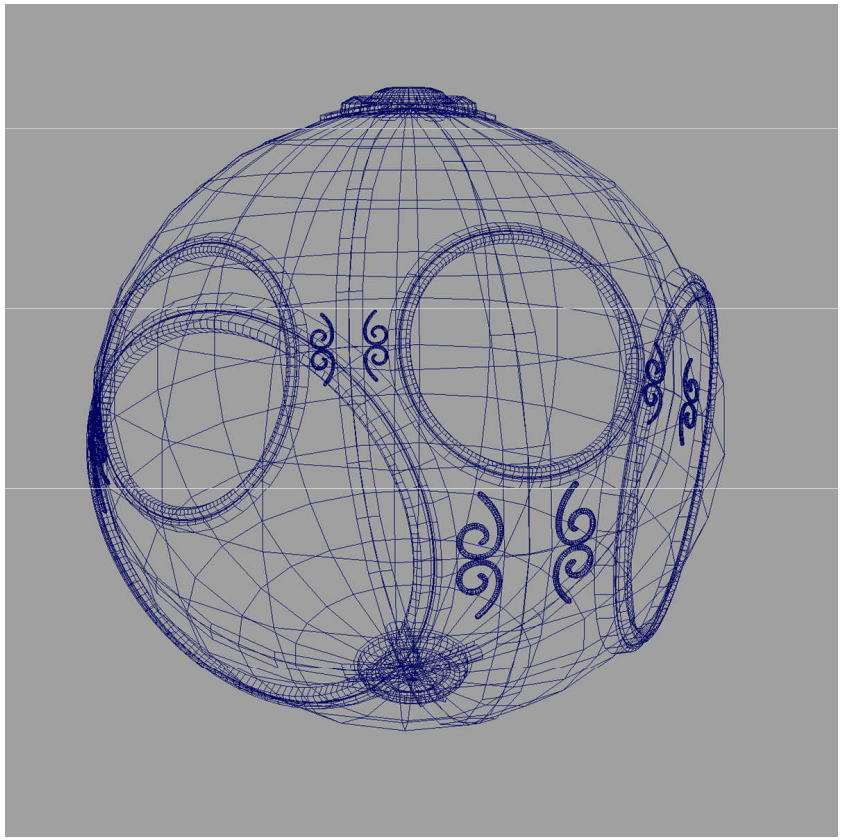
Computer Graphics: 1950-1960

- Computer graphics goes back to the earliest days of computing
  - Strip charts
  - Pen plotters
  - Simple displays using A/D converters to go from computer to CRT
- Cost of refresh for CRT too high
  - Computers slow, expensive, unreliable

Computer Graphics: 1960-1970

- *Wireframe* graphics
  - Draw only lines

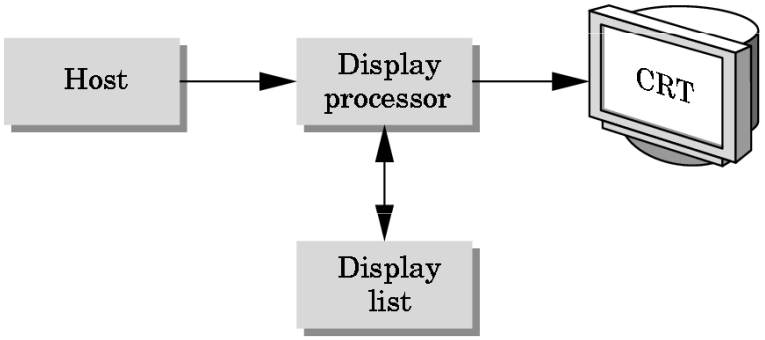
- Sketchpad
- Display Processors
- Storage tube



wireframe representation
of sun object

Display Processor

- Rather than have the host computer try to refresh display use a special purpose computer called a *display processor* (DPU)



- Graphics stored in display list (display file) on display processor

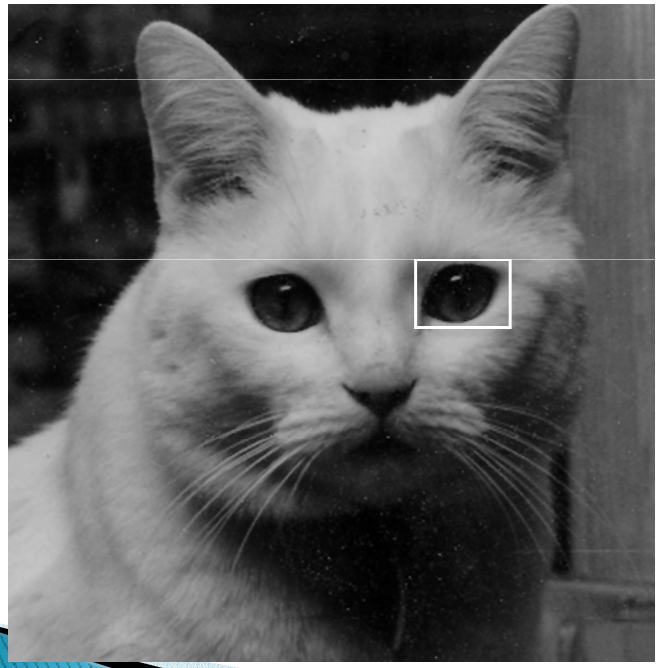
- Host *compiles* display list and sends to DPU

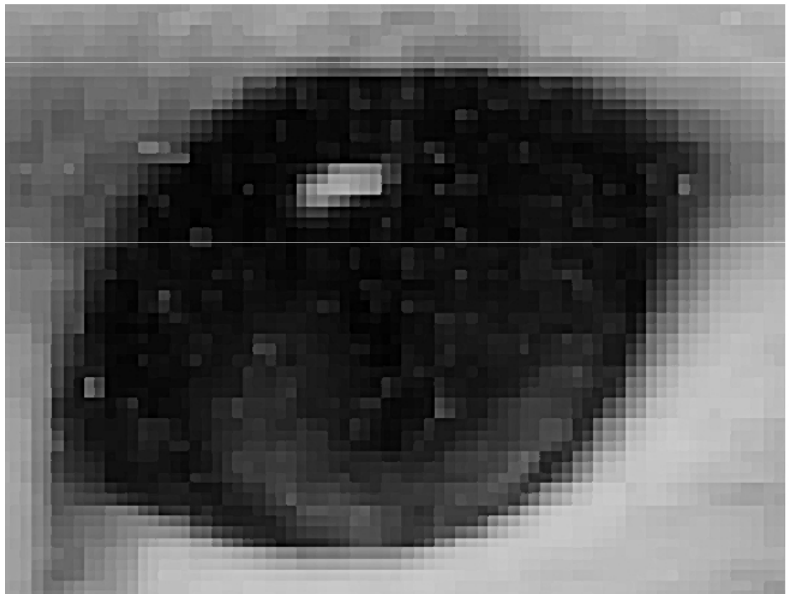
Computer Graphics: 1970-1980

- Raster Graphics
- Beginning of graphics standards
  - IFIPS (International Federation of Information Processing Society)
- Workstations and PCs

Raster Graphics

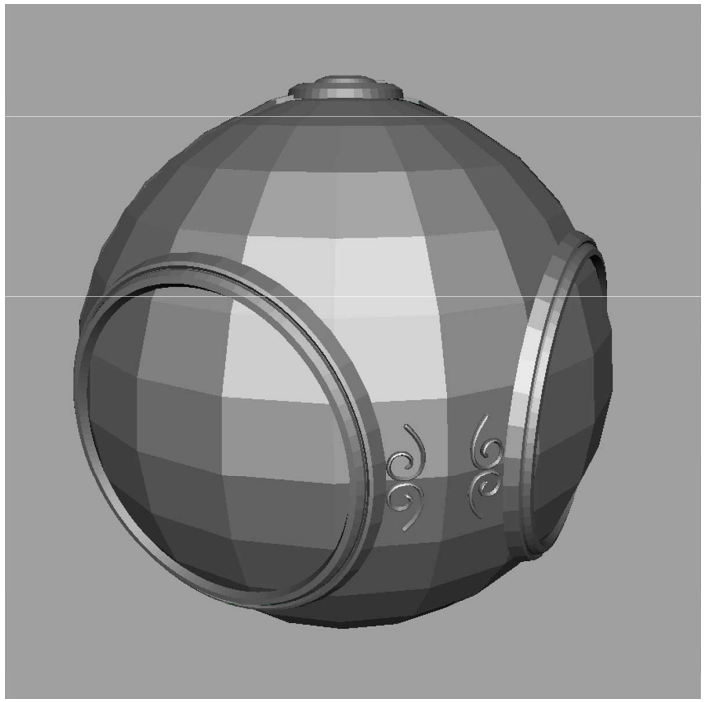
- Image produced as an array (the *raster*) of picture elements (*pixels*) in the *frame buffer*





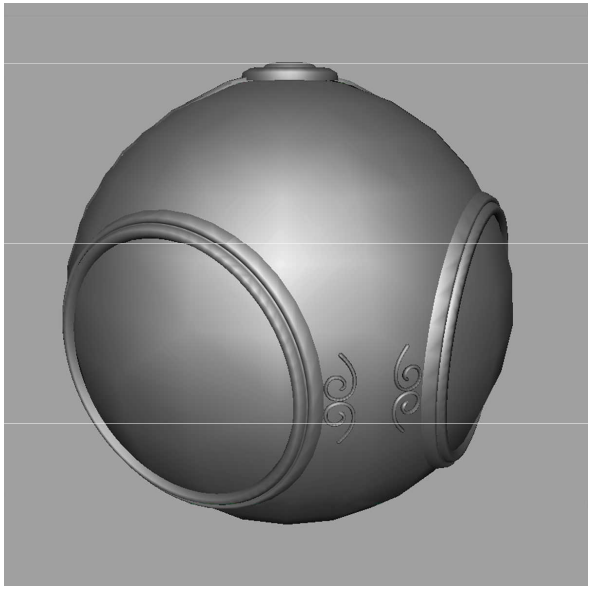
Raster Graphics

- Allows us to go from lines and wire frame images to filled polygons



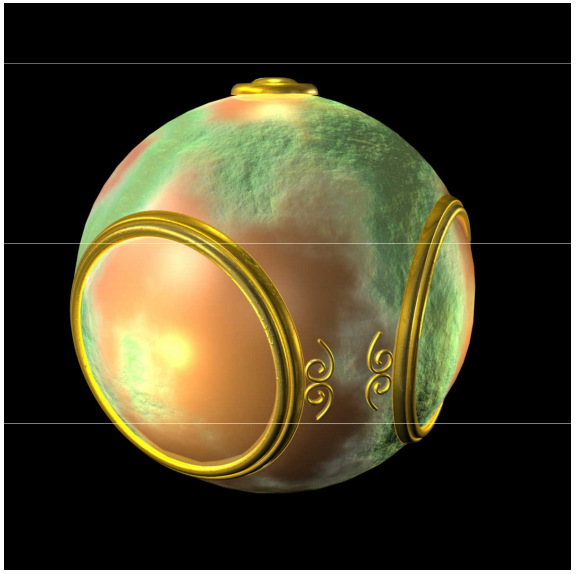
Computer Graphics: 1980–1990

Realism comes to computer graphics



smooth shading

environment mapping



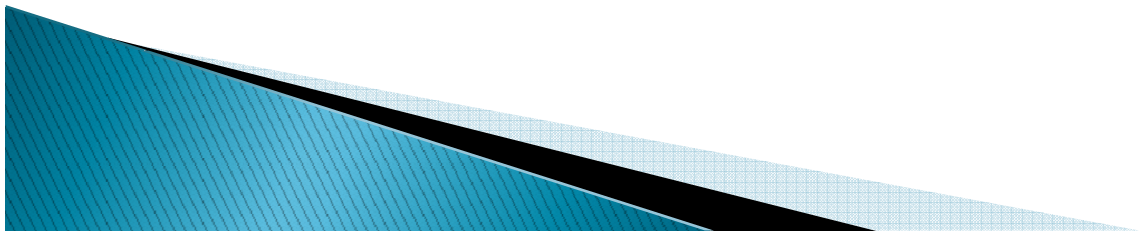
bump mapping

Computer Graphics: 1980-1990

- Special purpose hardware
  - Silicon Graphics geometry engine
    - VLSI implementation of graphics pipeline
- Industry-based standards
  - PHIGS(Programmer's Hierarchical Interactive Graphics Systems)
  - RenderMan
- Networked graphics: X Window System
- Human-Computer Interface (HCI)

Computer Graphics: 1990-2000

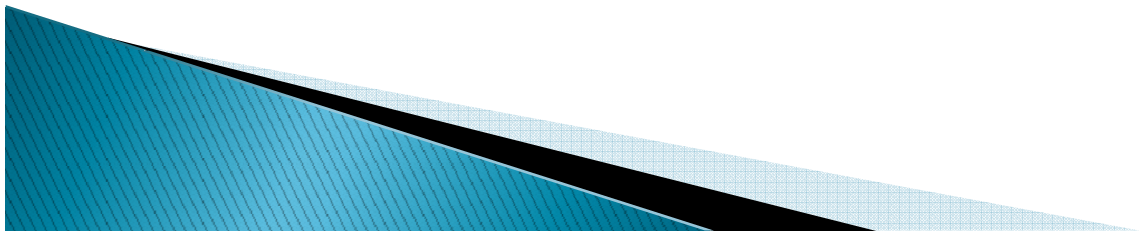
- OpenGL API
- Completely computer-generated feature-length movies (Toy Story) are successful
- New hardware capabilities
  - Texture mapping
  - Blending دمج
  - Accumulation, stencil buffers



Computer Graphics: 2000-

- Photorealism
- Graphics cards for PCs dominate market
  - Nvidia, ATI
- Game boxes and game players determine direction of market
- Computer graphics routine in movie industry: Maya,3D Max, Lightwave

- Programmable pipelines



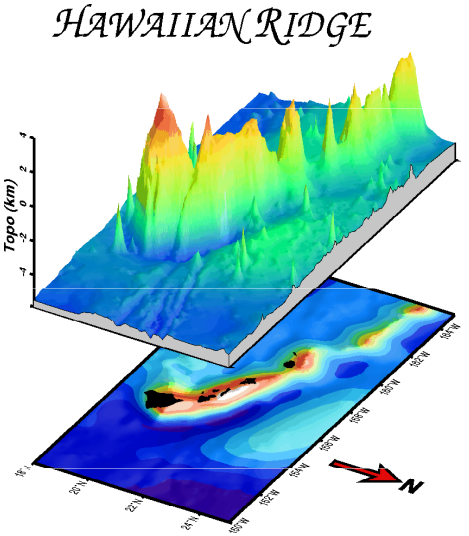
Applications of Computer Graphics

Applications of Computer Graphics

- divided in 4 majors area
  - Display of Information
  - Design
  - Simulation
  - User Interface

Display of Information

- Geographic information system (GIS)
- Computerized Tomography (CT)
- Magnetic resonance imaging (MRI)
- Ultrasound
- Positron تصوير مقطعي– emission tomography (PET)

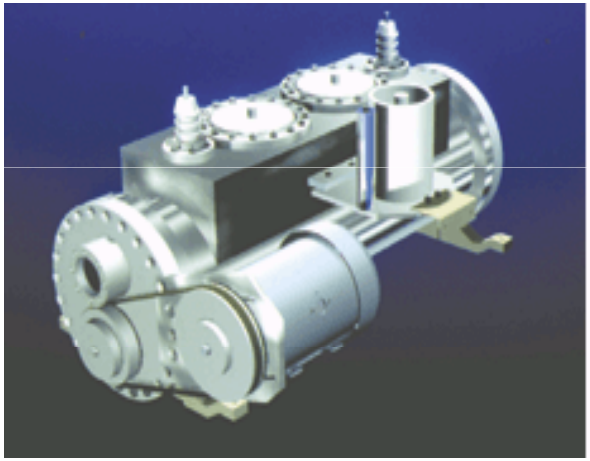


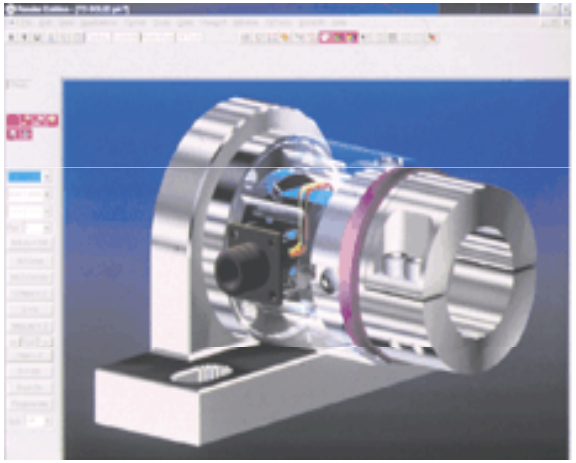
http://www.soest.hawaii.edu/soest/about.ftp.html

http://www.queens.org/qmc/services/imaging/ct.htm

Design

- Computer-Aided Design (CAD)
  - Architecture
  - Design of Mechanical part
  - VLSI
  - etc…



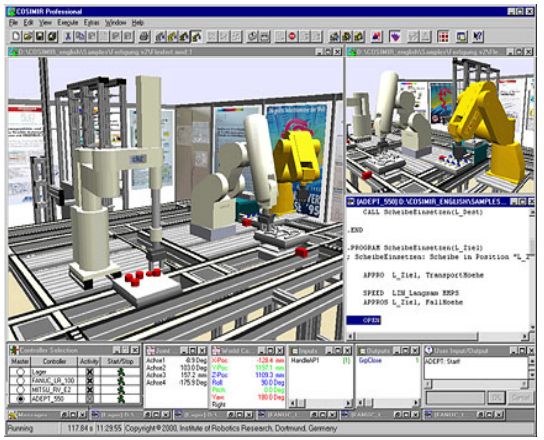


http://www.memagazine.org/contents/current/features/push/push.html

Simulation

- Graphical flight simulator
  - reduce training process
- Robotic simulation
- TV, Movie, advertising industries
  - generate photo realistic images
- Virtual Reality (VR)
  - reduce risk of training
    - surgery
    - astronaut

The Concorde Panel.



http://www.motionshop.com/pr/festocosimirlg.shtml

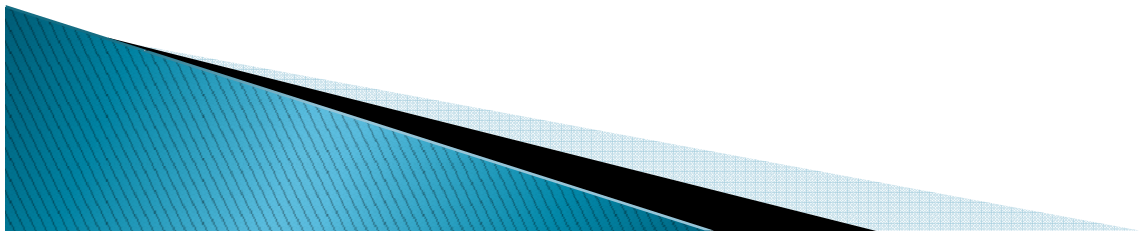
User Interfaces

- Window system
  - Window 2003
  - X window
  - MAC OS

- Graphical Network browsers
  - Netscape
  - Internet Explorer

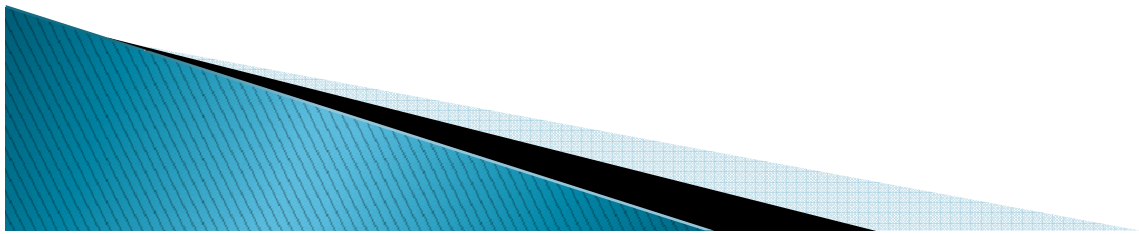
Areas of research in Graphics

- mathematical modeling:
  - interpolation, curve and surface fitting
  - computational geometry: algorithmic applications in geometry
  - study of light and optical phenomenon: colour, texture, shades
  - modelling the characteristics of physical objects



Areas of research in Graphics

- Software technology
  - standardized graphics languages and libraries
  - graphics tools and interfaces
  - algorithm design
- Hardware
  - specialized graphics chips, monitors, interface devices



Graphics Applications

- Entertainment: Cinema

Pixar: Geri's Game

Universal: Jurassic Park

Antz

A bug's Life

Graphics Applications (1 /4)

- Entertainment: Games

Aki Ross : Final Fantasy

Star Wars Jedi Outcast: Jedi Knight II

Quake III

Graphics Applications (2/4)

- Medical Visualization

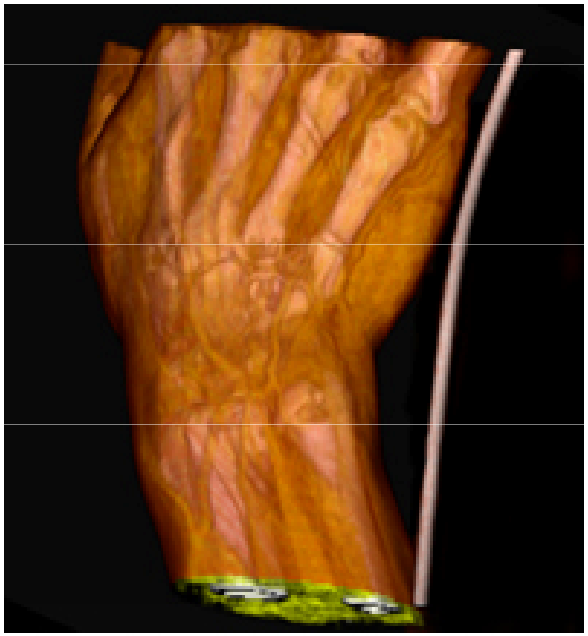
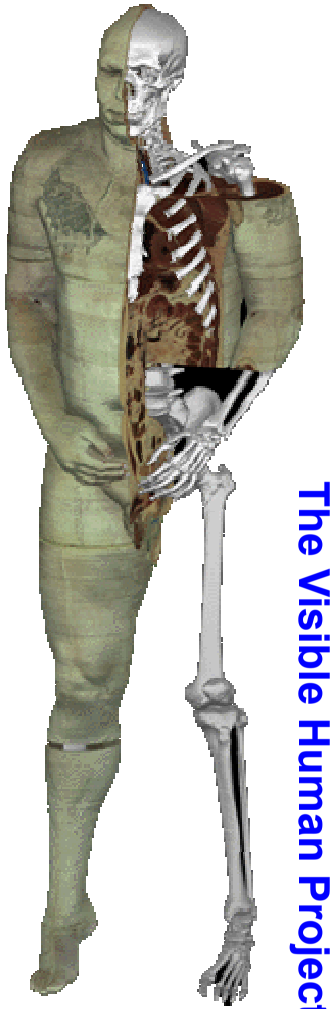


Figure 3: Rendering of a human hand. A complex transfer function was used to separate bones, blood vessels, ligaments and skin.

Figure 4: Another transfer function was used to display bone, blood vessels, and skin independently.

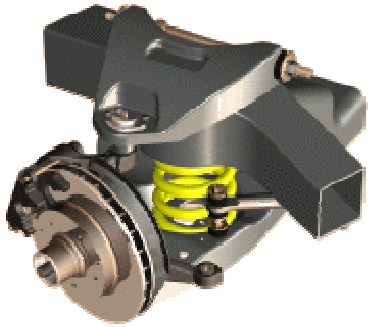
http://www.ercim.org/publication/Ercim_News/enw44/koenig.html

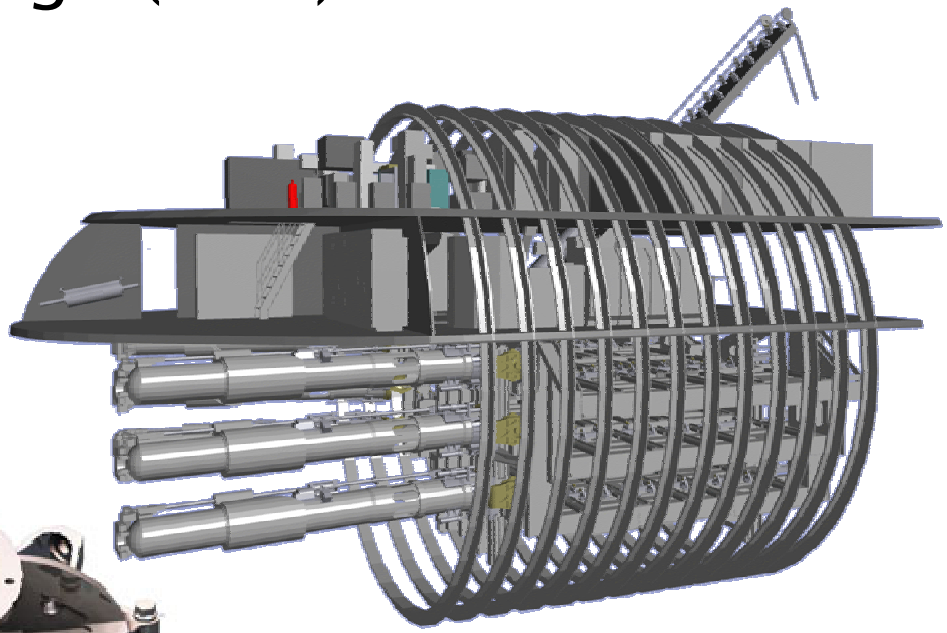


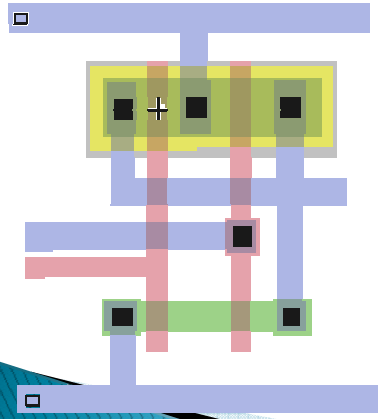
The Visible Human Project

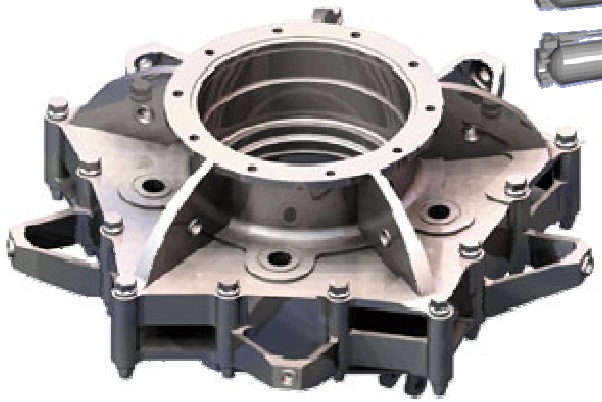
Graphics Applications (3/4)

- Computer Aided Design (CAD)



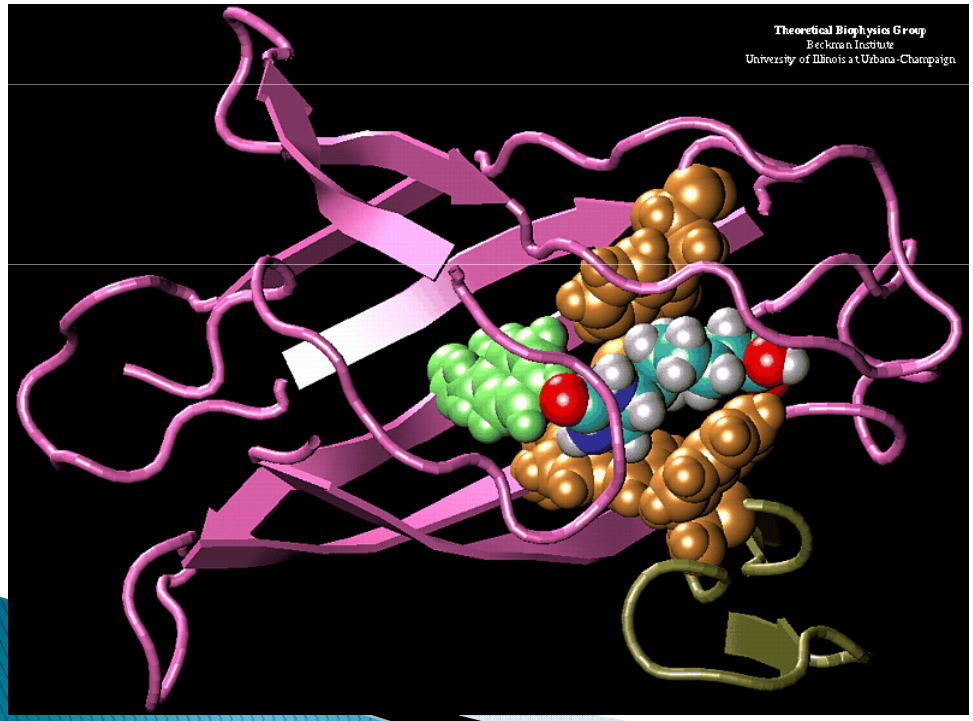


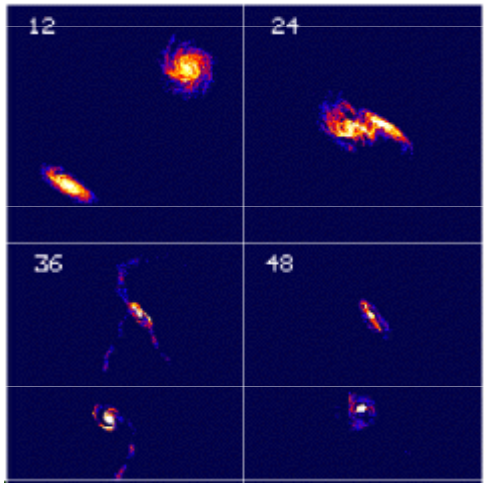




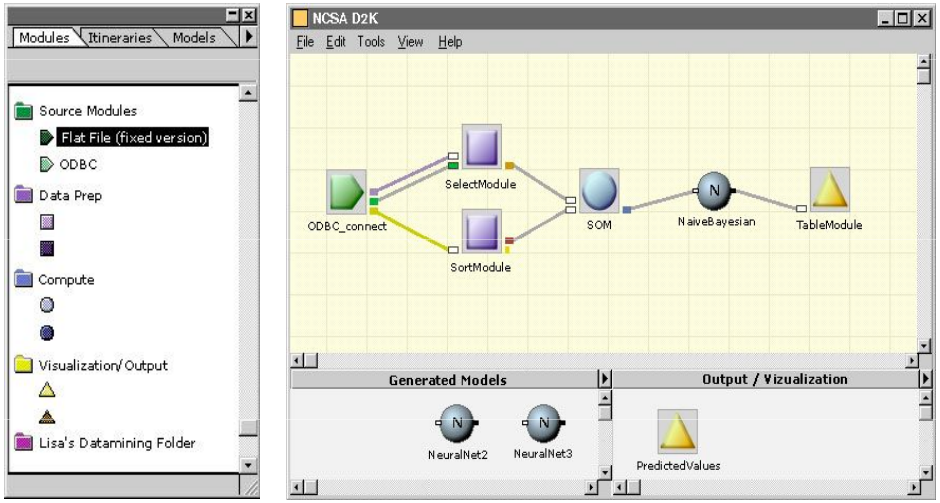
Graphics Applications (4/4)

- Scientific Visualization





Hypermedia User Interfaces (1/2)



NCSA *D2K*:

http://chili.ncsa.uiuc.edu

Visual programming system for high-performance knowledge discovery in databases (KDD)

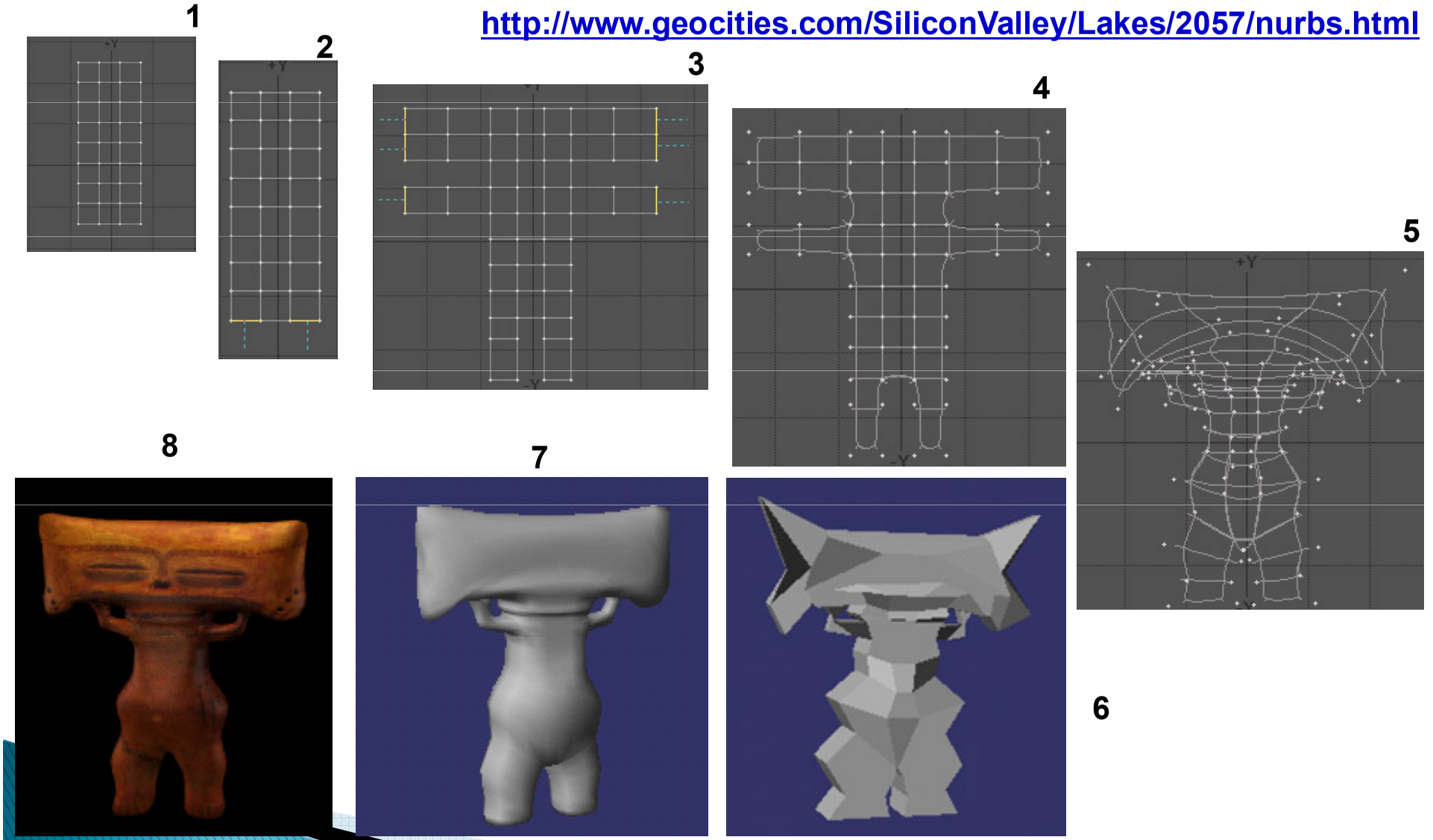
- **Hypermedia**
  - **Database format (similar to *hypertext*) that provides display-based access to (internetworked) *multimedia* (text, image, audio, video, *etc.*) documents**
  - ***Chimera*: http://www.ics.uci.edu/pub/chimera/**

Hypermedia User Interfaces (2/2)

- Virtual Environments
  - Immersion: interactive training, tutoring systems
  - Entertainment hypermedia
- Visualization and Computer-Aided Design and Engineering (CAD/CAE)
  - Visualization: scientific, data/information, statistics
  - User interfaces for CAD/CAE/CAM/CASE: http://www.isii.com

http://www.psl.cs.columbia.edu/chime/

Curve and Surface Modeling

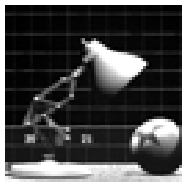


Photorealistic Illumination Models

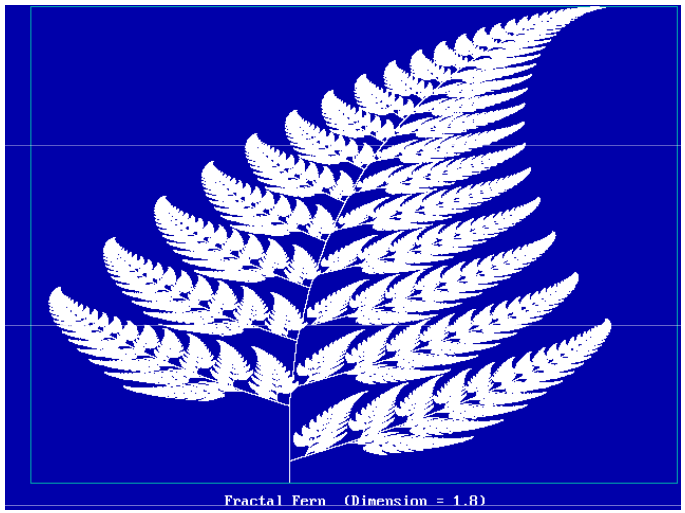
http://www.pixar.com

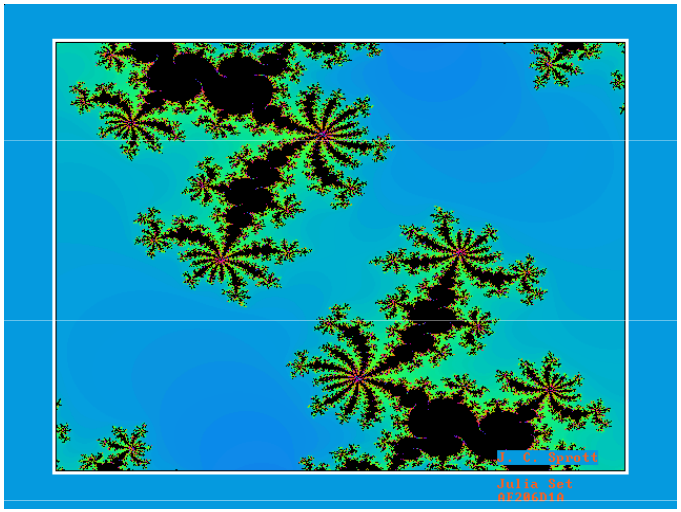
http://www.ktx.com/3dsmaxr3/

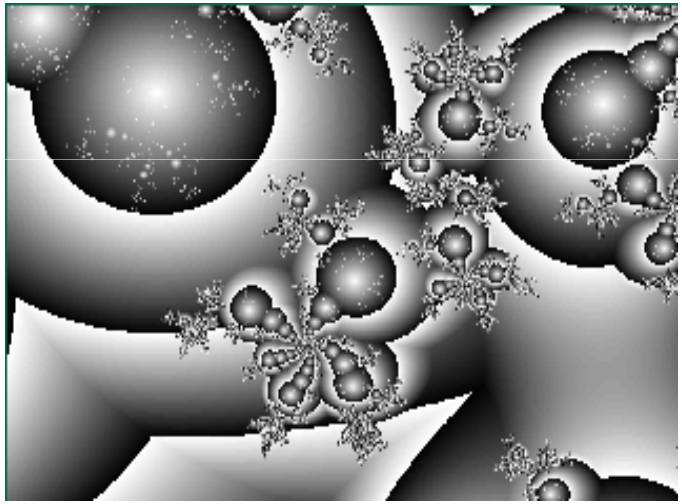
http://www.aliaswavefront.com

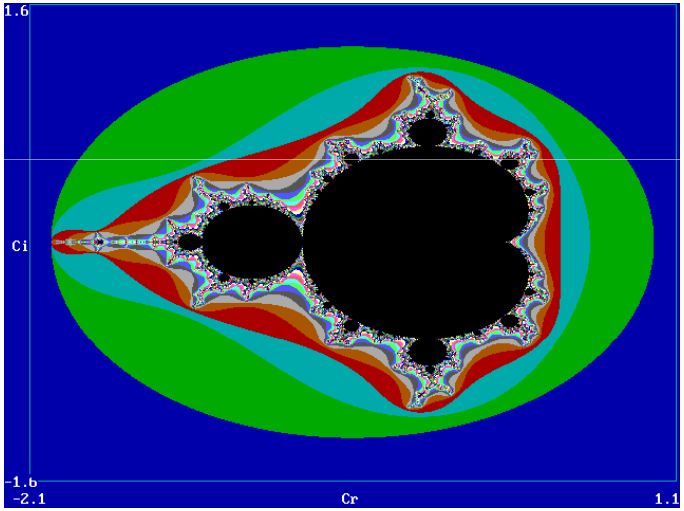


Fractal Systems



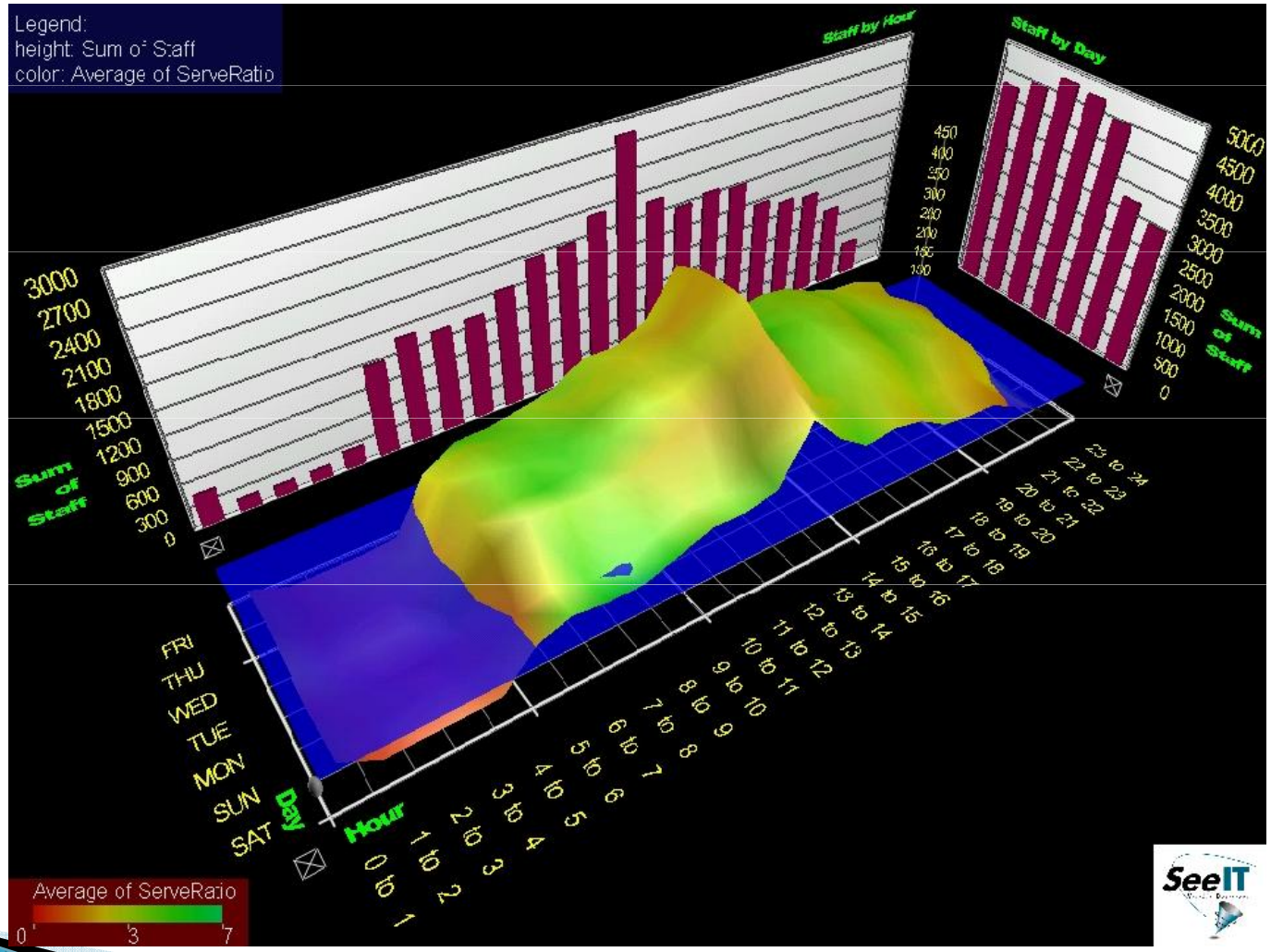






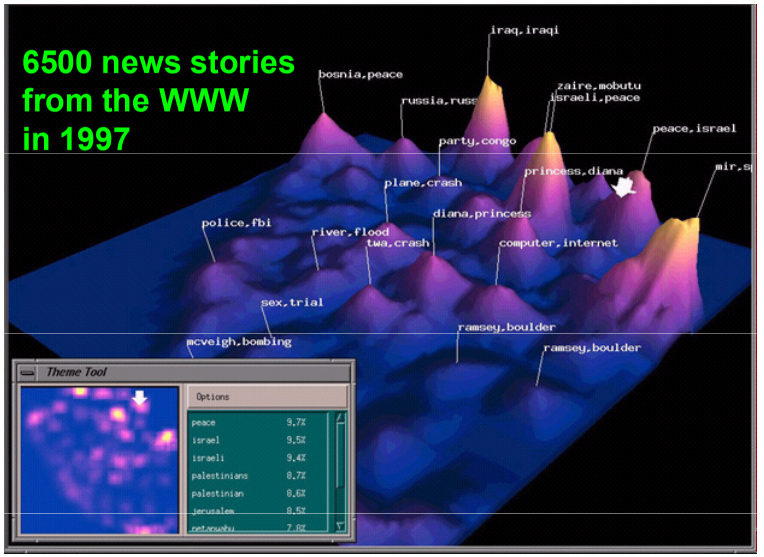
http://sprott.physics.wisc.edu/fractals.htm

Information Visualization



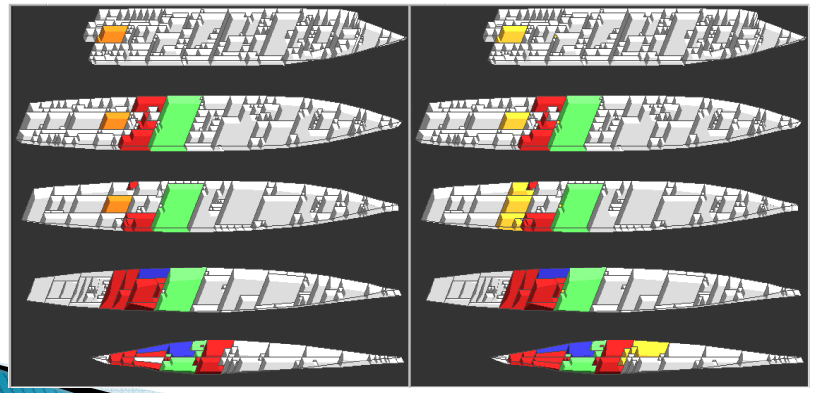
Visible Decisions *SeeIT* (http://www.vdi.com)

Interesting Industrial Applications

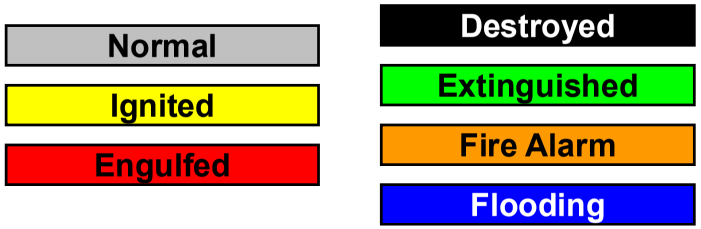


Cartia *ThemeScapes* – http://www.cartia.com

Hypermedia and Statistical Visualization



DC-ARM – http://www-kbs.ai.uiuc.edu



Virtual Environments for Immersive Training

Professional Societies

ACM SIGGRAPH

- Association for Computing Machinery Special Interest Group in Graphics

IEEE

- The Institute of Electrical and Electronics Engineers, Technical Committee on Computer Graphics

Software Portability and graphics standards

STANDARD ORGANIZATION

- ANSI = American National Standard Institute (private, non government)
- ISO = International Standards Organization(voluntary, non treaty)
- ANSI is a member of ISO

Some Notable Systems

- Tektronix commands in BASIC (mid-๑๙๗๐s)
- HP commands (Hewlett Packard)
- Microsoft BASIC (for PCs) graphics commands (early ๑๙๘๐s)
- QuickDraw (Apple Macintosh)
- X (MIT)
- OpenGL (Silicon Graphics)
- SRGP (Simple Raster Graphics Package)
- SPHIGS (Simple PHIGS)
- MS Windows
- Java AWT