

Multimedia II.



RNDr. Stanislav Stanek



- **About this course**
- **Introduction to Multimedia**
- **Multimedia Authoring**
- **Multimedia Technology**
- **Multimedia Data**



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About this course

- **Focus of this course**

- To give a broad grounding in to problems of surrounding *Multimedia*
- The role of *Multimedia* and *Multimedia Systems* (MMS)
- The design of *Multimedia* and *MMS*

- **Objectives of this course**

- Understand the relevance and underlying infrastructure of the multimedia systems
- Understand core multimedia technologies and standards (Digital Audio, Graphics, Video, VR, data transmission/compression)
- Be aware of factors involved in multimedia systems performance, integration and evaluation



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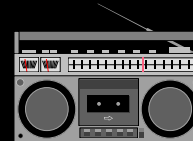
- History of Multimedia and Multimedia Systems

- **Newspaper**

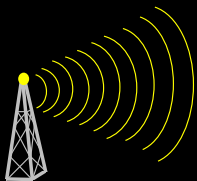


- were perhaps the first mass communication medium to employ Multimedia (they used mostly text, graphics, and images)

- **Wireless radio**

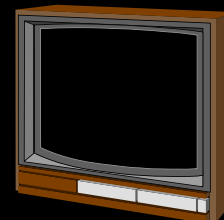


- In 1895, Guglielmo Marconi sent his first wireless radio transmission at Pontecchio, Italy.
 - A few years later (in 1901) he detected radio waves beamed across the Atlantic. Initially invented for telegraph, radio is now a major medium for audio broadcasting.



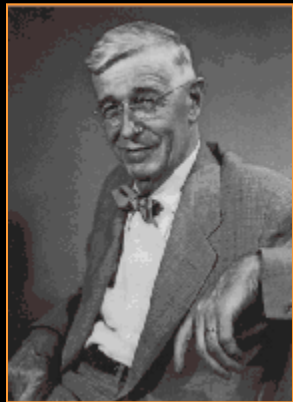
- **Television**

- Television was the new media for the 20th century.
 - It brings the video and has changed the world of mass communications.

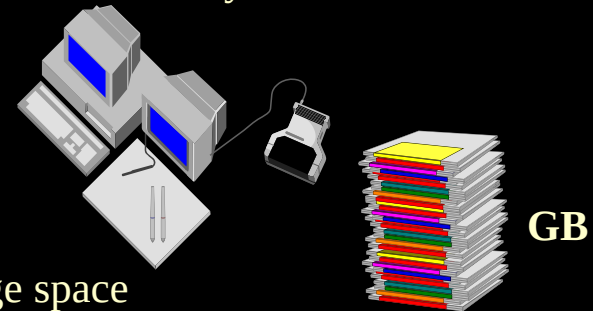


– Some of the important events in relation to Multimedia:

- 1945 - Vannevar Bush wrote about **Memex** in book "As We May Think"



- His conception of the Memex introduced, for the first time, the idea of an easily accessible, individually configurable storehouse of knowledge.
- The memex is "a device in which an individual stores all his books, records, and communications, and which is mechanized so that it may be consulted with exceeding speed and flexibility".
- A memex resembled a desk with:
 - two pen-ready touch screen monitors
 - scanner surface
 - several gigabytes (if not more) of storage space
(filled with textual and graphic information, and indexed according to a universal scheme)
- All of this seems quite visionary for the early 1930s, but Bush himself viewed it as "conventional".
- Bush saw *the ability to navigate the enormous data store as a more important development than the futuristic hardware.*



- 1965 - Ted Nelson - introduction of the term **Hypertext**
- 1967 - Nicholas Negroponte formed the Architecture Machine Group at MIT
 - responsible for many radically new approaches to the **human-computer interface**
- 1969 - Ted Nelson & Andries Van Dam at Brown University
 - **HES** - Hypertext Editor System
- Birth of The **Internet**
- 1971 - **e-mail**
- 1976 - Architecture Machine Group - **Multiple Media**
- 1983 - Backer: **Electronic Book**
- 1989 - Tim Berners-Lee proposed the **World Wide Web**
- 1992 - the first M-Bone (Multicast-Bone) **audio multicast** on the Net
- 1993 - National Center for Supercomputing Applications: **NCSA Mosaic**
- 1994 - Jim Clark and Marc Andreessen: **Netscape**
- 1995 - **JAVA** for platform-independent application development
- 1996 - Microsoft: **Internet Explorer**



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- **What is medium?**

- Any medium which can store, transmit, represent, process or receive information.
- Examples of media are: text, pictures, video, animation, sound, smell, taste, ...

- **What is Multimedia?**

- *Multimedia* means that computer information is represented through audio, video, and animation in addition to traditional media (i.e., text, graphics drawings, images).
- *Multimedia* is the field concerned with the computer-controlled integration of text, graphics, drawings, still and moving images (Video), animation, audio, and any other media where every type of information can be represented, stored, transmitted and processed digitally.



- Multimedia can be characterized by:
 - domain of interest
 - key-elements (processors, optical store media, norms or standards for text, image, sound, music, video, animation1, ...)
 - functional units (Image processing, pattern recognition, Sound processing, sound recognition, sound output, ...)
- A *Multimedia Application* is an application which uses a collection of multiple media sources e.g. text, graphics, images, sound/audio, animation and/or video
- *Hypermedia* can be considered as one of the multimedia applications
- *A Multimedia and hypermedia application integrate and compose any kind of media in order to solve a specific problem*



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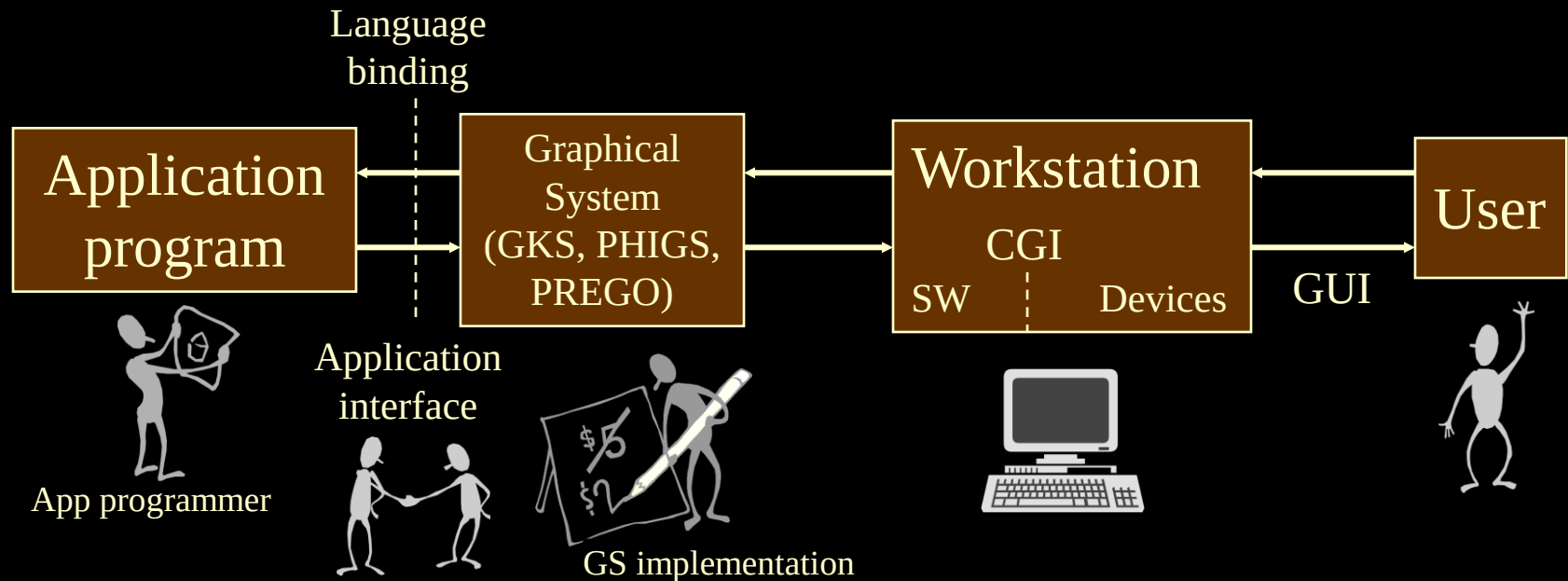


- Multimedia Systems

- A *Multimedia System* is a system capable of processing multimedia data and applications
- A *Multimedia System* is characterized by the processing, storage, generation and manipulation of Multimedia information
- A *Multimedia system* has four basic characteristics:
 - Multimedia systems must be computer controlled
 - Multimedia systems are integrated
 - The information they handle must be represented digitally
 - The interface to the final presentation of media is usually interactive



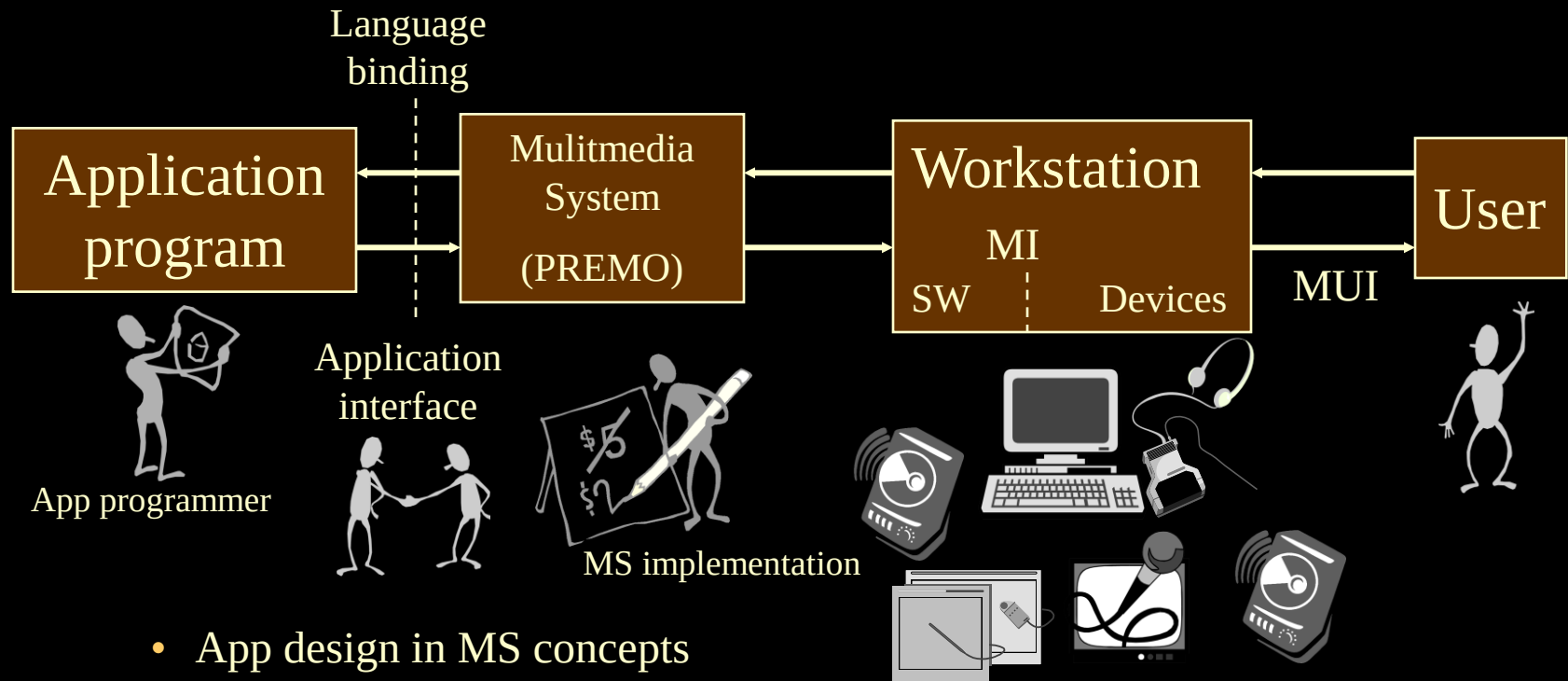
- Computer Graphics
 - Reference model of graphical system



- App design in GS concepts
- App programming in language binding
- PREGO - Presentation Environment for Graphical object (OOP)



- Multimedia
 - Reference model of multimedia system



- App design in MS concepts
- App programming in language binding
- PREMO - Presentation Environment for Multimedial Objects (OOP)



- Challenges for Multimedia Systems
 - Supporting multimedia applications over a computer network
 - => *distributed application*
 - => *special computing techniques* (transport, compresion, ...)
 - Multimedia systems may have to render a variety of media at the same time (a distinction from normal applications)
 - There is a temporal relationship between many forms of media
 - for example: Video and Audio

Inter-media scheduling - Synchronization

Lip synchronization is clearly important for humans to watch playback of video and audio and even animation and audio



- The key problems multimedia systems need to deal with are:
 - How to represent and store temporal information.
 - How to strictly maintain the temporal relationships on play back
- Data has to be represented *digitally* so many initial source of data needs to be *digitized* (translated from analog source to digital representation).
 - scanning (graphics, still images)
 - sampling (audio / video)
 - digital cameras now exist for direct scene to digital capture of images and video
- The data is *large* several MB for audio and video
 - => storage, transfer (bandwidth) and processing overheads are high
 - => data compression techniques very common



- Desirable Features for a Multimedia System
 - Given the above challenges the following feature are desirable (if not a prerequisite) for a Multimedia System:
 - Very High Processing Power
 - needed to deal with large data processing and real time delivery of media. Special hardware become commonplace
 - Multimedia Capable File System
 - needed to deliver real-time media *e.g.* Video/Audio Streaming. Special Hardware/Software needed
 - Data Representations/File Formats that support multimedia
 - data representations/file formats should be easy to handle
 - allow for compression/decompression in real-time.
 - Efficient and High I/O
 - input and output to the file subsystem needs to be efficient and fast
 - Needs to allow for real-time recording as well as playback of data. (*e.g.* Direct to Disk recording systems)



Multimedia System

- Special Operating System
 - to allow access to file system and process data efficiently and quickly. Needs to support direct transfers to disk, real-time scheduling, fast interrupt processing, I/O streaming *etc.*
- Storage and Memory
 - large storage units (of the order of 50 -100 GB or more) and large memory (50 - 100 MB or more)
 - large Caches also required and frequently of Level 2 and 3 hierarchy for efficient management
- Network Support
 - Client-server systems common as distributed systems common
- Software Tools
 - user friendly tools needed to handle media, design and develop applications, deliver media



- Components of a Multimedia System
 - Components (Hardware and Software) required for a multimedia system:
 - Capture devices
 - Video Camera, Video Recorder, Audio Microphone, Keyboards, mice, graphics tablets, 3D input devices, tactile sensors, VR devices. Digitizing/Sampling Hardware
 - Storage Devices
 - Hard disks, CD-ROMs, Jaz/Zip drives, DVD, *etc*
 - Communication Networks
 - Ethernet, Token Ring, FDDI, ATM, Intranets, Internets.
 - Computer Systems
 - Multimedia Desktop machines, Workstations, MPEG/VIDEO/DSP Hardware
 - Display Devices
 - CD-quality speakers, HDTV, SVGA, Hi-Res monitors, Color printers *etc.*



Multimedia System

- **Human** $\leq$ **interface** $\geq$ **Computer**
- **The types of human input channels: VAKOG and S**

Visual

- text, graphics, animations, video

Acoustic

- sound, music

Kinesthetic

- touch

Ophtalactic

- smell

Gustative

- taste

Symbolic

- symbols

the **first** signal system

---- the **second** signal system



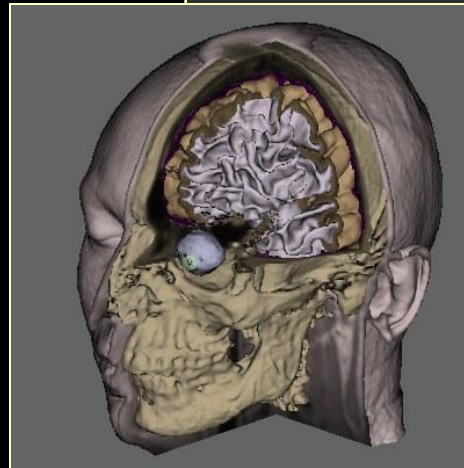
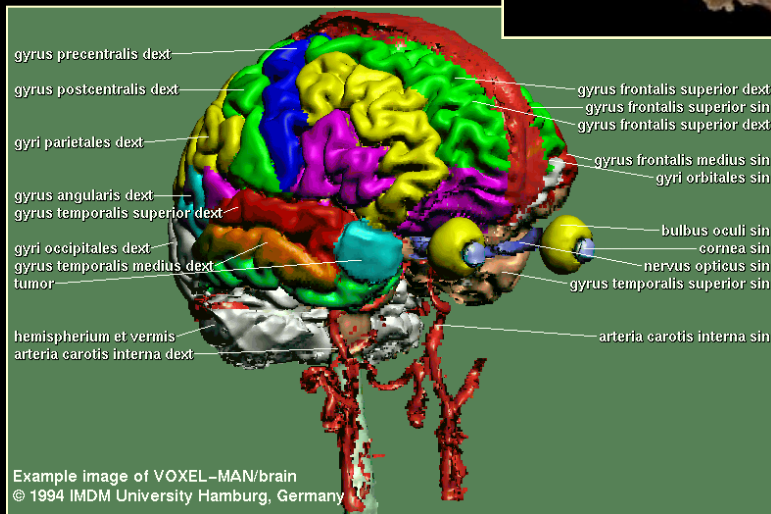
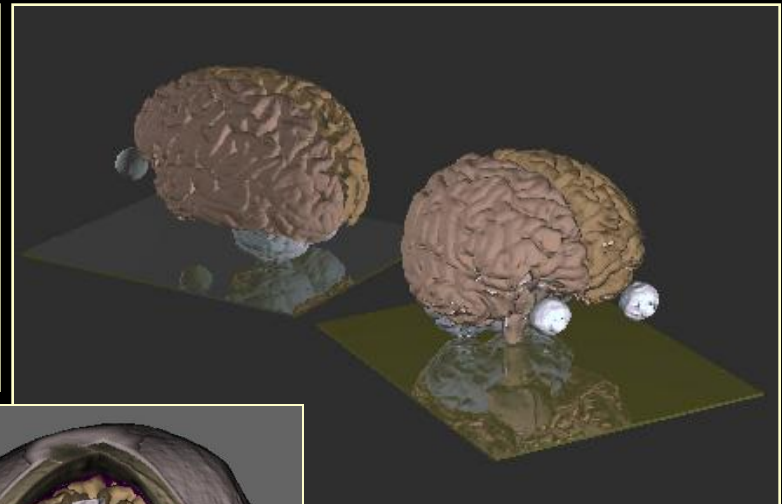
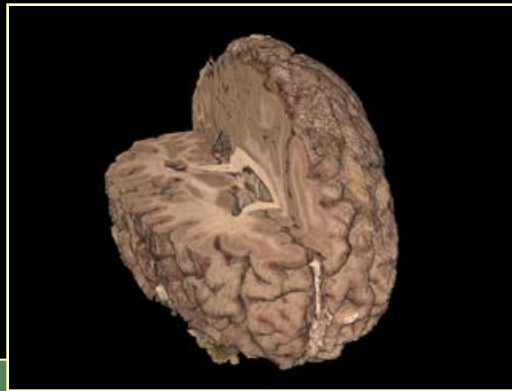
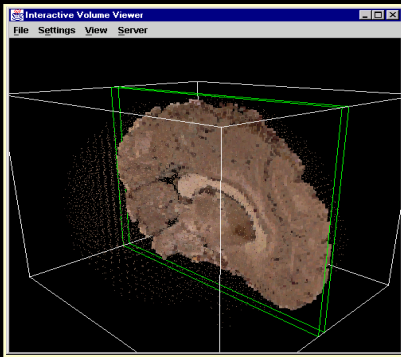
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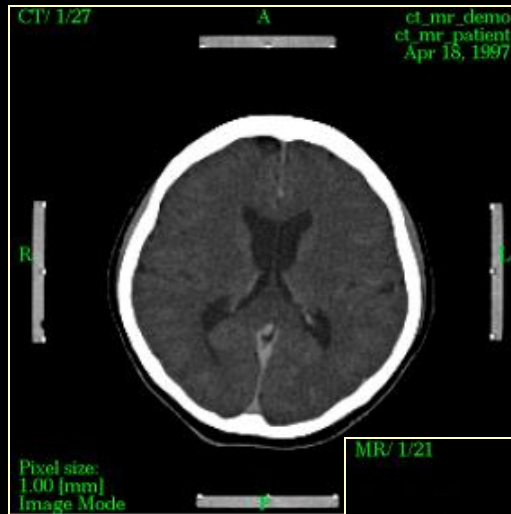
- Applications
 - **Examples of Multimedia Applications include:**
 - World Wide Web
 - Hypermedia courseware
 - Video conferencing
 - Video-on-demand
 - Interactive TV
 - Home shopping
 - Games
 - Virtual reality
 - Digital video editing and production systems
 - Multimedia Database systems



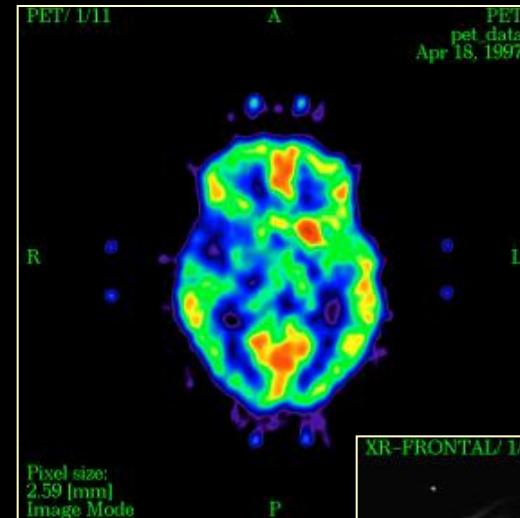
- **Reconstruction of 3D surface from medical images**
 - 2D -> 3D
 - different multimedial representation depending on user requests



- Medical Imaging



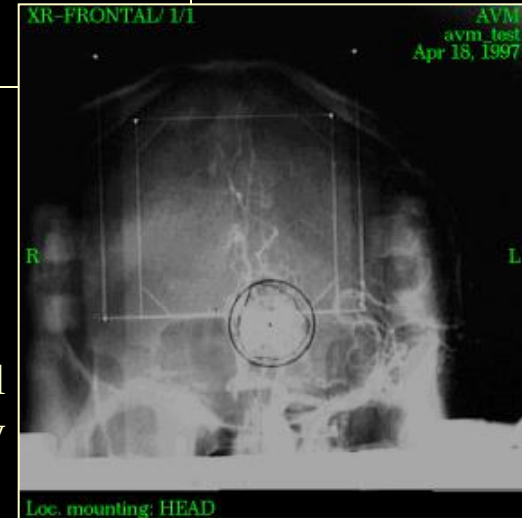
Computed
Tomography



Positron
Emission
Tomography



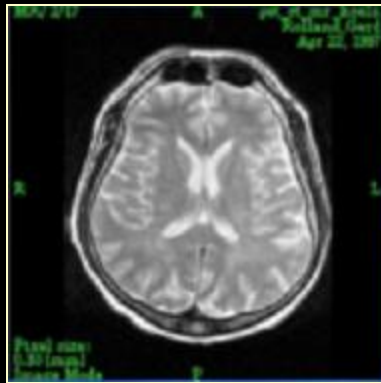
Magnetic
Resonance
Imaging



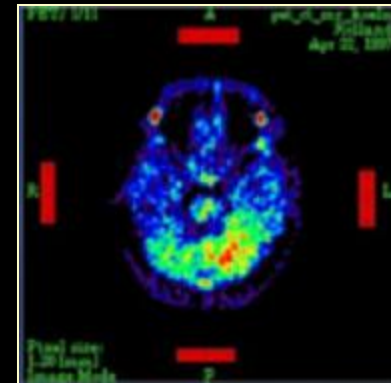
General
Radiology



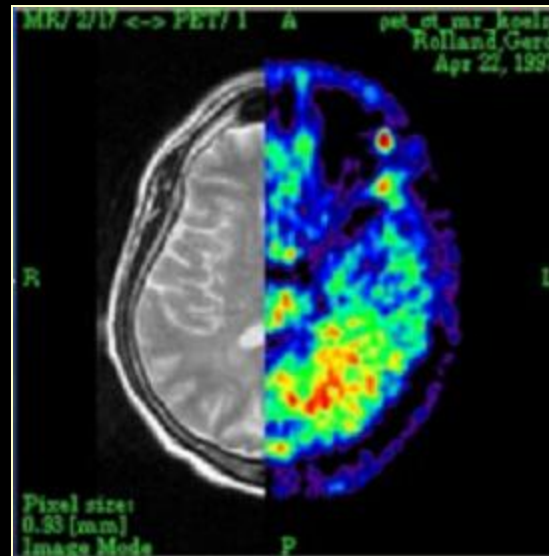
- Image fusion



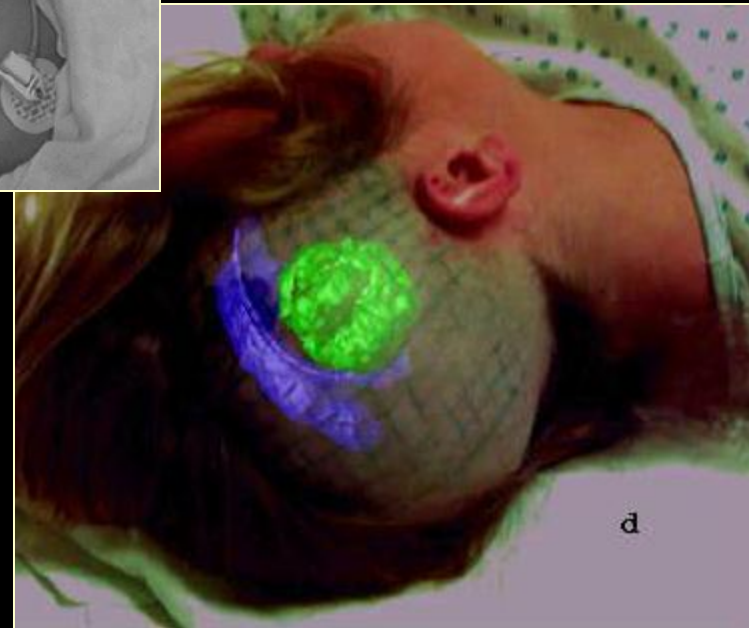
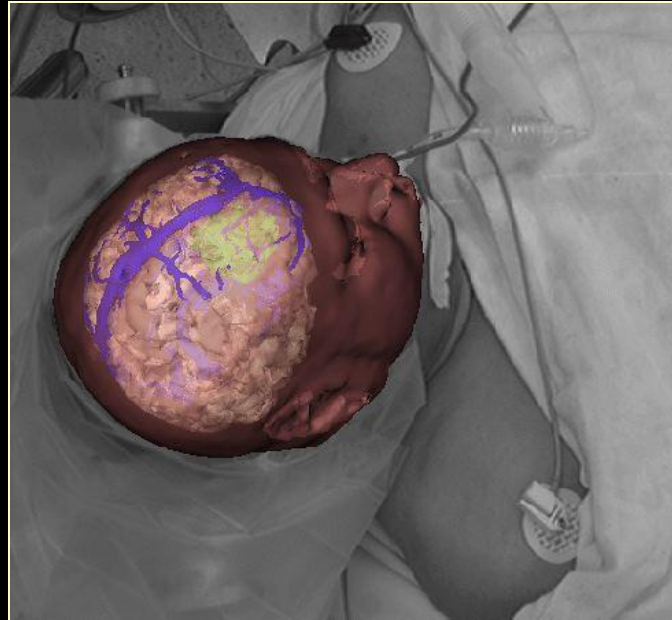
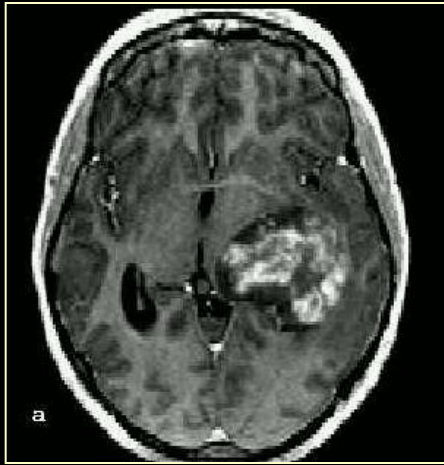
Magnetic
Resonance
Imaging



Positron
Emission
Tomography



- Visualization

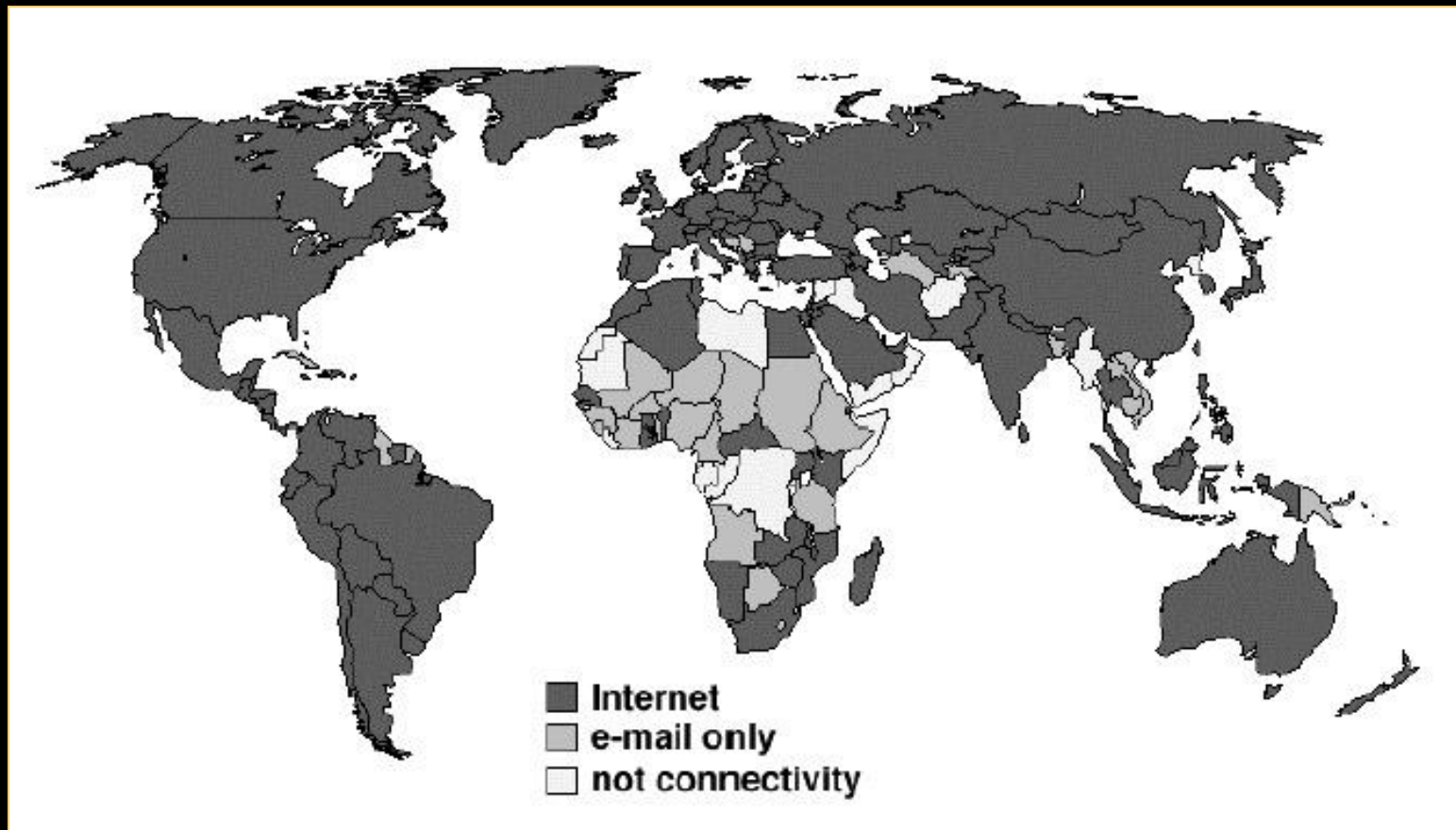


– **World Wide Web - hypermedial global communication**

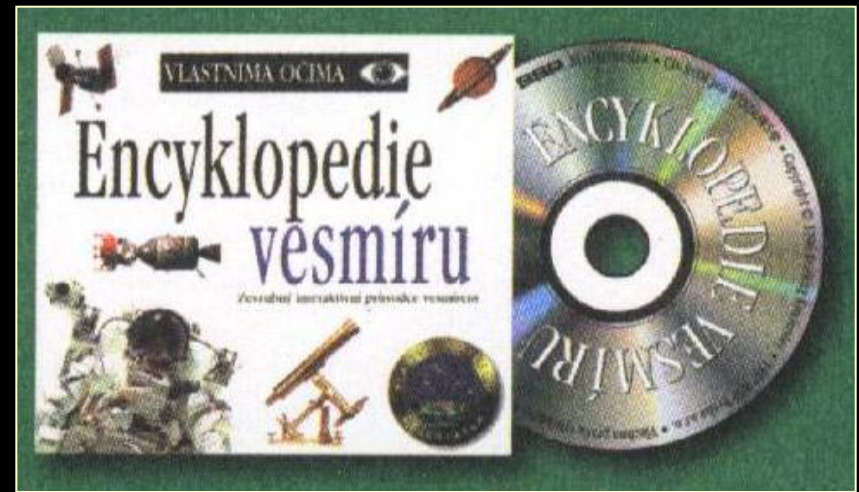
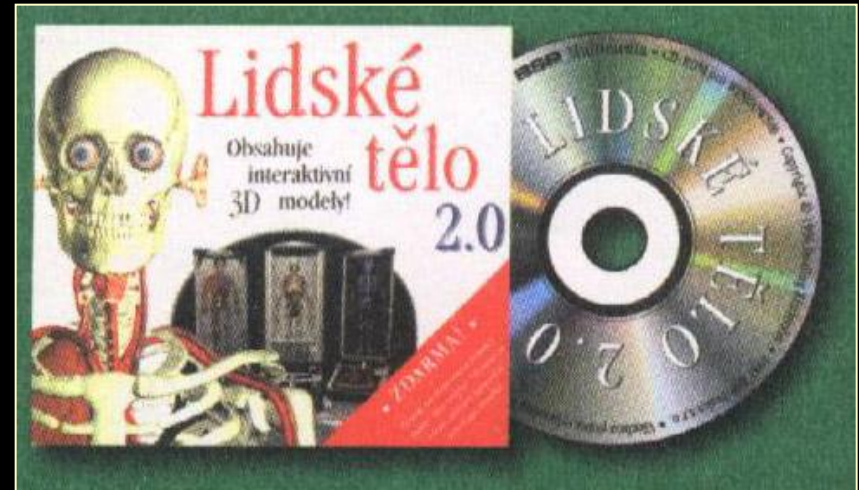
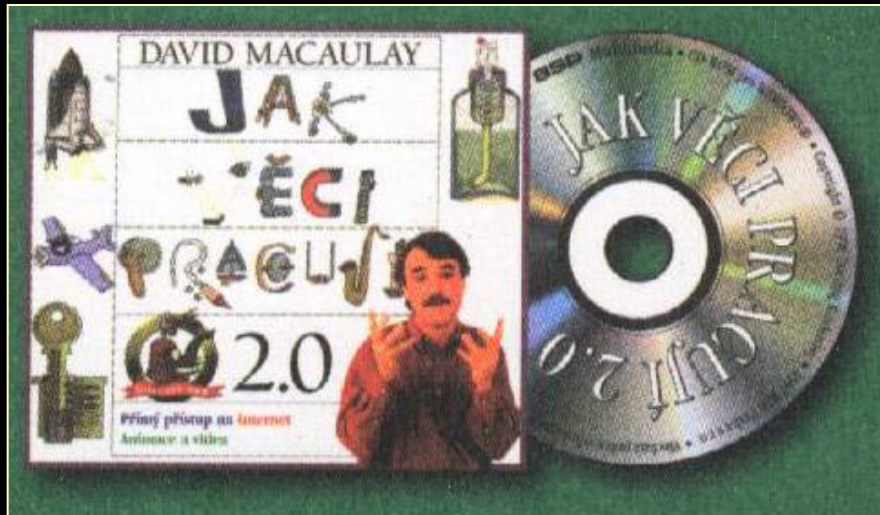
- ARPANET - 1969 transmission of first electronic message
- has spread over the world to global net INTERNET - connecting users
- e-mail, ftp, telnet, ... transport of images and music
- In 1989 Tim Barner-Lee World Wide Web project
 - introduced using of hypertext to facilitate network communication
- remove of formalism in communication and working with information
- documents in WWW are coded in HTML (HyperText Markup Language)
- Web server and Web client communicate using HTTP (HyperText Transmission Protocol)



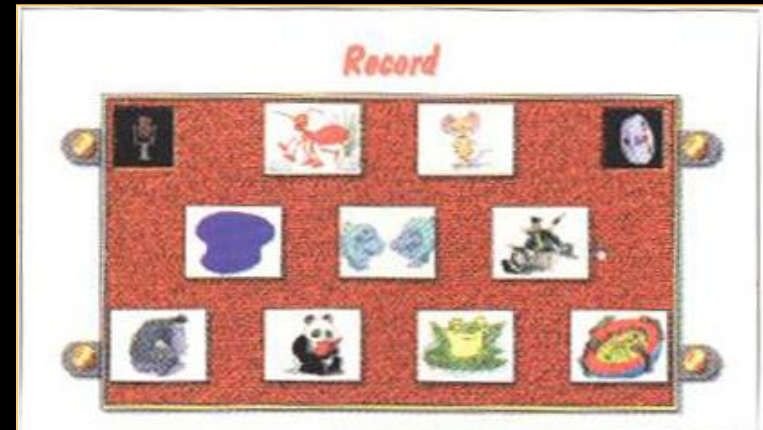
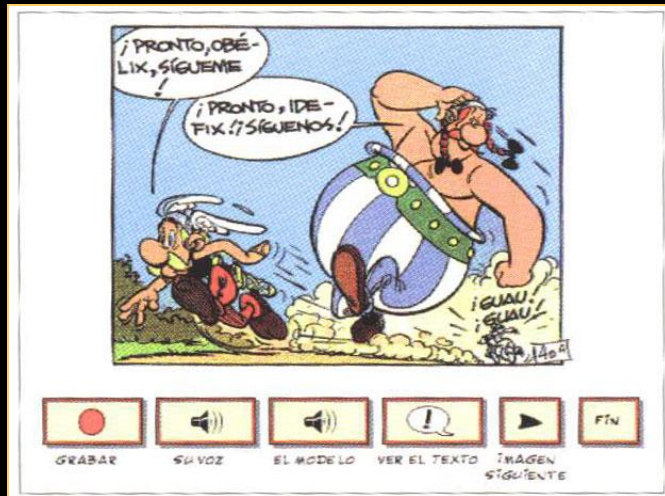
- Worldwide Internet Availability**



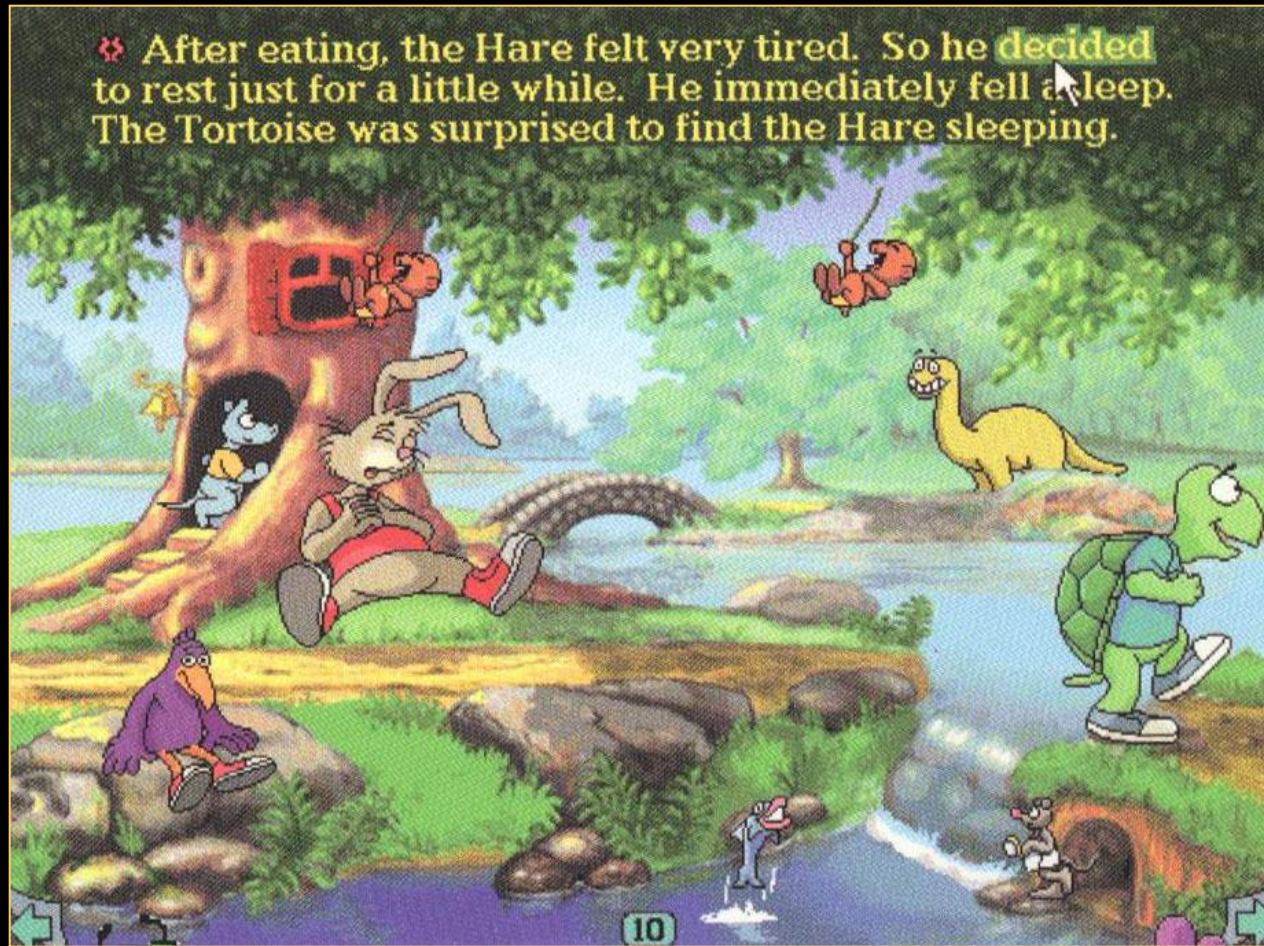
- Encyclopedia



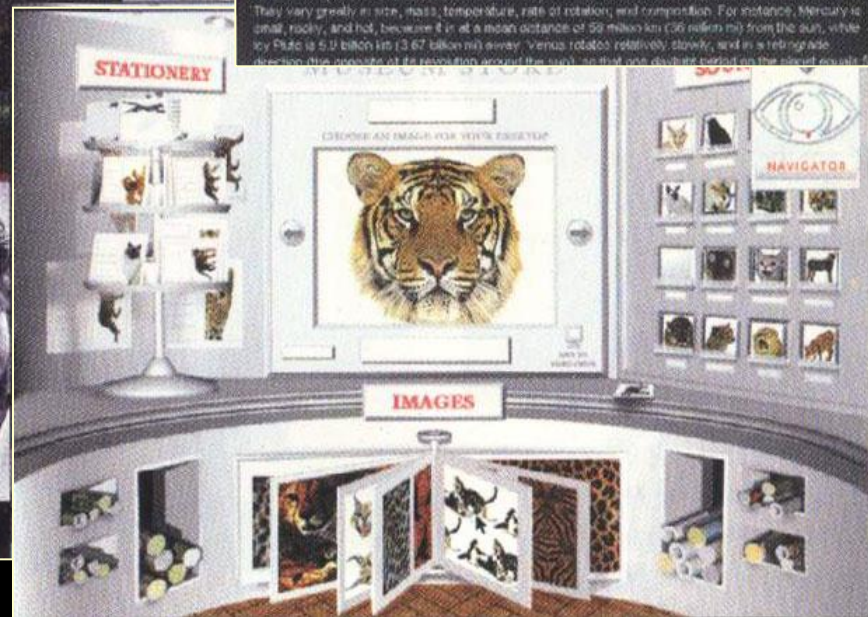
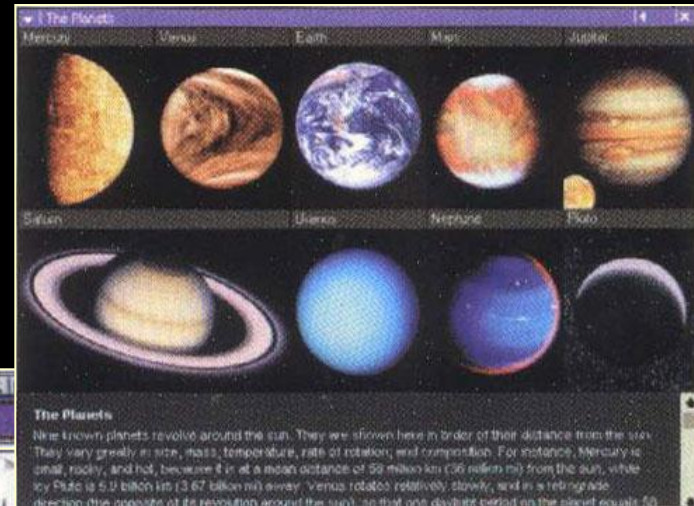
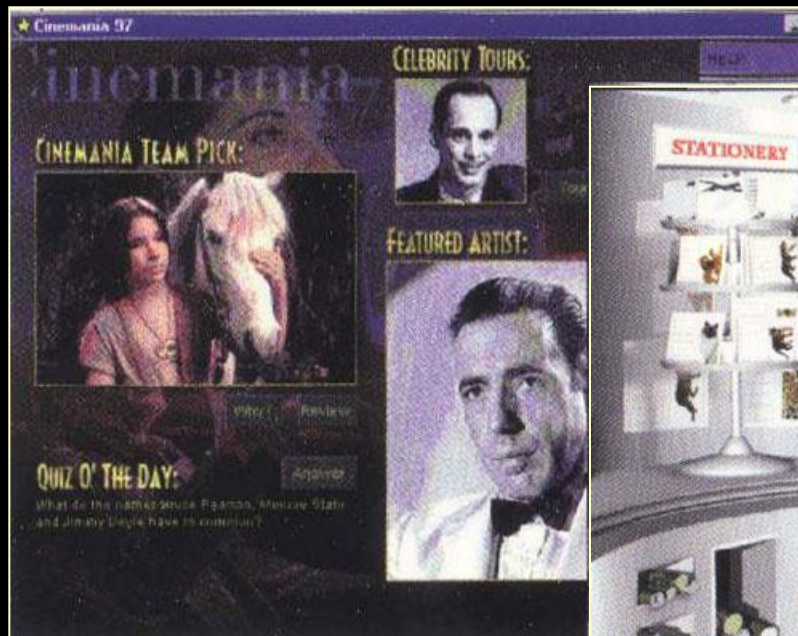
- Teaching - Languages



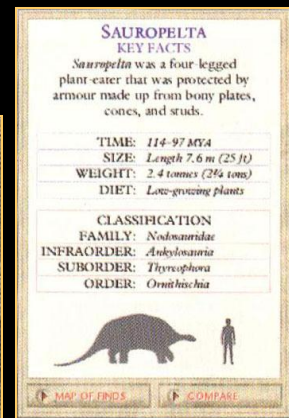
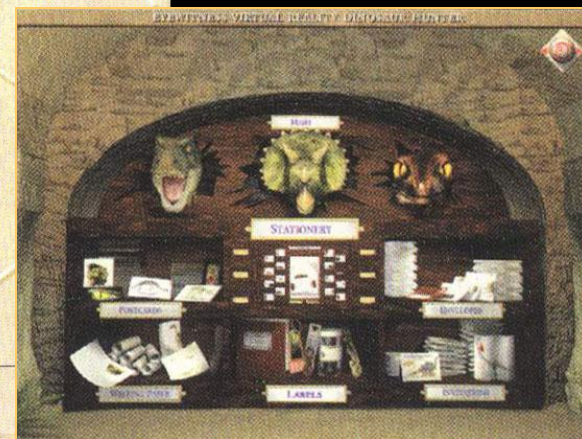
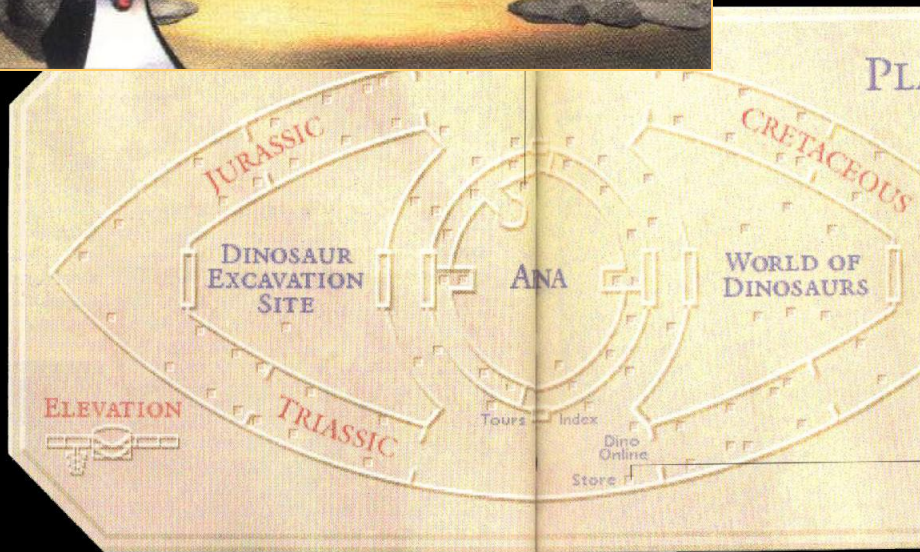
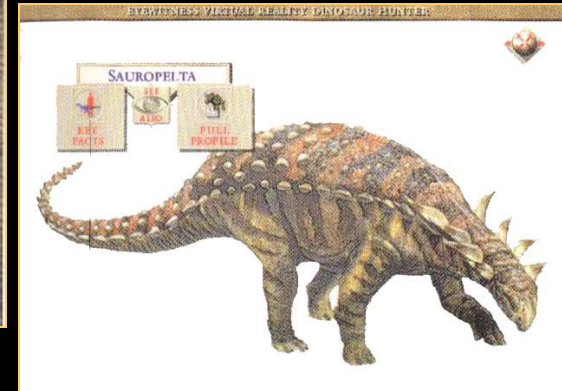
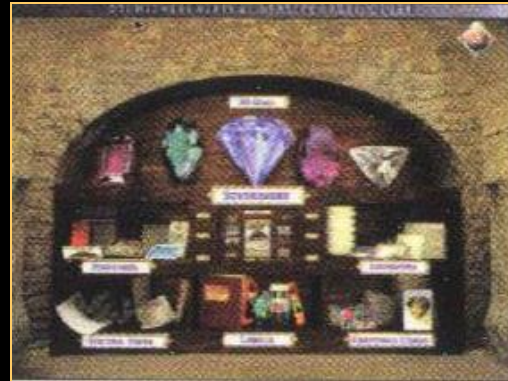
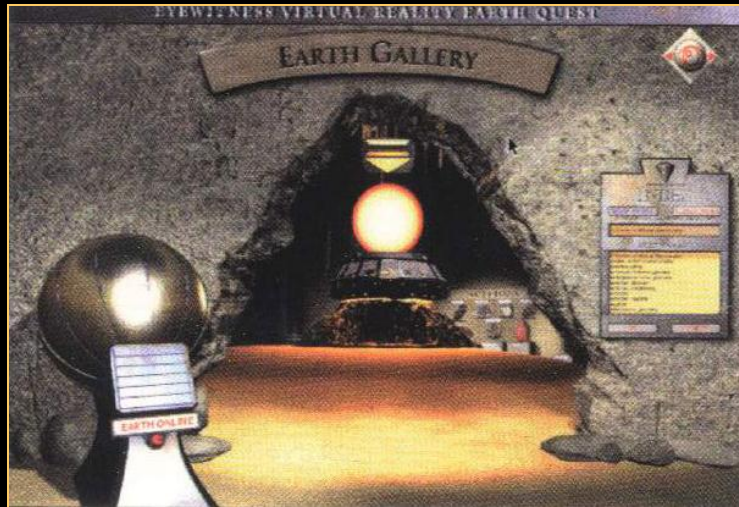
- Life book for children



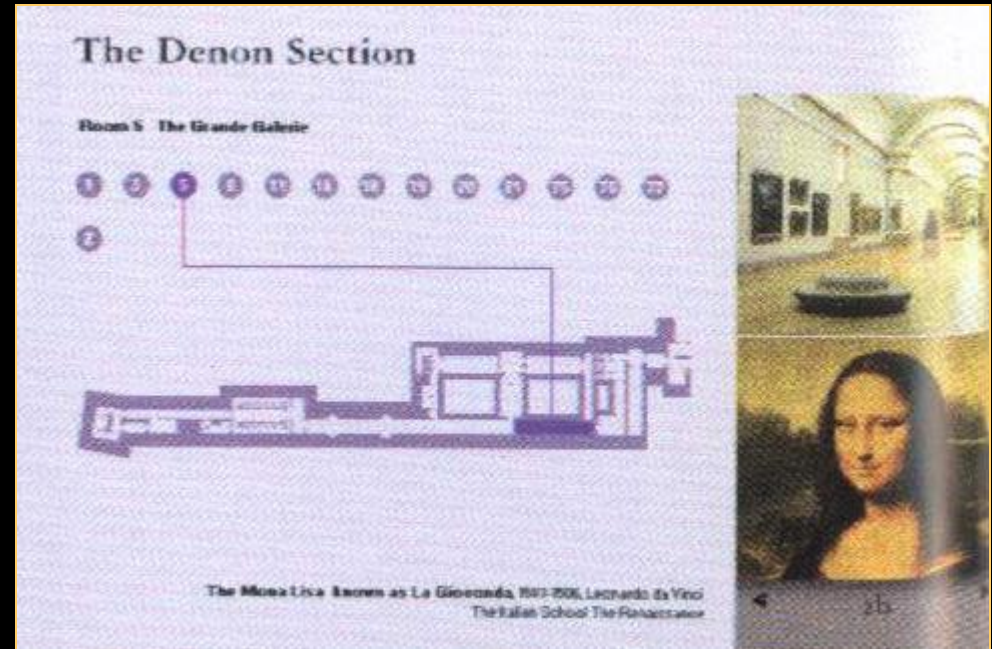
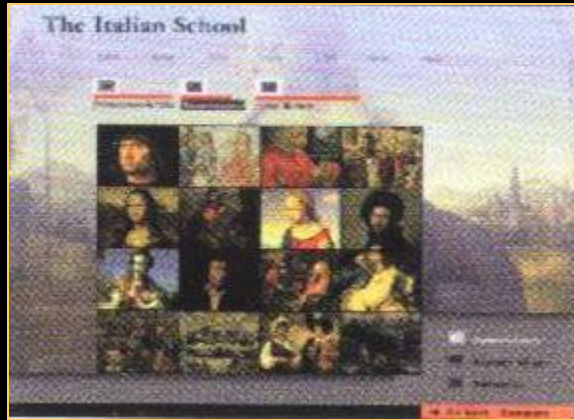
- **Electronic guidebooks**
 - Encarta 97
 - Cinemania
 - Virtual reality cat



- Virtual Museum



- Virtual Gallery



Gallery navigation



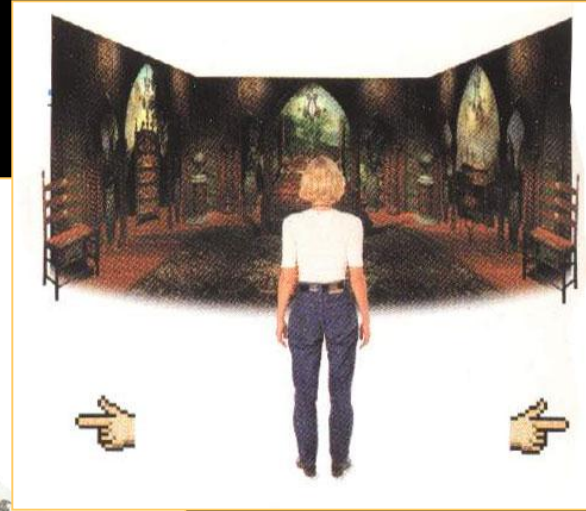
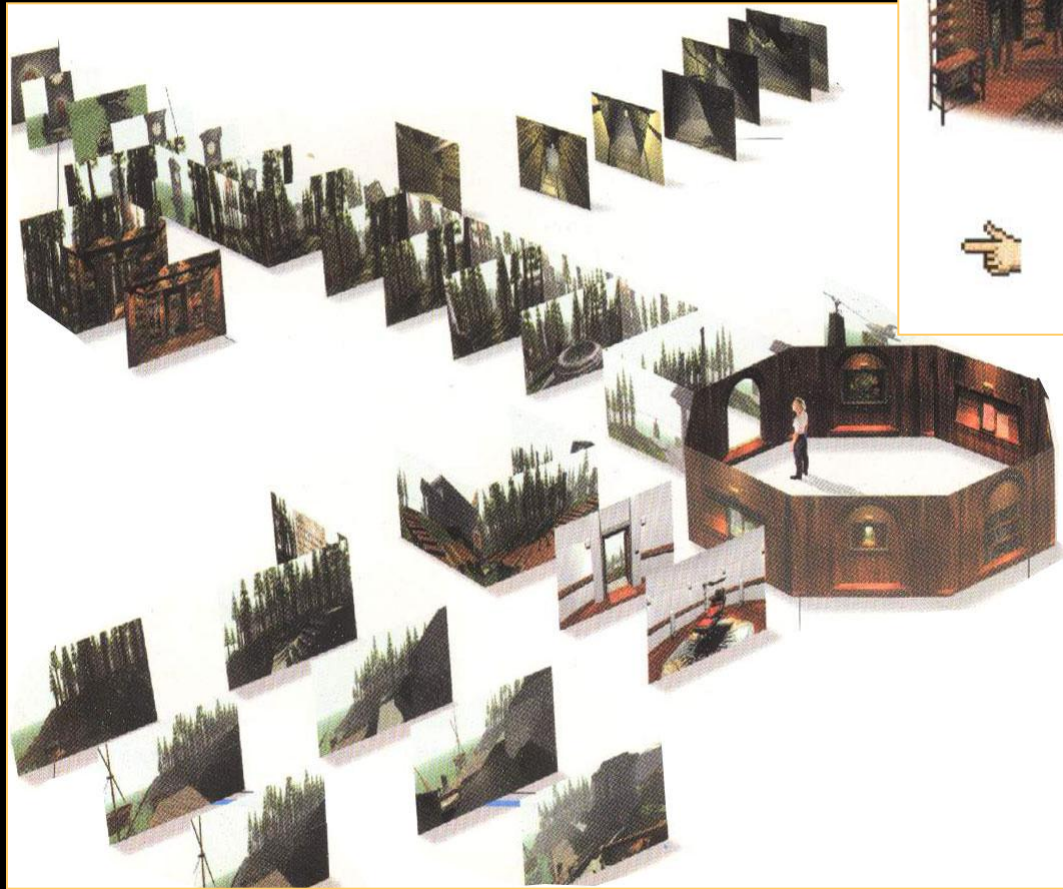
- Atlas



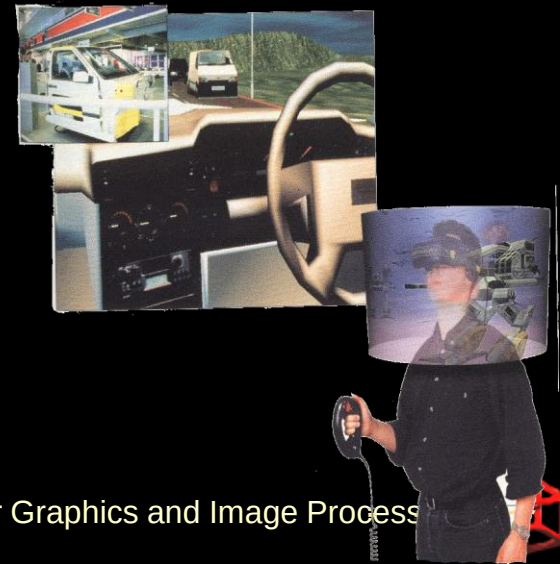
- 3D Atlas
- Magnifying



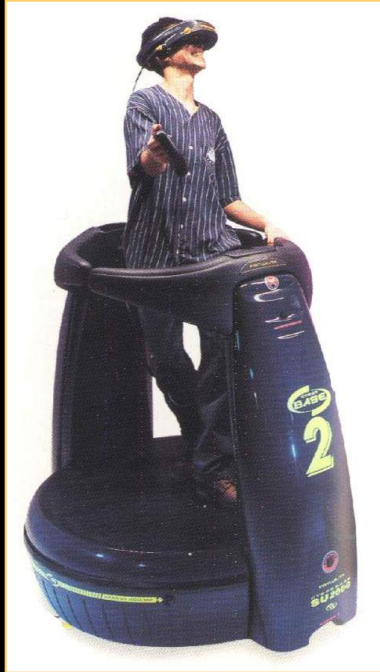
- Games



- Simulators



- Virtual Reality



- Comics & Cartoons

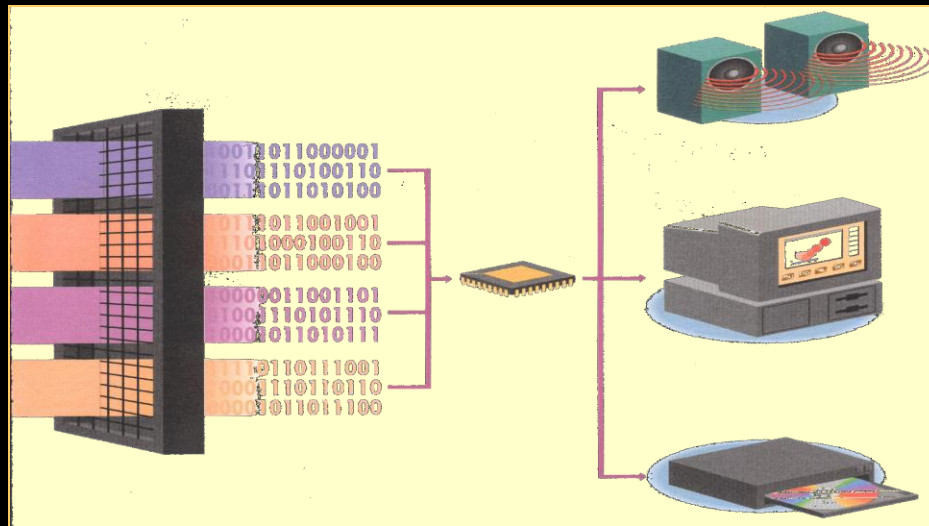
backgrounds



motions



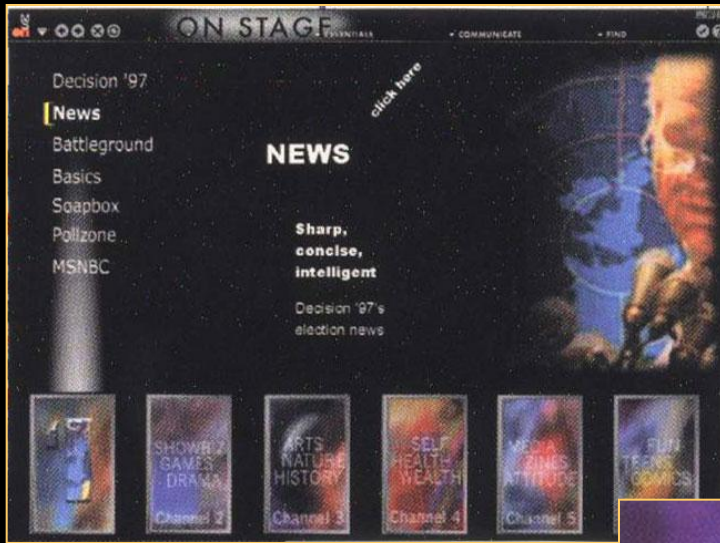
scene



sounds



- On-line services



- Services



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Authoring System

- What is an *Authoring System*?
 - An *Authoring System* is a program which has pre-programmed elements for the development of interactive multimedia software titles.
 - *Authoring systems* vary widely in orientation and capabilities.
 - A completely point-and-click automated authoring system?
 - authoring is actually just a *speeded-up* form of programming
 - you *don't need to know the intricacies* of a programming language, or an API
 - some knowledge of *heuristic thinking* and *algorithm design* is necessary
 - you do need to understand how *programs work*



Authoring System

- Why should you use an authoring system?
 - Creation of interactive multimedia project is faster (1/8th)
 - authoring system < > programming
 - Re-use of code
 - do not create something what already exists
 - easy to modify
 - similar project needs small modifications and new prototypes
 - Time is used for
 - prototyping (graphics, text, video, audio, animation, etc.)
 - interaction and flow scheme
 - Not for programing basics or something that already exists



Multimedia Authoring

- Authoring System
- Authoring Paradigms
- Programming vs. Authoring
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- Multimedia Software Tools
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Authoring Paradigms

- The *authoring paradigm*, or *authoring metaphor*, is the methodology by which the authoring system accomplishes its task
- There are various paradigms, including:
 - Scripting Language
 - Iconic/Flow Control
 - Frame
 - Card/Scripting
 - Cast/Score/Scripting
 - Hierarchical Object (OOP)
 - Hypermedia Linkage
 - Tagging



Authoring Paradigms

– Scripting Language

- close to traditional programming
- the centerpiece is a powerful *object-oriented scripting language*
- programming language, which specifies multimedia elements, sequencing, hotspots, synchronization, etc.
- the scripting paradigm tends to be *longer in development time* (it takes longer to code an individual interaction), but generally *more powerful interactivity* is possible.
- most Scripting languages *are interpreted*, not compiled



- The media handling can vary widely; check out your system with your contributing package formats carefully.

Examples of multimedia scripting languages :

Scripting Language	Authoring System	Created by
HyperTalk	HyperCard	Apple
OpenScript	ToolBook	Assymetrix
Lingo	Director	Macromedia

Example Lingo script “ to jump to a frame ”

```
global gNavSprite
on exitFrame
    go to frame
    play sprite gNavSprite
end
```



- The core of the paradigm is
 - the **Icon Palette**, containing the possible functions/interactions of a program and
 - the **Flow Line**, which shows the actual links between the icons.



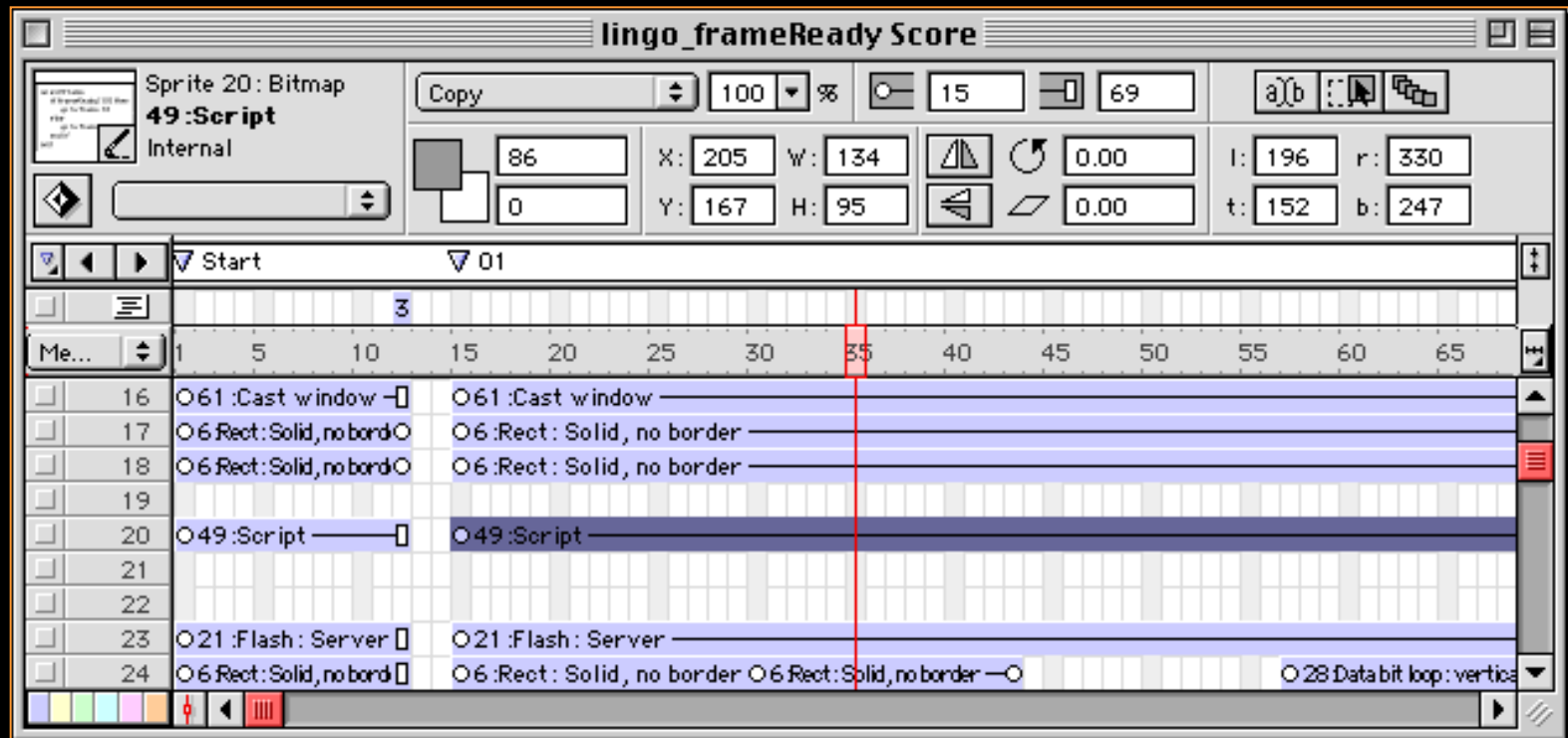
Authoring Paradigms

- This tends to be the **speediest** authoring style (in development time)
- It is best suited for **rapid prototyping** and **short-development time** projects
- Many of these tools are also optimized for developing Computer-Based Training (CBT)
- These programs tend to be the **slowest runtimes**, because each interaction carries with it all of its possible permutations
- The higher end packages, such as Authorware or IconAuthor, are **extremely powerful** and suffer least from runtime speed problems.

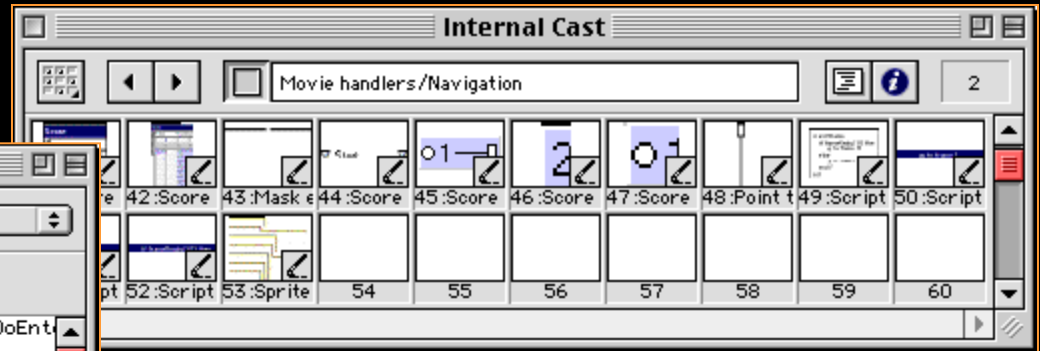
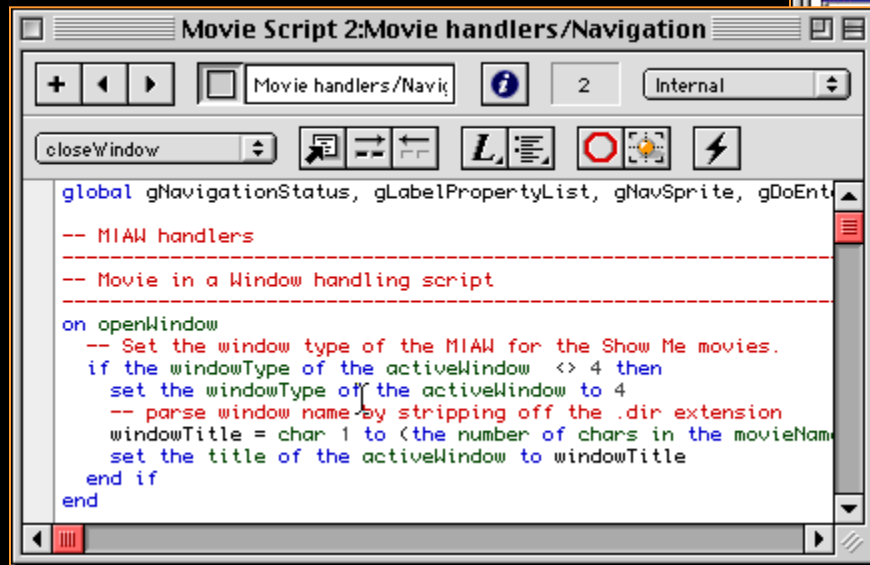


– Cast/Score/Scripting

- The Cast/Score/Scripting paradigm uses a **music score** as its primary authoring metaphor
- the synchronous elements are shown in various horizontal **tracks** with simultaneity shown via the vertical columns.



- The true power of this metaphor lies in the ability to script the behavior of each of the cast members.



- The most popular member of this paradigm is Director, which is used in the creation of many commercial applications.



Authoring Paradigms

– **Tagging**

- The Tagging paradigm uses **tags** in text files
 - to link pages
 - to provide interactivity
 - to integrate multimedia elements.
- SGML/HTML
- SMIL (Synchronised Media Integration Language)
- VRML, 3DML
- WinHelp



Multimedia Authoring

- Authoring System
- Authoring Paradigms
- Programming vs. Authoring
- Multimedia Applications Design
- Multimedia Software Tools
- Examples



Programming vs. Authoring

- Multimedia Programming vs. Multimedia Authoring
 - It should be noted that a distinction should be made between Programming and Authoring.
 - Authoring involves the assembly and bringing together of Multimedia with possibly *high level graphical interface design* and some *high level scripting*.
 - Programming involves *low level* assembly and construction and control of Multimedia and involves real languages like C and Java.



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Multimedia Applications Design

- Content design
- Technical design
- Visual design
- Creation of MM Application



- Content design deals with: “*What to say, what vehicle to use.*”
- "In multimedia, there are many ways to format and deliver your message”
- You can *write* it, *illustrate* it, *wiggle* it, *hear* it, and *interact* with it
- In close future we can add *taste*, *smell* and *touch*

- **Scripting (*writing*)**

Rules for good writing:

1. Understand your audience and *correctly address* them
2. Keep your writing as simple as possible
 - write out the full message(s) first, then shorten it
3. Make sure technologies used *complement each other*



– Graphics (*illustrating*)

- Make use of pictures to *effectively* deliver your messages
- Create your own (draw, (color) scanner, PhotoCD, ...)
- Keep "copy files" of art works
- Graphics Styles
 - fonts
 - colors
 - pastels
 - earth-colors
 - metallic
 - primary color
 - neon color



– Animation (*wiggling*)

1. Types of Animation

- Character Animation - humanize an object (a toothbrush, a car, a coke bottle, ...)
- Factors in choosing a character
 - Emotion - Is it happy, sad, funny, ...?
 - Movement - Is it fast, slow, ...?
 - Visual style - Is its color/texture consistent with the rest?
 - Copyright - "Don't use Mickey before checking with Walt."
 - Adequacy - Does it provide various poses? (can't make a broomstick sit!)
- Highlights and Sparkles - to pop a word in/out of the screen
to sparkle a logo ==> to draw attention
- Moving Text - put up one character at a time like a typewriter
- Video - live video or digitized video
 - more powerful than still images
 - often easier to obtain than graphics animation
 - takes a lot of disk space
 - sometimes needs special hardware



2. When to Animate

"A leaf doesn't flutter if the wind doesn't blow. "

Only animate when it has a specific purpose

- Enhance **emotional** impact
 - dove softly flapping its wings -> peace
 - air bag explosion + dummy movements -> car crash.
- **Demonstration**
 - show insertion of a memory chip onto the motherboard (much better than a diagram)
- Improve **information delivery**
 - "pulsing" words (in and out of screen) adds emphasis
- Indicate **passage of time**
 - clock/hourglass -> program still running
 - animated text -> to prompt for interaction/response
- Provide a **transition** to next subsection
 - Wipes - L-to-R, T-D, B-U, diagonal, center to edge, ...

Dissolve - the current image distorts into an unrecognizable form before the next clear image appears, (boxy dissolve, cross dissolve, ...)

Fade - a metaphor for a complete change of scene

Cut - immediate change to next image - for making story points using close-up



– **Audio (*hearing*)**

Types of Audio in Multimedia Applications:

Music

set the mood of the presentation, enhance the emotion, illustrate points

Sound effects

to make specific points - squeaky doors, explosions, wind, ...

Narration

speech, natural sounds - most direct message, often effective



– Interactivity (*interacting*)

- interactive multimedia systems
- people remember 70% of what they interact with
- Types of Interactive Multimedia Applications:
 1. Menu driven programs/presentations
 - a hierarchical structure (main menu, sub-menus, ...)
 2. Hypermedia
 - less structured, cross-links between subsections of the same subject
=> non-linear, quick access to information
 - easier for introducing more multimedia features (more interesting "buttons")
 - !could sometimes get lost in navigating the hypermedia
 3. Simulations / Performance-dependent Simulations
 - Games (SimCity, Flight Simulators)
 - VR devices for interaction



Multimedia Applications Design

- Content design
- Technical design
- Visual design
- Creation of MM Application



– Technical Design

Technological factors may limit the ambition of your multimedia application:

Technical parameters affect the design and delivery of multimedia applications

Video Mode	Resolution	Colors
-----	-----	-----
CGA	320 x 200	4
MCGA	320 x 200	256
EGA	640 x 350	16
VGA	640 x 480	256
S-VGA	1,024 x 768	\$>\$= 256
S-VGA	1,280 x 1,024	\$>\$= 256
	:	
	:	
	:	
16-bit color	--\$>\$	65536 colors
24-bit color	--\$>\$	16.7 million colors

- **1. Video Mode and Computer Platform**
 - PC <-> Macintosh
 - There are many "portable", "cross-platform" software and "run-time modules", but many of them lose quality/performance during the translation.



- **2. Memory and Disk Space Requirement**
 - Rapid progress in hardware alleviates the problem, but software is too "greedy", especially the multimedia ones.
- **3. Delivery**
 - Live Presentation

Short checking list for hardware/software requirements:

 - type of graphics card
 - video memory (1 MB, 2 MB, 4 MB, ...)
 - access time of hard disk (important for real-time video)
 - type of sound card (support for General MIDI)
 - audio-video software
 - Delivery by diskette
 - small in size
 - slow to install
 - Delivery by CD-ROM
 - Large capacity
 - Access time of CD-ROM drives is longer than hard-disk drives
 - Electronic Delivery (ftp, www, ...)
 - depends on baud rate
 - network connection
 - monthly bill



Multimedia Applications Design

- Content design
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– Visual Design

Factors that should be considered in the visual design:

1. Themes and Styles

- Should have a consistent theme/style
(it should not be disjointed and cluttered with multiple themes)
- The choice of theme/style depends on the styles and emotions of your audience

– Some Possible Themes:

- Cartoon theme
interesting / entertaining
must be consistent with the character's personality
- High tech theme
modern computer art work (morphing, texture mapping, explosions, ...)
attractive, easy to animate
- Technical theme
include plan, 3D models of the product, ...
start with a drawing, then transformed into a rendered image
shows adequate technical information
- Natural and floral
(outdoor scenes - mountains, lakes, ...) -> getting back to nature
- Oil paints, watercolours, colored pencils, pastels
these art styles can be combined with e.g., cartoon or high tech themes



2. Basic Layout

- (a) Title
 - (b) Action area
 - (c) Narration
 - (d) Dialog
 - (e) Interactive controls
- make sure that the information delivery path in the layout is smooth, not irregular/jumpy
 - use headlines/subtitles, additional shapes, buttons, fonts, backgrounds and textures to enhance the visual appearance



3. Useful Rules

- Do not use too many text information
- objects should be readable
- Good background for easy reading
- size of the text should be adequate of its meaning
- Allow a block of text to be slowly read twice
- Show pictures at least for 5 seconds
- Transition time should be an indication of real-time
 - a) dissolve - time delay, scene change
 - b) cut - two views of same scene at same time, or abrupt scene change
- bright colors takes attention
- do not use too many colors
- build in breaks for long presentations



- Content design
- Technical design
- Visual design
- Creation of MM Application
 - **MM Project Perfect Vision**
 - **Preparation**
 - **Production**
 - **Promotion**
 - **Distribution**
 - **Re-edition**



Creation of MM Application

- MM Project Perfect Vision
- Preparation
- Production
- Promotion
- Distribution
- Re-edition



- What? (MM Project **Topic Area**)
- Who will use it?(Who will be **user**)
- General or special MM Project? (**Content** of MM Project)
- How to deliver MM Project to user? (**Distribution media**)
- What all you need? (MM Project **Costs** - bills, money, stuff)
- Is it actual? (**Market review**)
- Is it possible and effective?



- Preparation
 - Scenario
 - Flow diagram
 - Visual demonstrations
- producent
- art redactor
- interface designer
- content designer
- main programator

Jak správně seřadit barvy na vašem video monitoru.

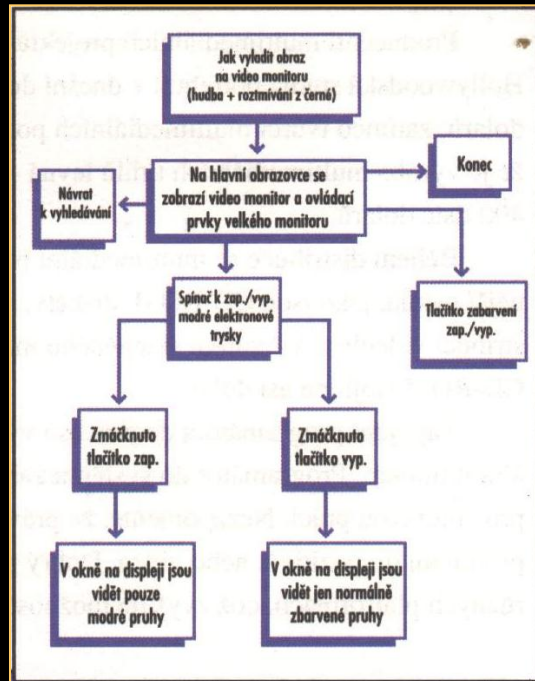
B14. Správné nastavení monitoru má rozhodující význam pro všechny stolní video aplikace, zvláště při animaci nebo videografickém návrhu.

Chcete-li vidět, jak můžete seřadit barvy pomocí barevných pruhů, stačí kliknout na dřevěný panel pod video monitorem.

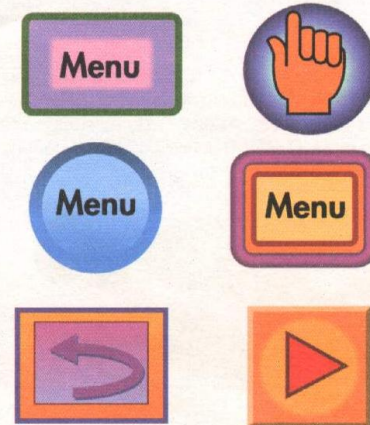
B15. Pokud nejsou barvy seřazeny, můžete se dále informovat o všech ovládacích prvcích, jaké mívají dobré video monitory. Těch hlavních, které potřebujete k seřízení barev, je poměrně dost.

Klikněte na ovládací panel.

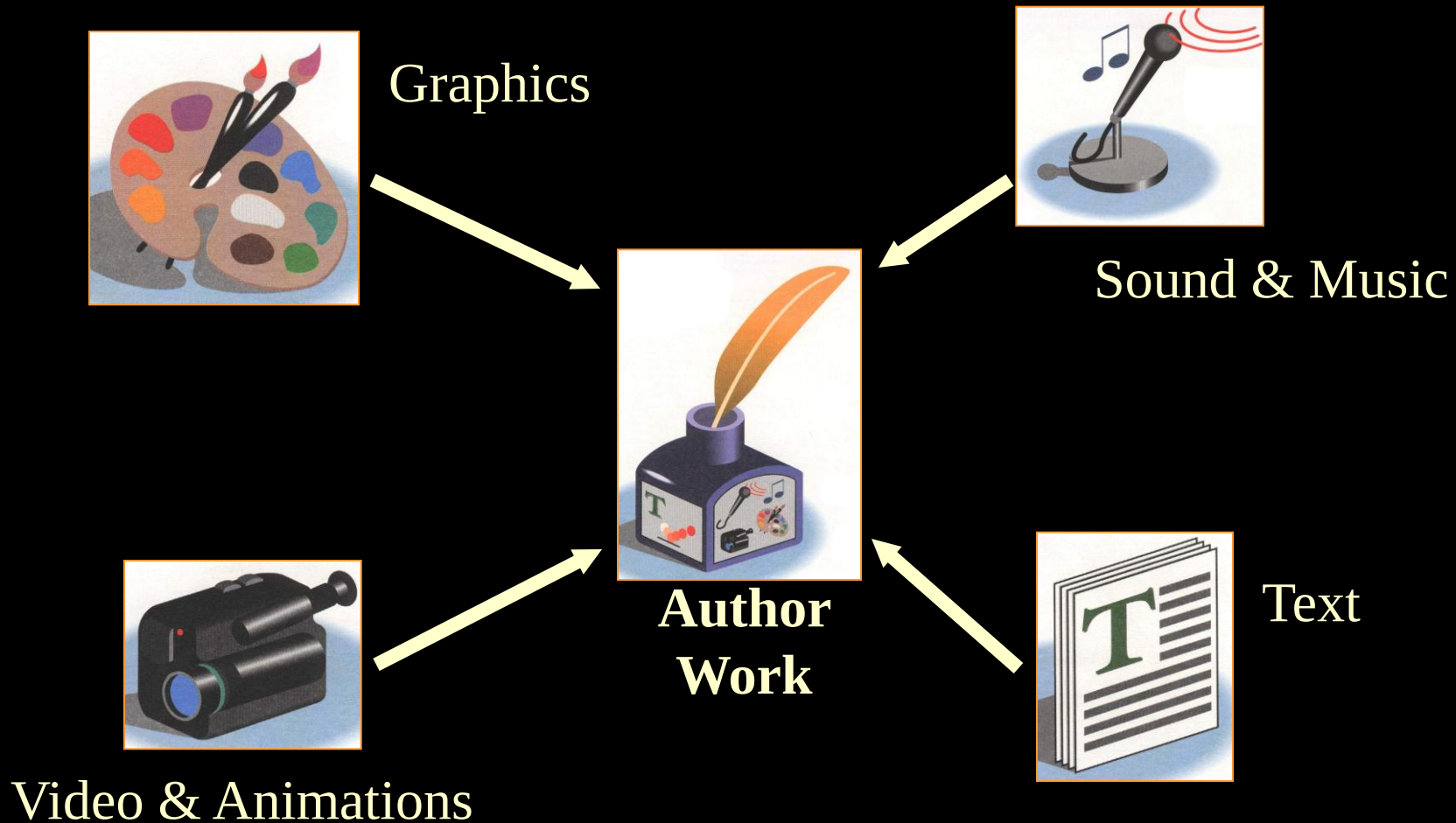
B16. Spínač modré elektronové trysky vypne zbývající dvě (červenou a zelenou), takže vidíte obraz pouze v modré barvě. Toto je tlačítko k ovládání video



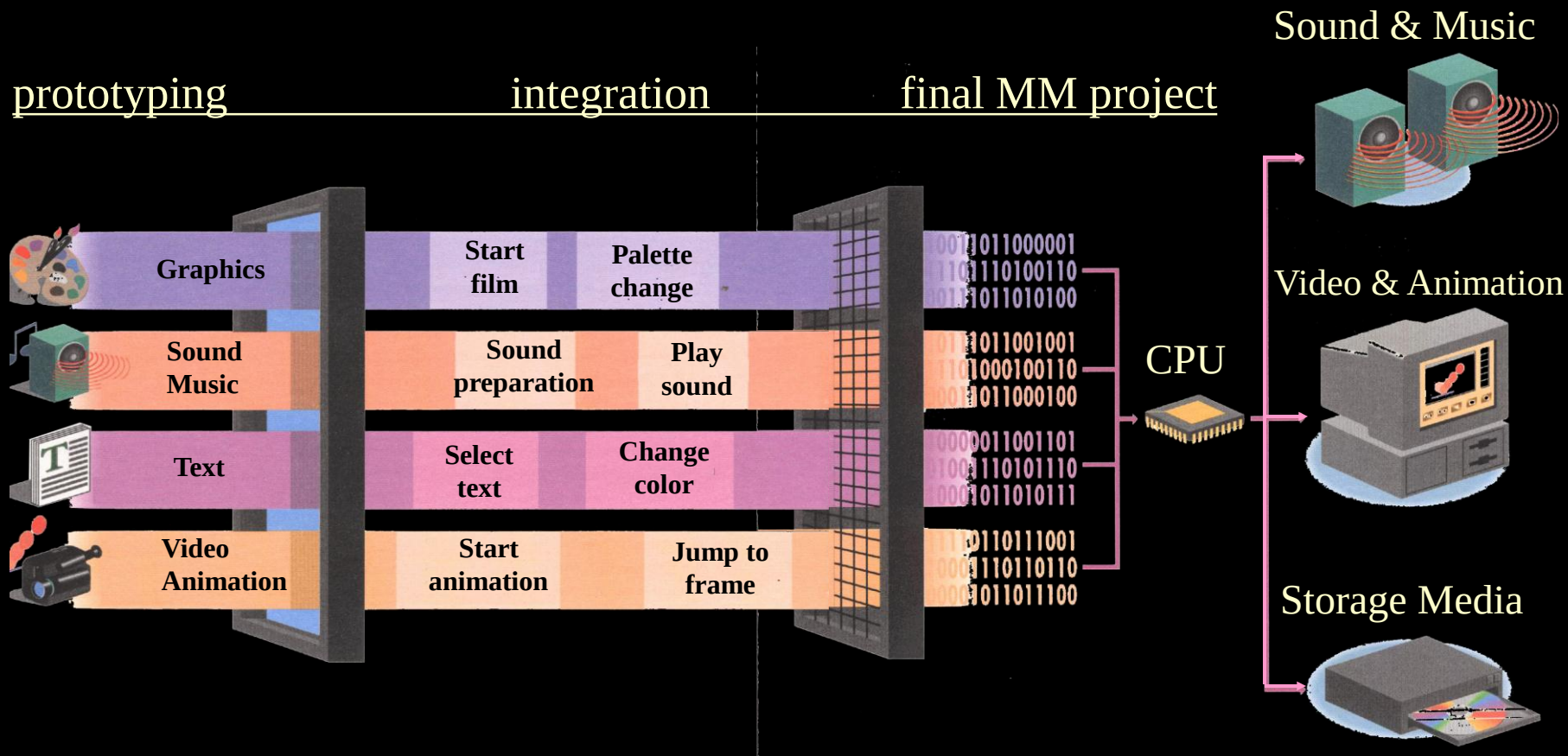
Typy tlačítek



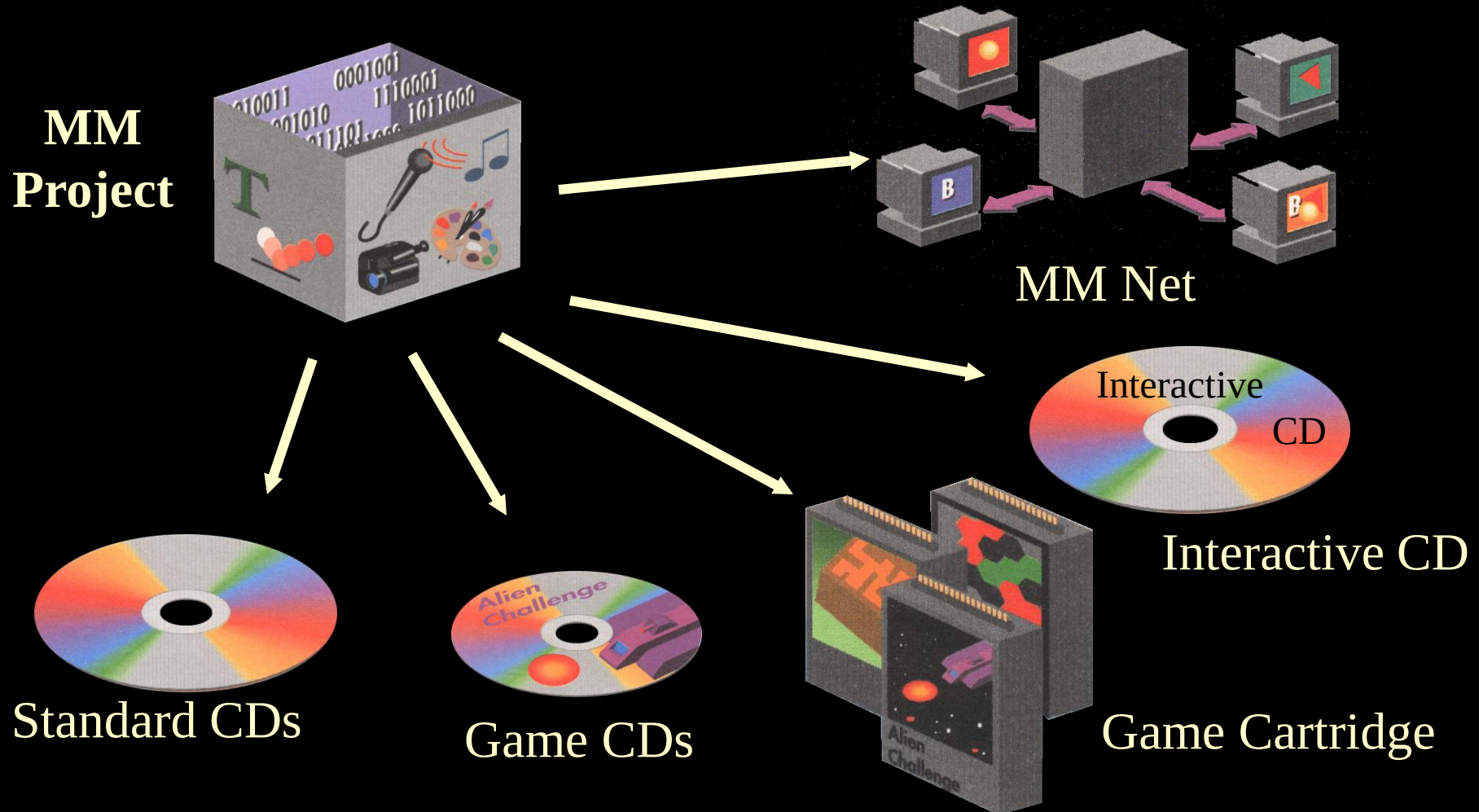
- Creation (prototyping) and Integration of media



- Creation (prototyping) and Integration of media



- Distribution to user by different media types



- Image advertising
 - package design
 - poster design
 - image sentence
- Kinds of promotion
 - depending on user of MM Project
 - Radio, TV, Billboards
 - offer to companies, organizations, schools, ...



- To repair mistakes made in previous version
- To remove functionality bugs
- To enhance
 - functionality
 - contents
 - any other part of presentation
- To upgrade

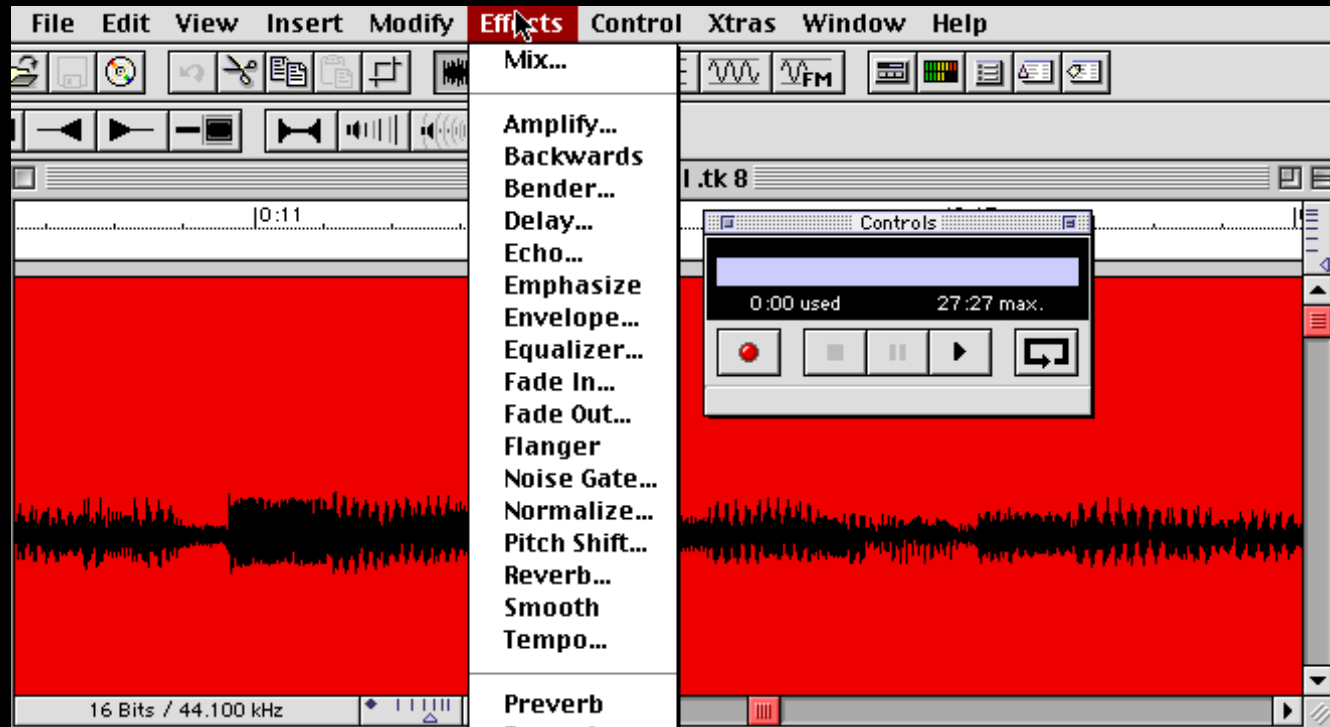


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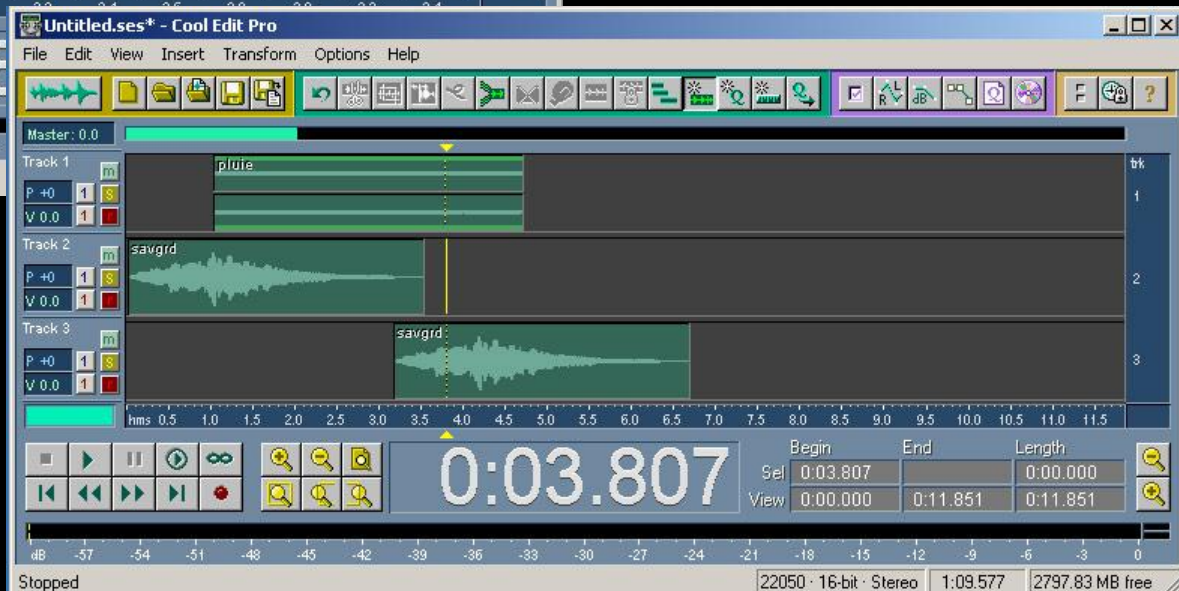
- Overview of Multimedia Software Tools
 - Digital Audio
 - **Macromedia Soundedit** - Edits a variety of different format audio files, apply a variety of effects



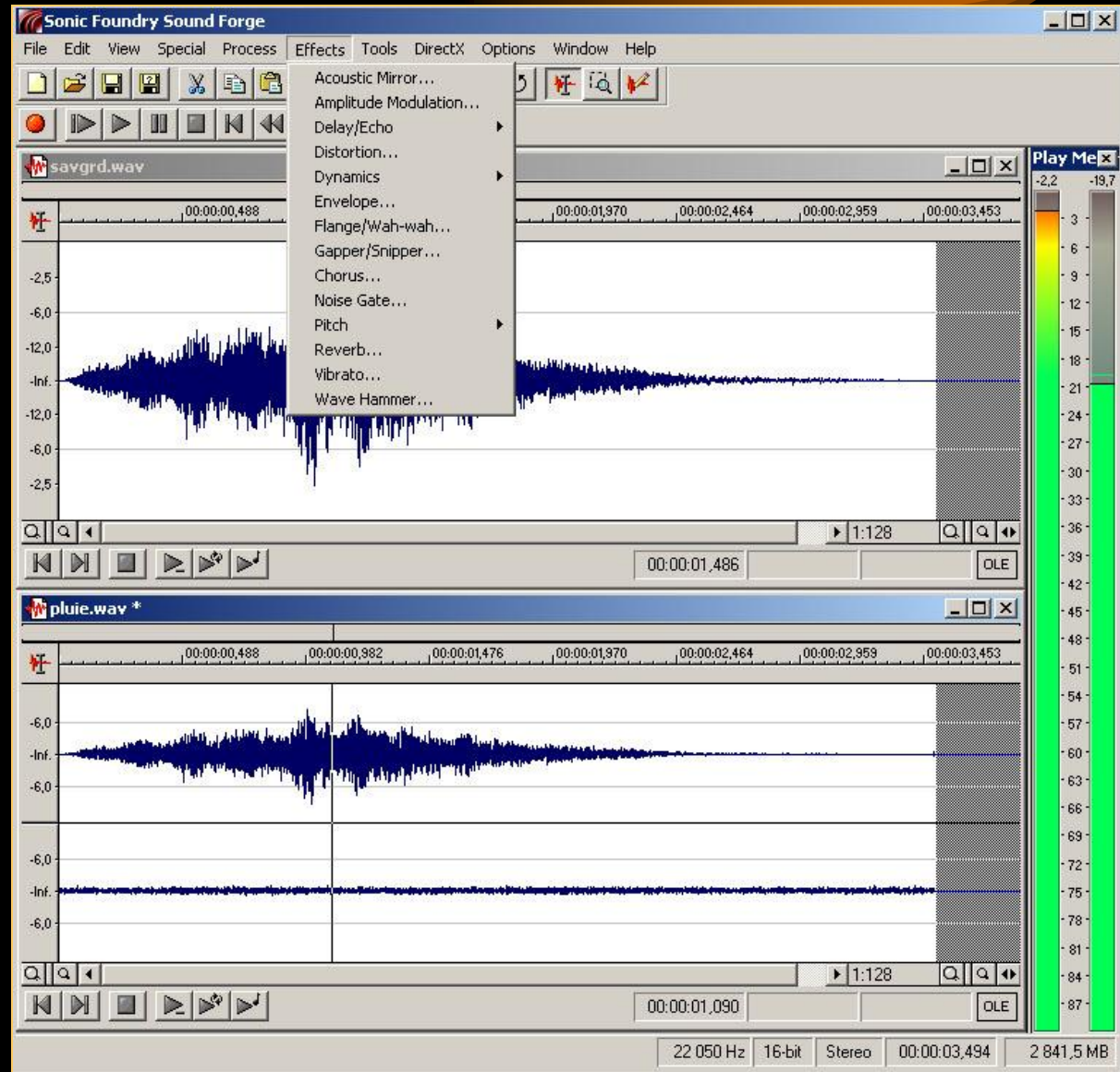
- Macromedia Soundedit Main and Control Windows and Effects Menu



- **CoolEdit - Edits a variety of different format audio files**



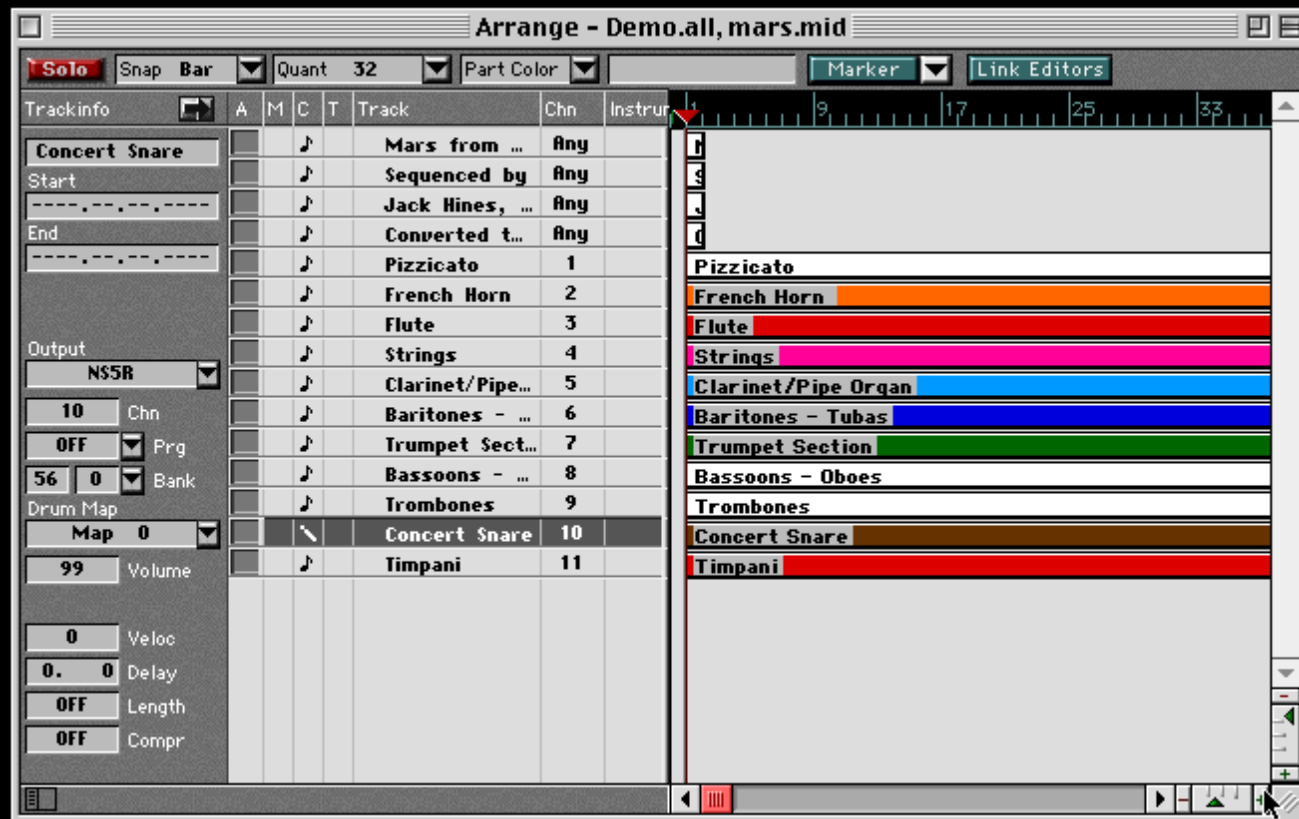
- Sound Forge



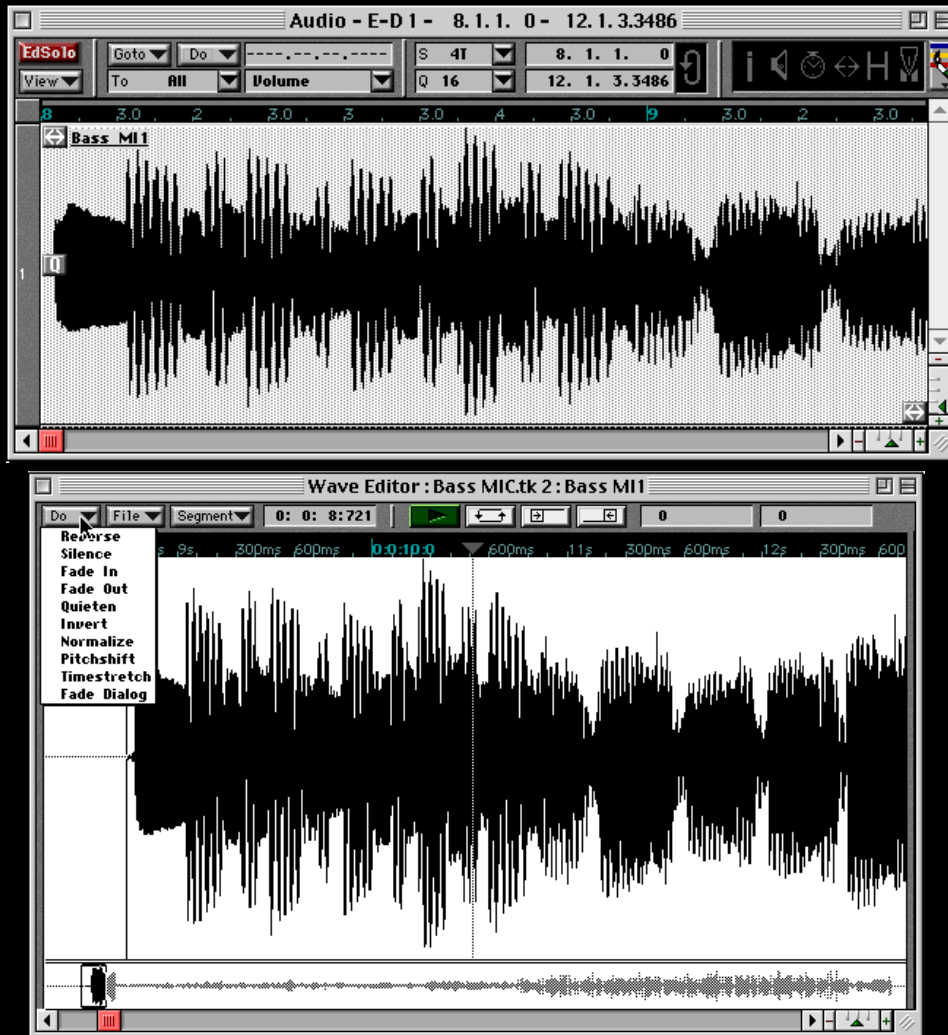
- Music Sequencing and Notation
 - **Cakewalk**
 - Supports General MIDI
 - Provides several editing views (staff, piano roll, event list) and Virtual Piano
 - Can insert WAV files
 - **Cubase**
 - A better software than Cakewalk Express
 - Intuitive Interface to arrange and play Music
 - Wide Variety of editing tools including Audio



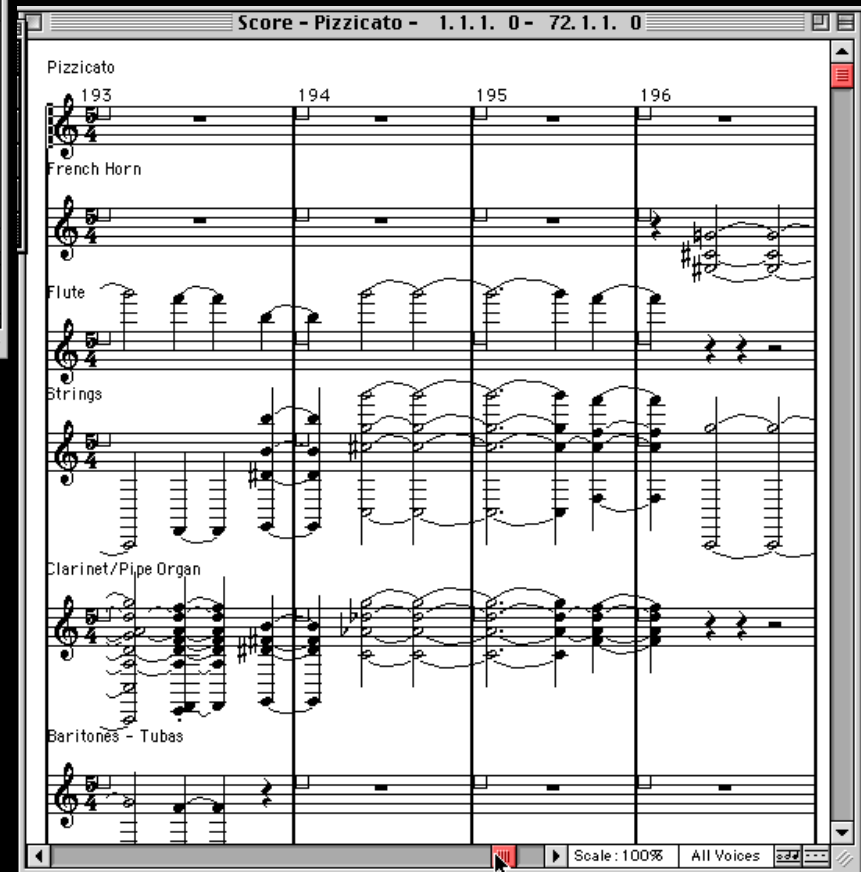
Cubase Arrange Window (Main)



Cubase Audio Editing Window & Editing Functions



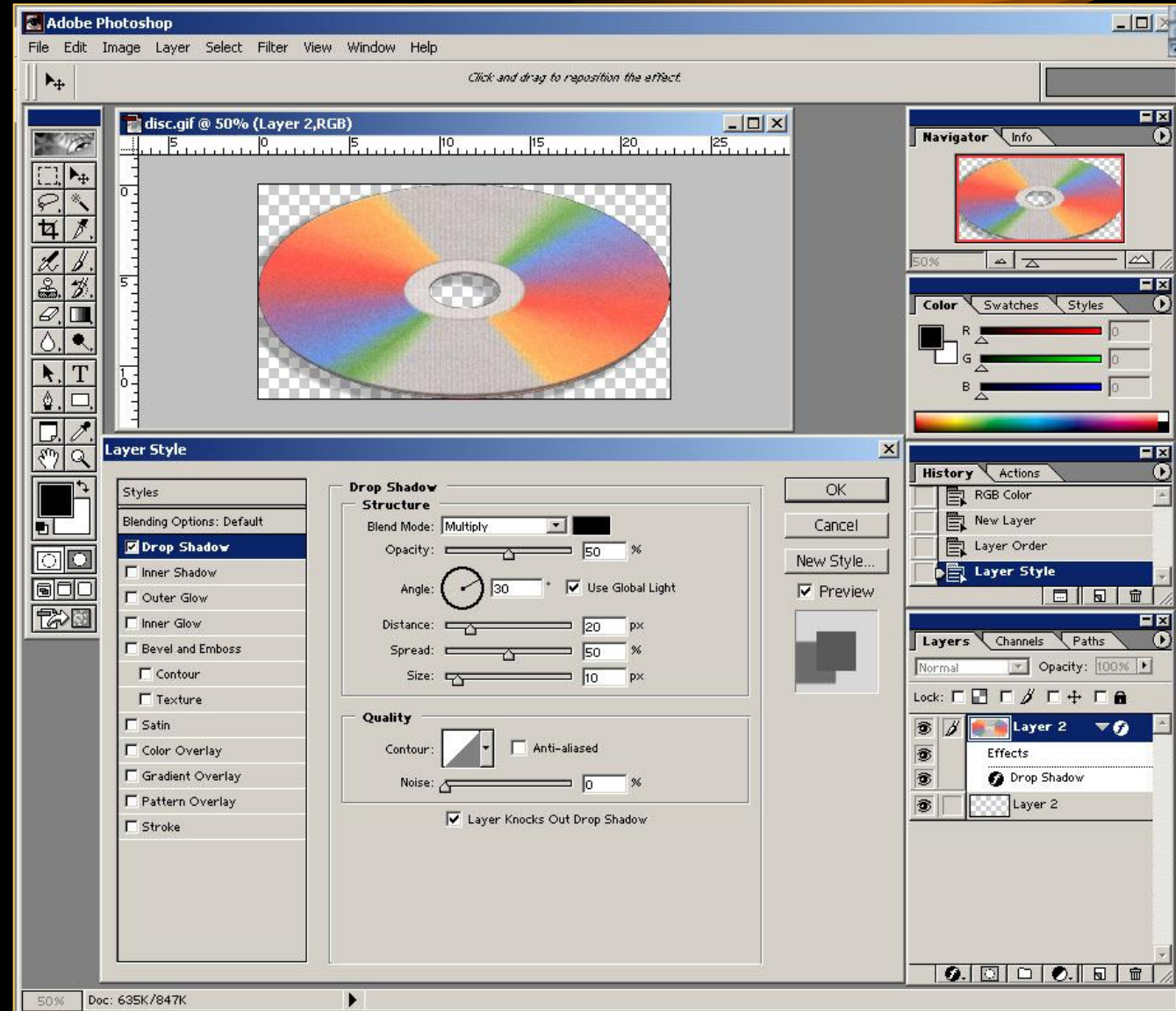
Allows printing of notation sheets
Score Editing Window



– Image/Graphics Editing

- **Adobe Photoshop**

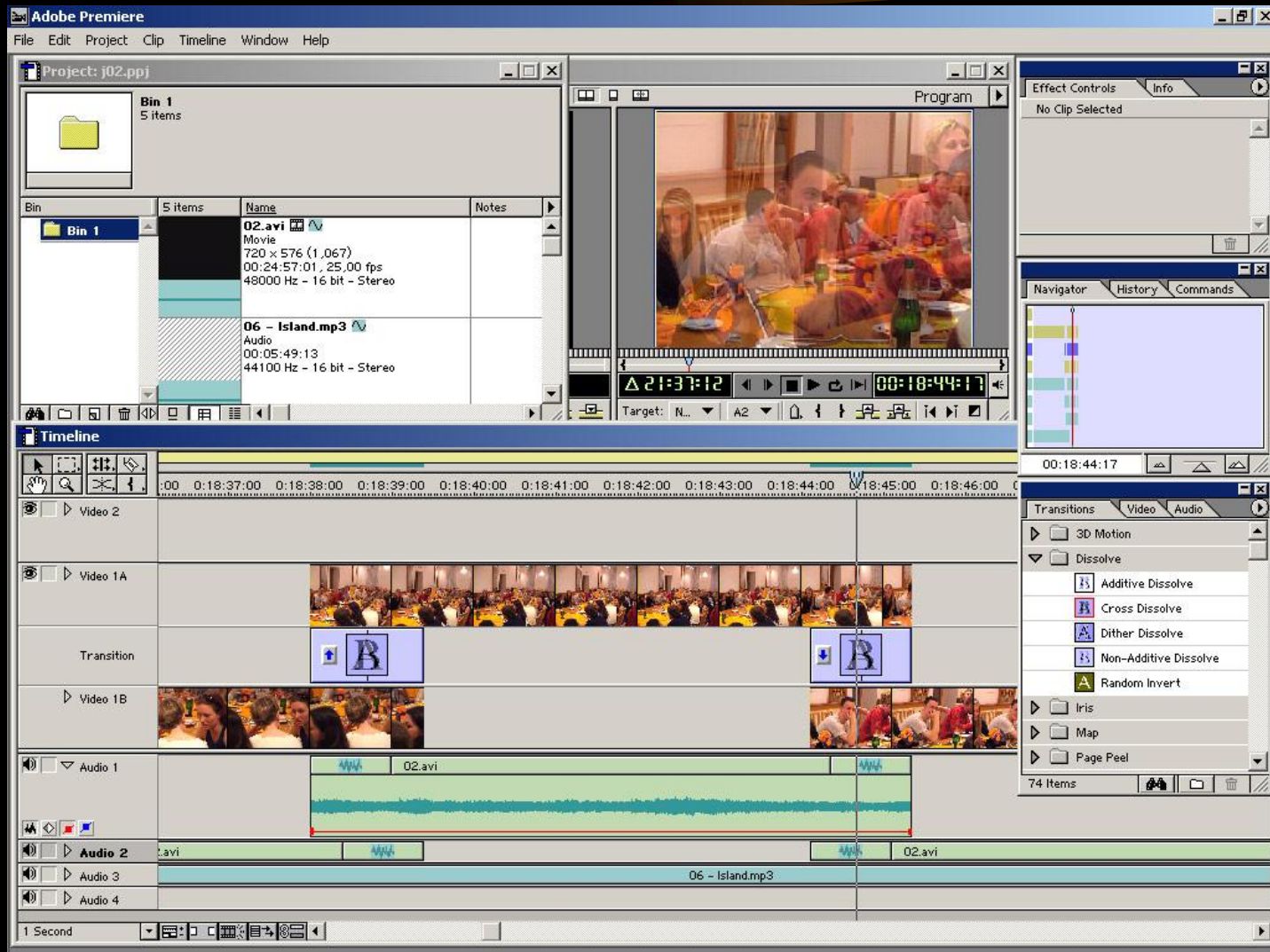
- Allows layers of images, graphics and text
- Includes many graphics drawing and painting tools
- Sophisticate lighting effects filter
- A good graphics, image processing and manipulation tool



– Video/Graphics Editing

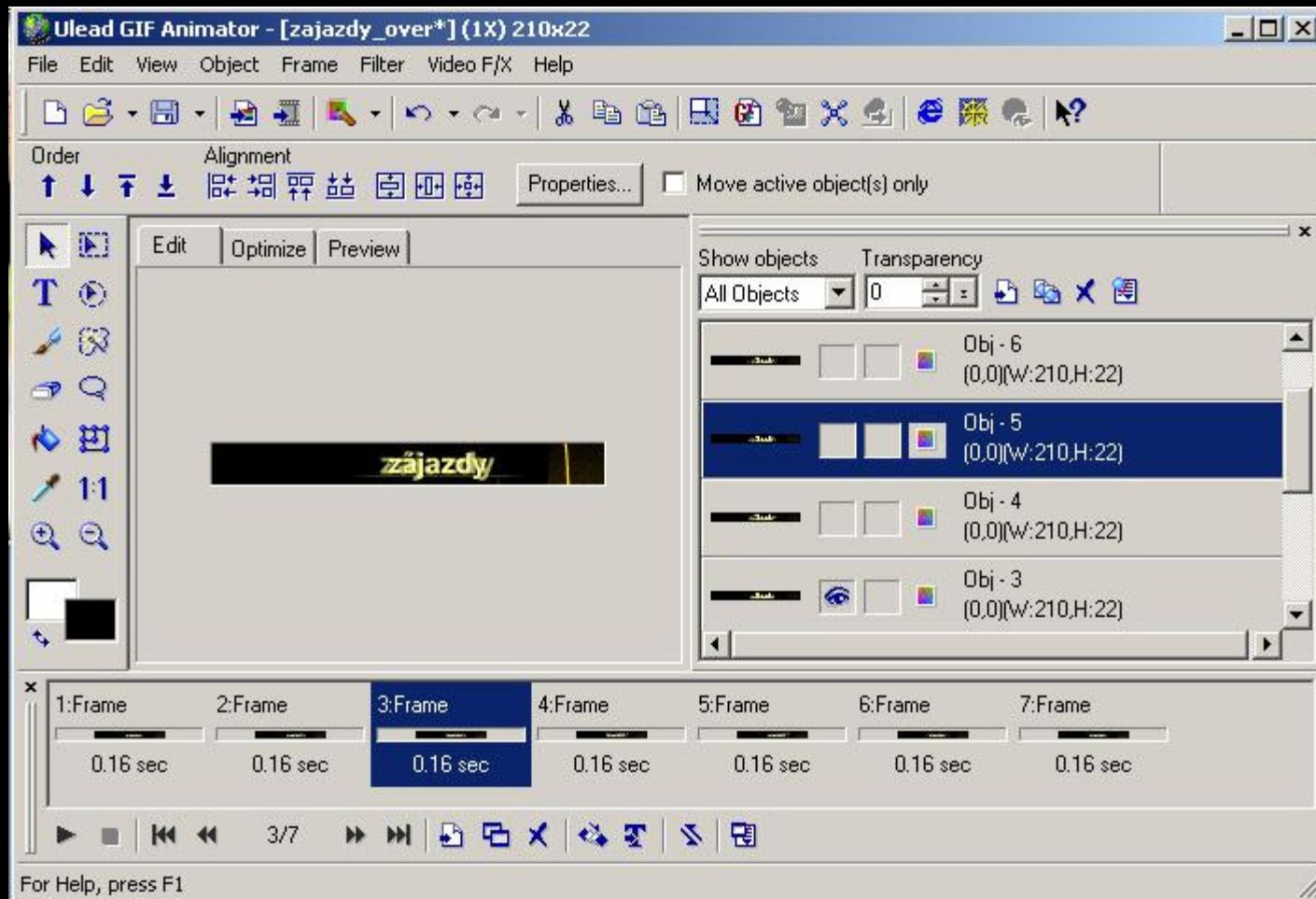
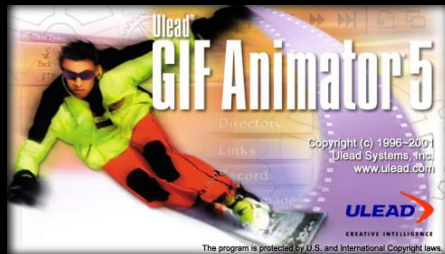
- **Adobe Premiere**

- Provides large number (up to 99) of video and audio tracks, superimpositions and virtual clips
- Supports various transitions, filters and motions for clips



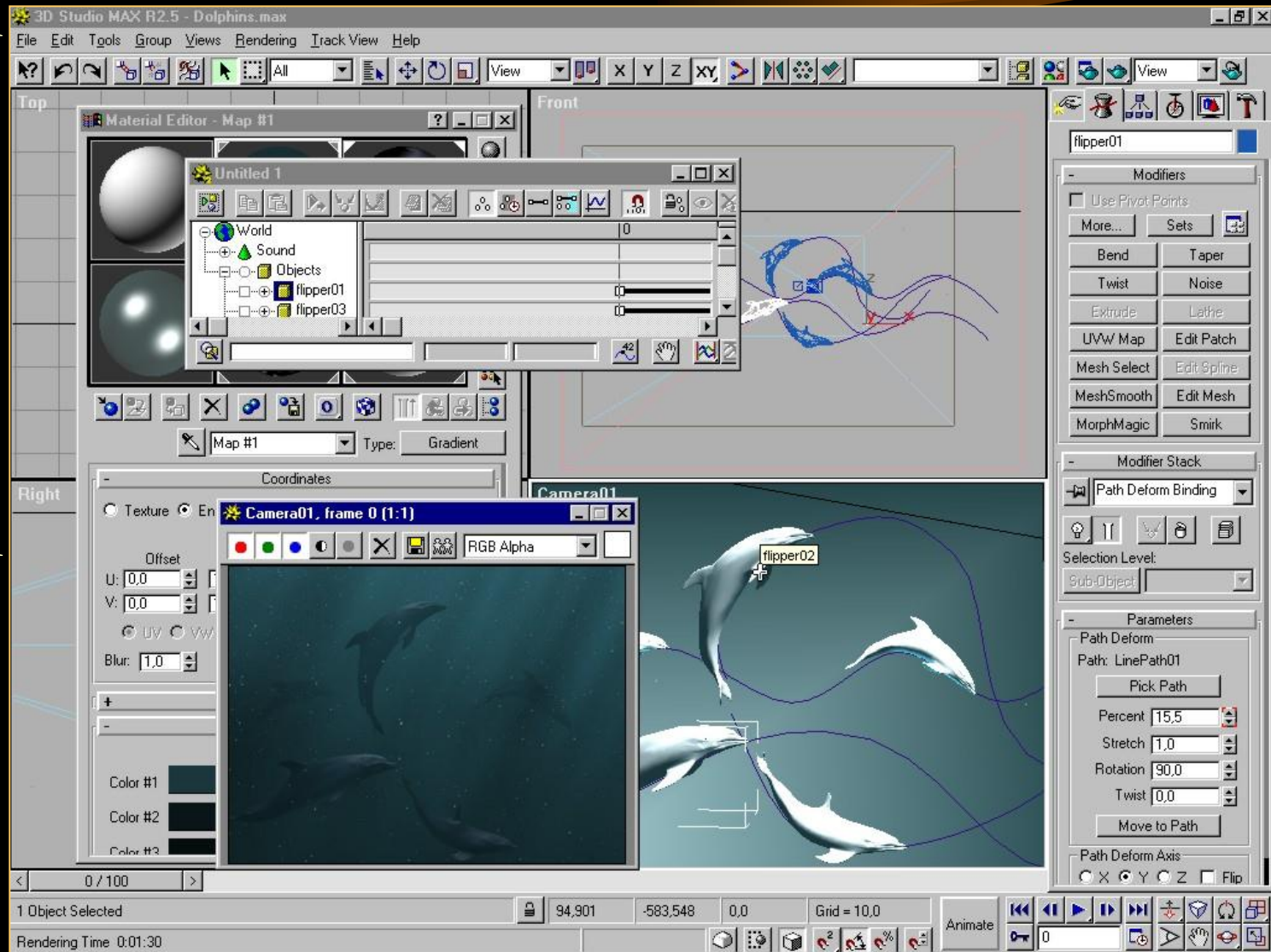
– Animation

- Ulead GIF Animator



– Animation

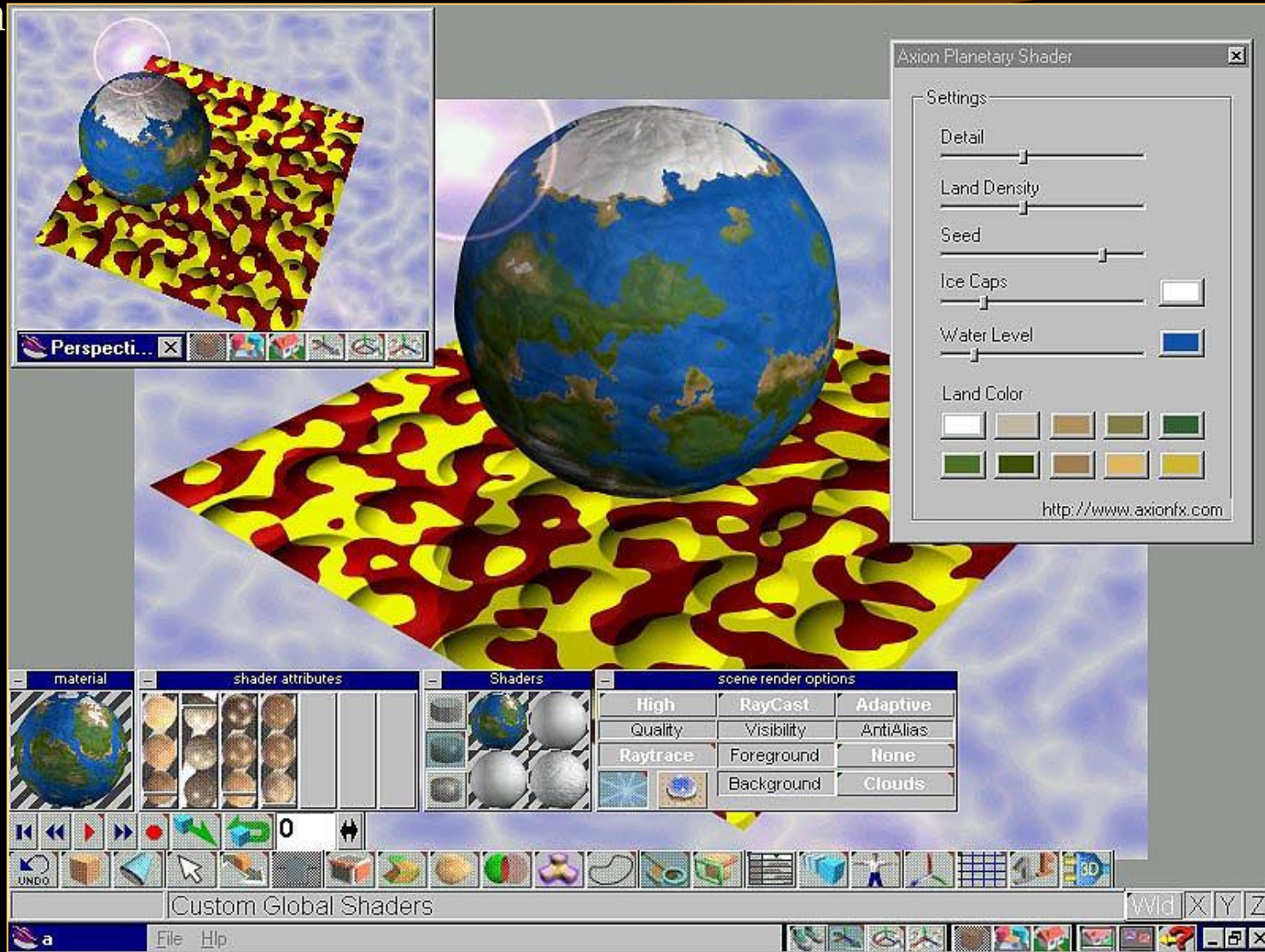
3D Studio MAX
(Kinetix,inc.)
www.discreet.com



– Animation

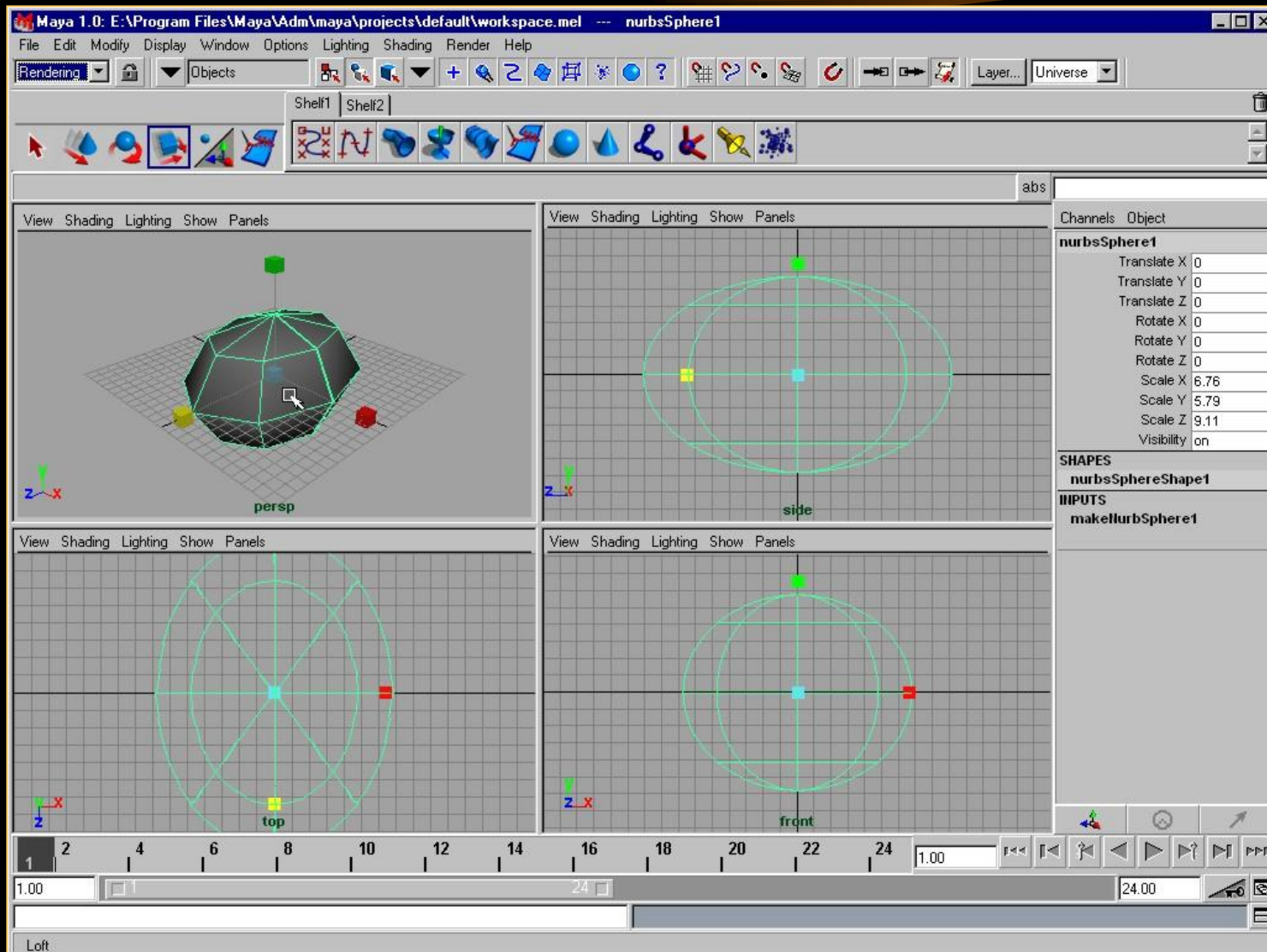
trueSpace

Caligari corporation
www.caligari.com



– Animation

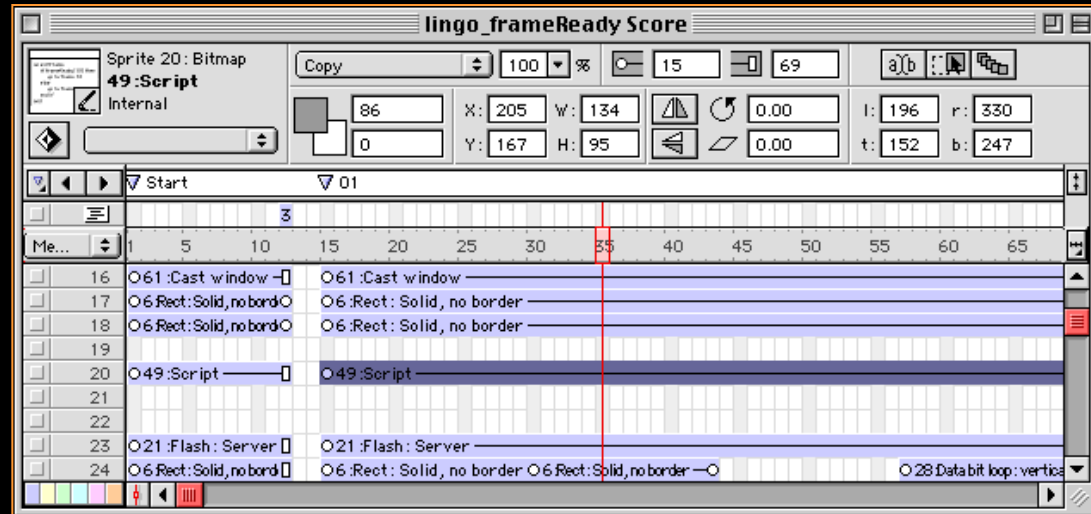
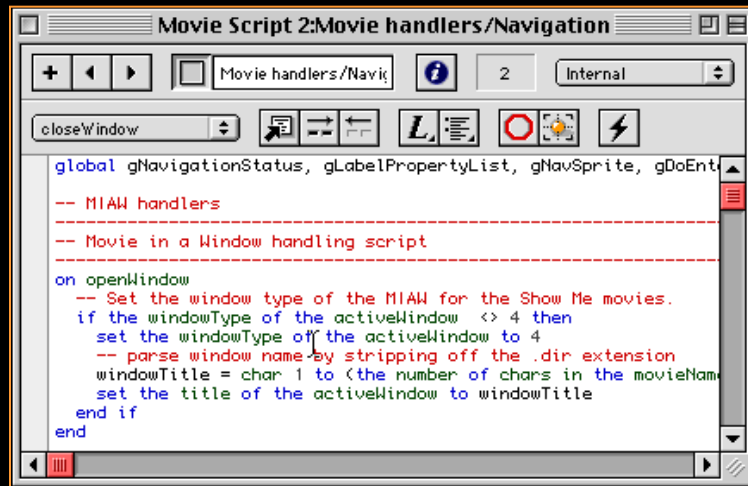
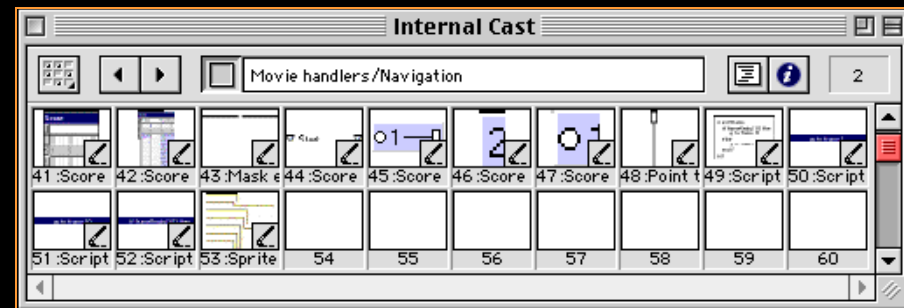
Maya
(Alias/Wavefront)
www.aw.sgi.com



– Multimedia Authoring Software Tools

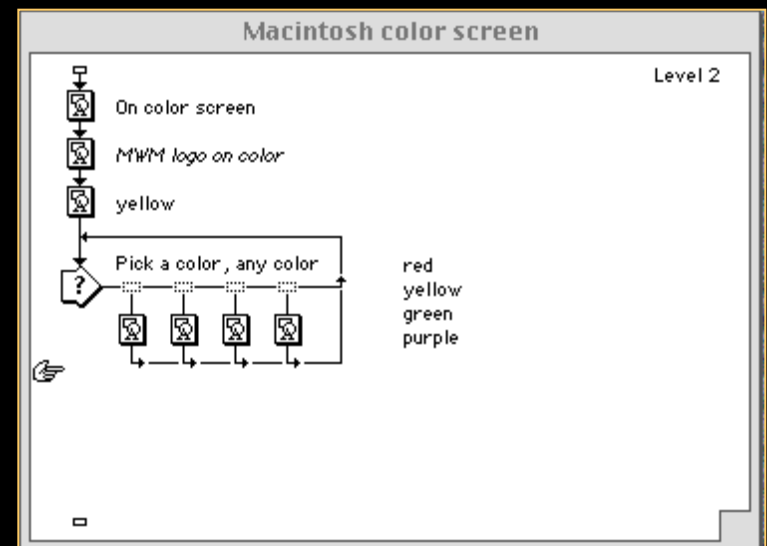
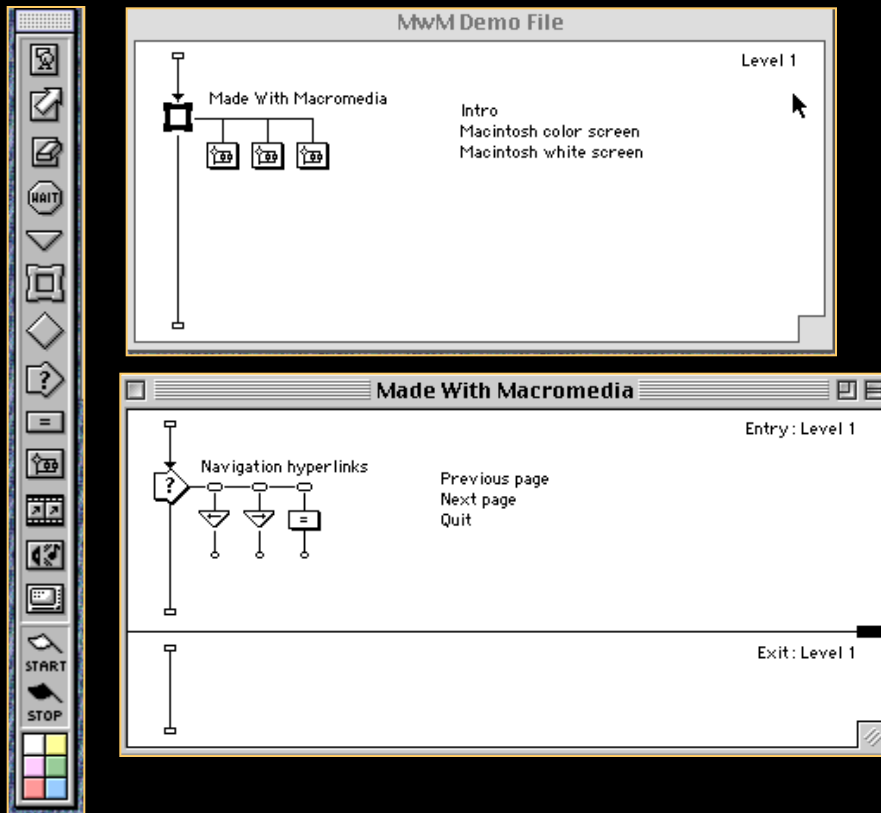
- **Director** - Macromedia

- Movie metaphor (the cast includes bitmapped sprites, scripts, music, sounds, and palettes, etc.)
- Lingo script language with own debugger allows more control including external devices
- Ready for building more interactivities (buttons, etc.)
- cast/score/scripting paradigm



- **Authorware - Macromedia**

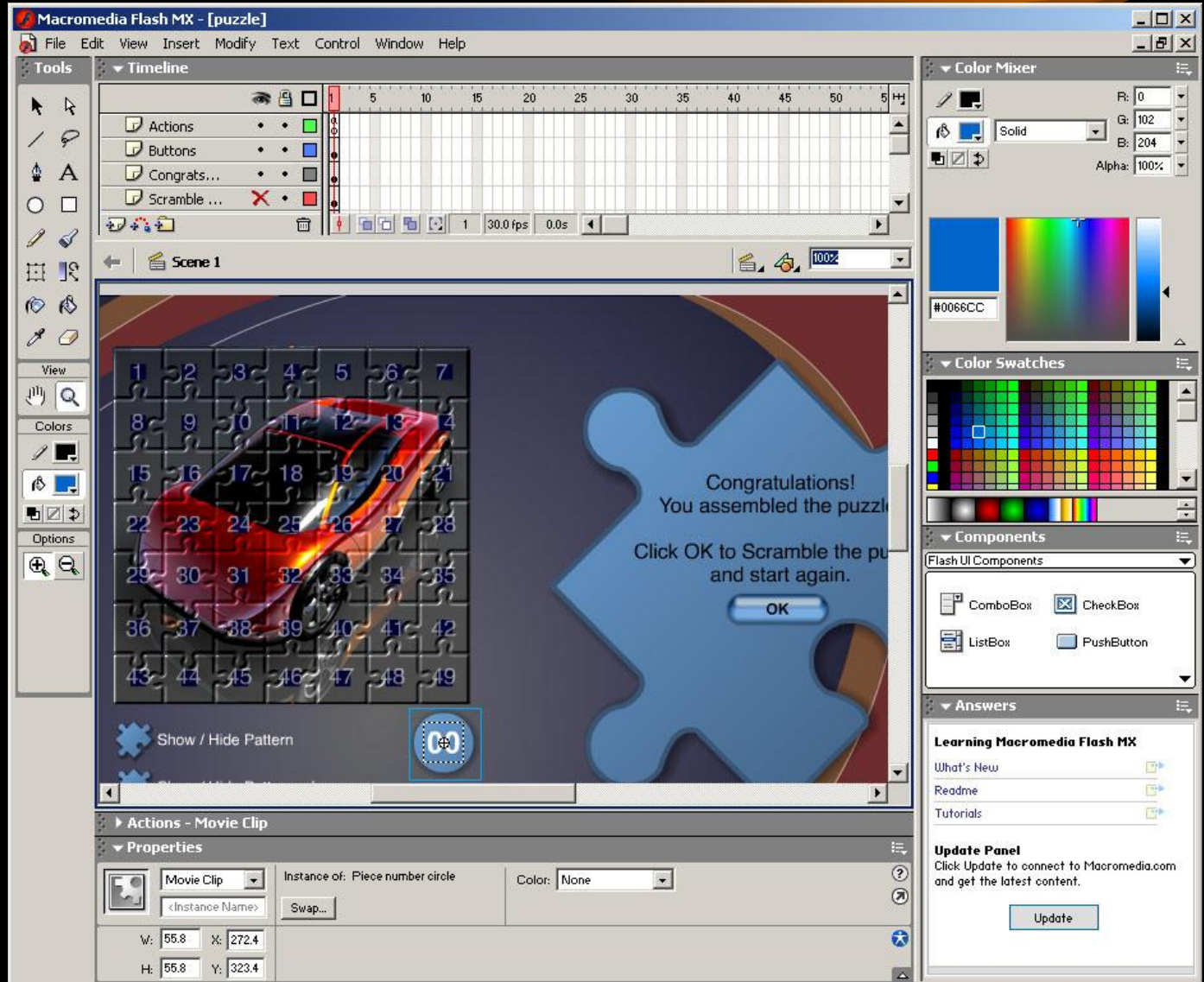
- Professional multimedia authoring tool
- Supports interactive applications with hyperlinks, drag-and-drop controls, and integrated animation
- Compatibility between files produced from PC version and MAC version



- Other authoring tools include:
 - **Microcosm** - Multicosm, Ltd.
 - DOS, Windows
 - is a Hypermedia Linkage authoring system.
 - **Emblaze Creator 2.5** - Geo International
 - is a cast/score/scripting tool which is designed for Web-based playback of interactive multimedia.
 - **Flash** - Macromedia
 - is a cast/score/scripting tool
 - primarily uses vector graphics (and can create vector graphics from imported bitmaps).
 - It is optimized for Web delivery, and is especially common for banner ads and small interactive web deliverables.
 - **HyperCard** (Apple Computer), **HyperGASP** (Caliban Mindwear), **HyperStudio** (Roger Wagner Publishing), **IconAuthor** (Asymetrix)



— Flash MX Macromedia



- **About this course**
- **Introduction to Mutimedia**
- **Multimedia Authoring**
- **Multimedia Technology&Data**



Multimedia Technology & Data

Multimedia systems deal with the generation, manipulation, storage, presentation, and communication of information in digital form.

- The data may be in a variety of formats:
 - text, graphics, images, audio, video, future data
- Large data (technologies for storage)
- Media synchronization (temporal relationships as an integral property)
- Static $\Leftrightarrow$ Continuous media
 - time independent $\Leftrightarrow$ time dependent
 - S: normal data, text, single images, graphics
 - C: video, animation, audio, future data



Multimedia Technology & Data

- Analog $\Leftrightarrow$ Digital Signals
 - analog signals are all around the world
 - digital signals - for computers
 - Digitalization
 - converting analog signals to digital signals
 - Special A/D (Analog-to-Digital) hardware devices
 - Playback
 - converting digital signals to analog signals
 - Special D/A (Digital-to-Analog) hardware devices
 - created as digital signal - computer written text, graphics, some images
 - need to be digitalized - hand written text, speech, paintings, ...
 - HW: scanner, electronic pen, ...



Input, Storage, Output & Processing of different data

- Text
 - Input
 - keyboards, electronic pen & tablet, scanner (by digitalisation)
 - Storage
 - hard disks, floppies, CD-Roms
 - stored as text files
 - character is basic element (1byte)
 - TXT - without formatting
 - HTML, DOC, PDF, PS - formatting and structure information
 - Output
 - monitor, printer, projector



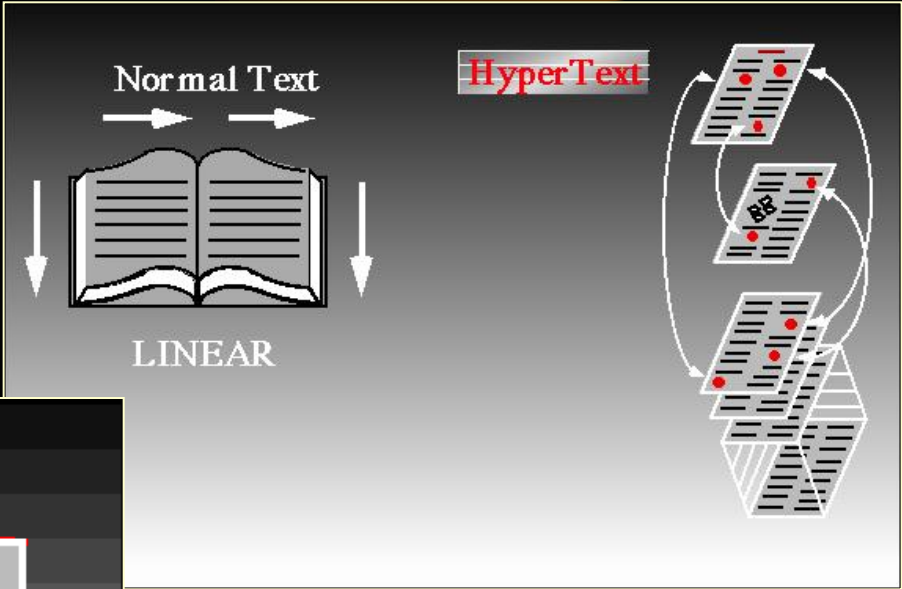
– Processing

Text file formats

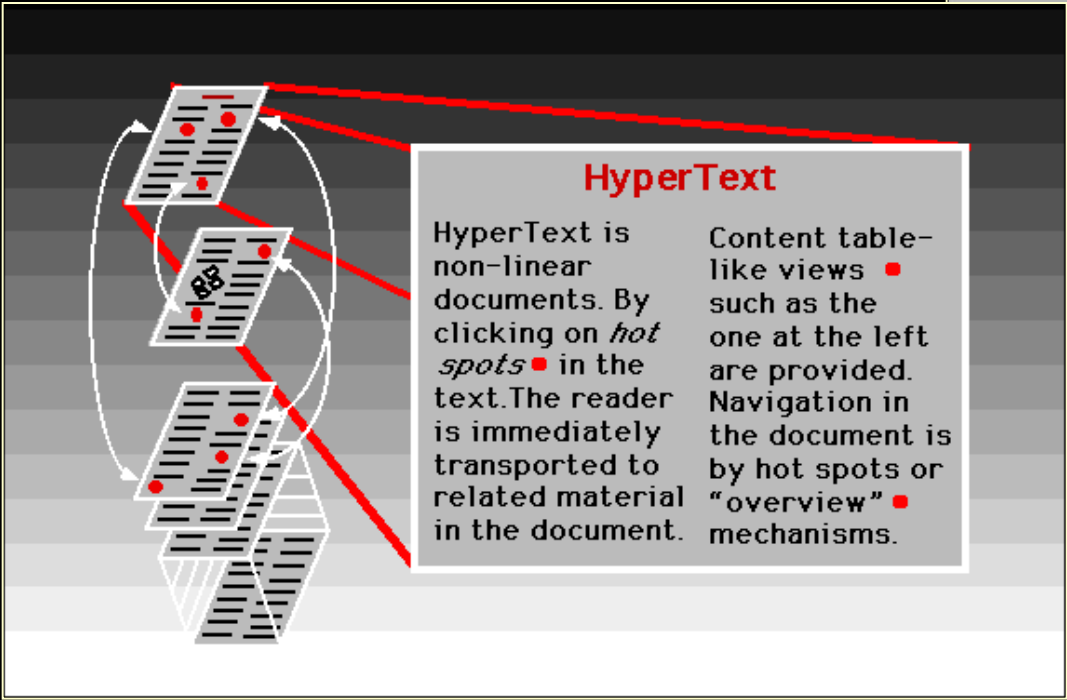
- TXT - Pure Text (one character per byte - special characteres -end of line)
- SGML (Standard Generalized Markup Language)
 - standard for text-based documents
 - it is fundamental part for HTML
- HTML (Hyper Text Markup Language)
 - The term was invented by Ted Nelson around 1965
 - Hypertext is a text which contains **links** to other texts
 - Hypertext is therefore usually non-linear (as indicated on pictures).



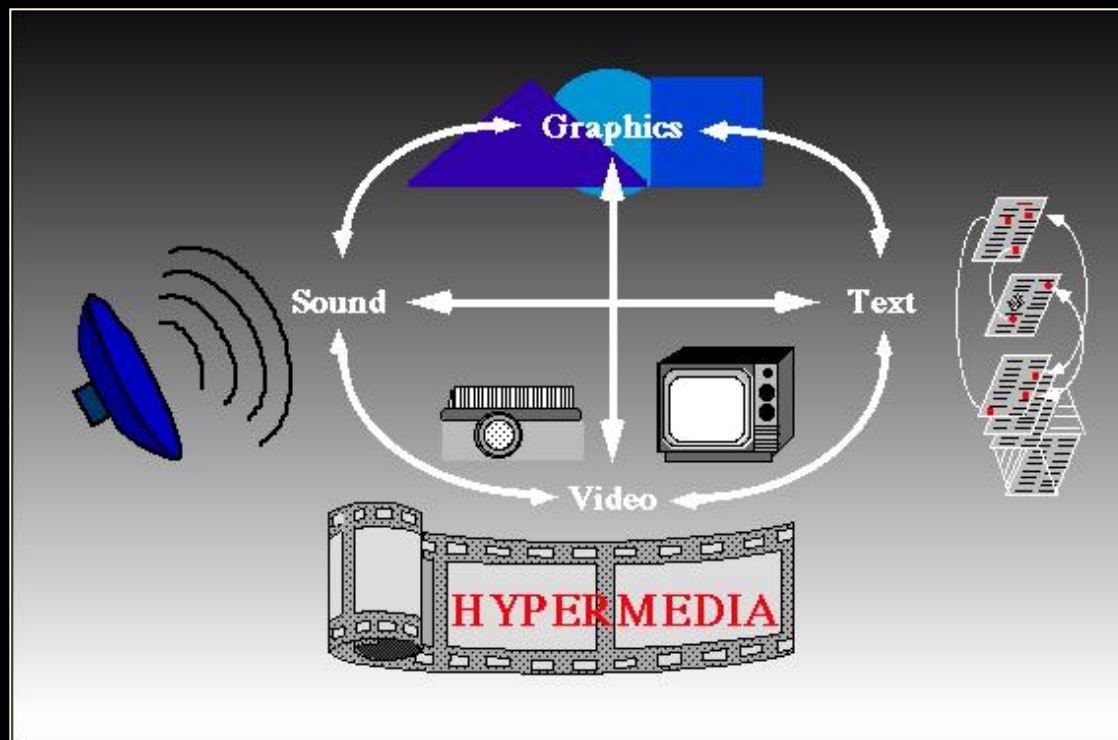
links to other texts



non-linear text



- *HyperText* => *HyperMedia*
 - not constrained to be text-based
 - include other media (graphics, images, sound, video, ...)
 - Ted Nelson was also the first to use this term.



- The World Wide Web (WWW) is the best example of hypermedia applications.

- XML (eXtended Markup Language)
- VRML (Virtual Reality Markup Language)
- DOC (DOCumet Microsoft file)
- PDF (Portable Data Format - Adobe)
- PS (PostScript file - usually used for printers)
- TEX (special text formatting - unix)

Converting (Import/Export)

- converting from one file format to other is done by text applications

DTP - DeskTop Publishing

- arrange of text and pictures for books, magazines, papers, ...
- Page Maker, InDesign, Corel



- Graphics
 - Input
 - keyboards, mouse, trackball, graphic tablets (graphic editors)
 - Storage
 - HDD, floppies, CD-Roms
 - stored as graphic files
 - usually structured and content editable files
 - composition of primitive objects such as lines, polygons, circles, curves and arcs
 - Output
 - monitor, printer, projector



– Processing

Graphics file formats

- application dependent

Converting (Import/Export)

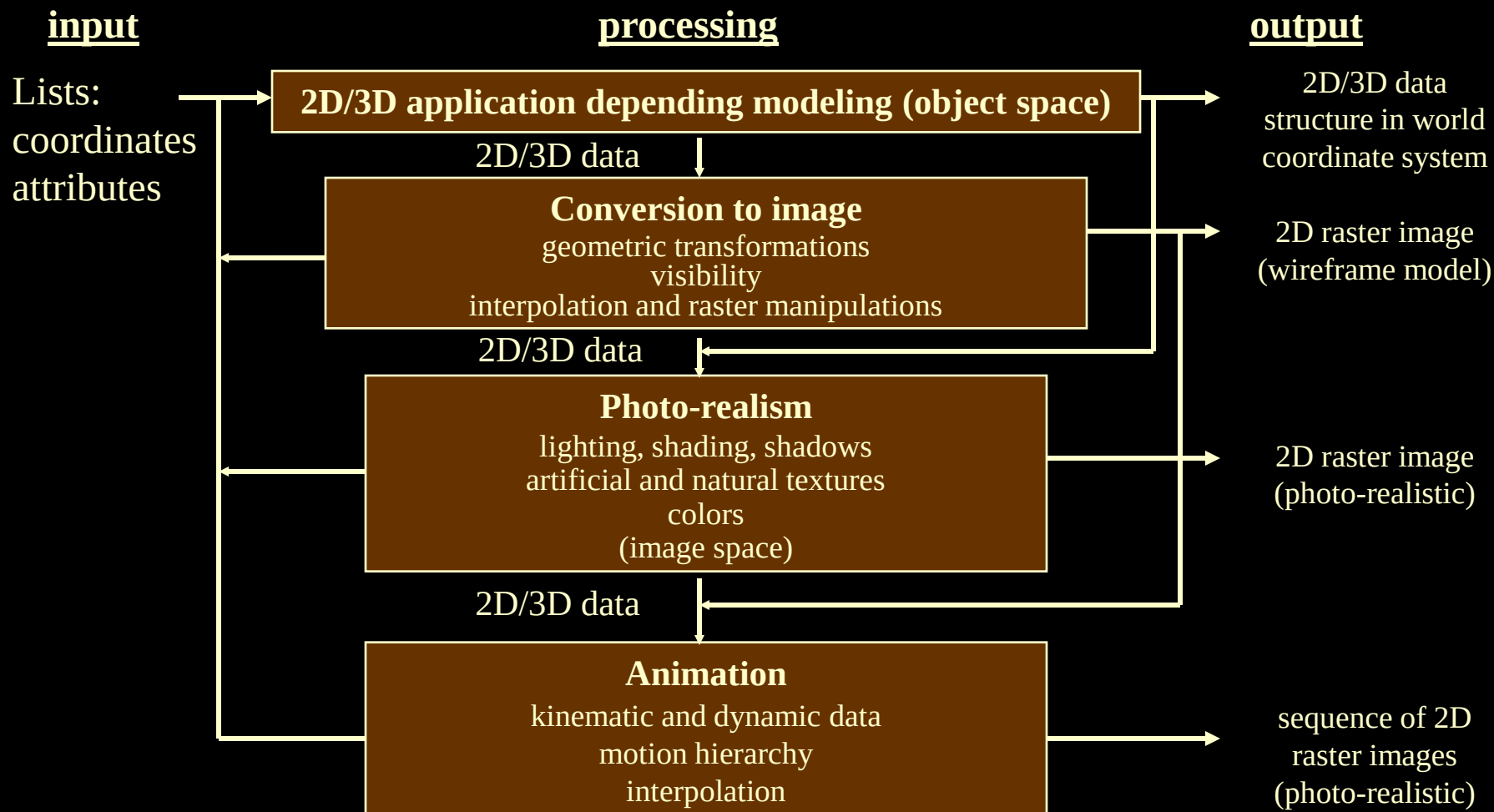
- converting from one file format to other is done by graphic applications

Creating Graphics

- creation and arrangement of graphic elements (2D / 3D)
- Imaging, Corel Draw
- 3D Studio MAX, Maya, SoftImage, trueSpace
- many others solving problem dependent (web design)



- Graphics & Animation synthesis



- Images
 - Input
 - scanners, digital cameras, (converted from graphic files)
 - Storage
 - HDD, floppies, CD-Roms,
 - stored as image files
 - if not compressed are represented as bitmaps (a grid of pixels)
 - for safe storage amount, compression is commonly applied
 - Output
 - monitor, printer, projector



– Processing

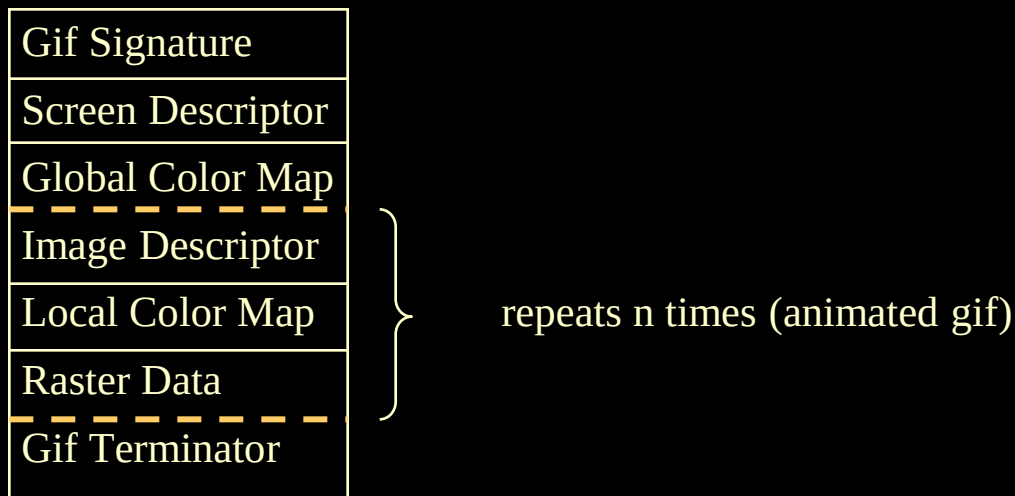
Images file formats

- BMP - Bitmap (grid of pixels - resolution = Rows x Columns x Colors)
- PCX
 - (128 byte header - data - „color planes“ lines RGBI)

```
FOR each byte, X, read from the file
  IF the top two bits of X are 1's then
    count = 6 lowest bits of X
    data = next byte following X
  ELSE
    count = 1
    data = X
```



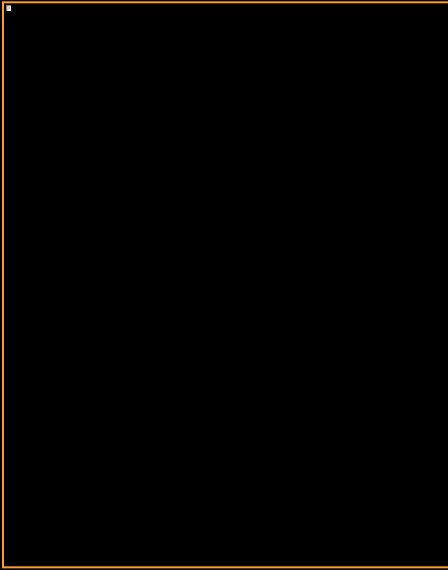
- GIF - Graphics Interchange Format



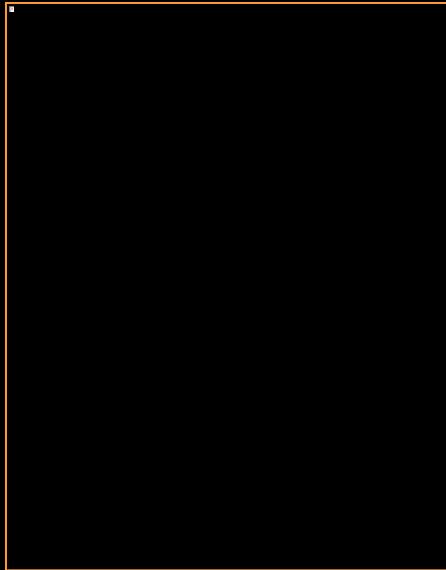
- Raster Data - RGBRGBRGB.....
- Compression : **Lempel-Ziv Welch compression algorithm**
 - adaptive glossary
 - encoding time = decoding time



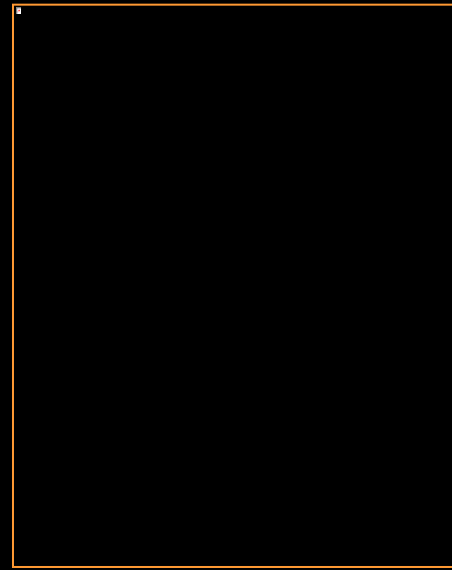
- JPEG (Joint Photographic Experts Group)
 - compressions: lose, lossless



Original (11,2 MB)



Compression 8:1 (1,4 MB)



Compression 100:1 (11 kB)



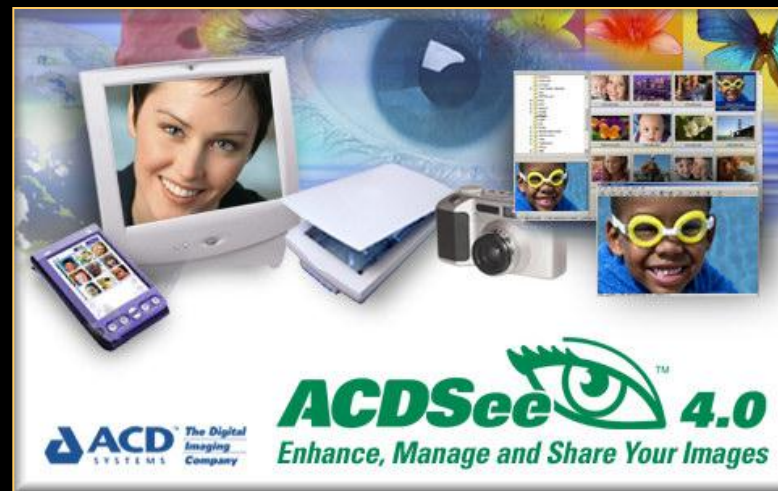
- PNG (Portable Network Graphics)
- TIFF (Tagged Image File Format)
 - stores many different types of images (e.g., monochrome, greyscale, 8-bit & 24-bit RGB, etc.)
- TGA

Converters

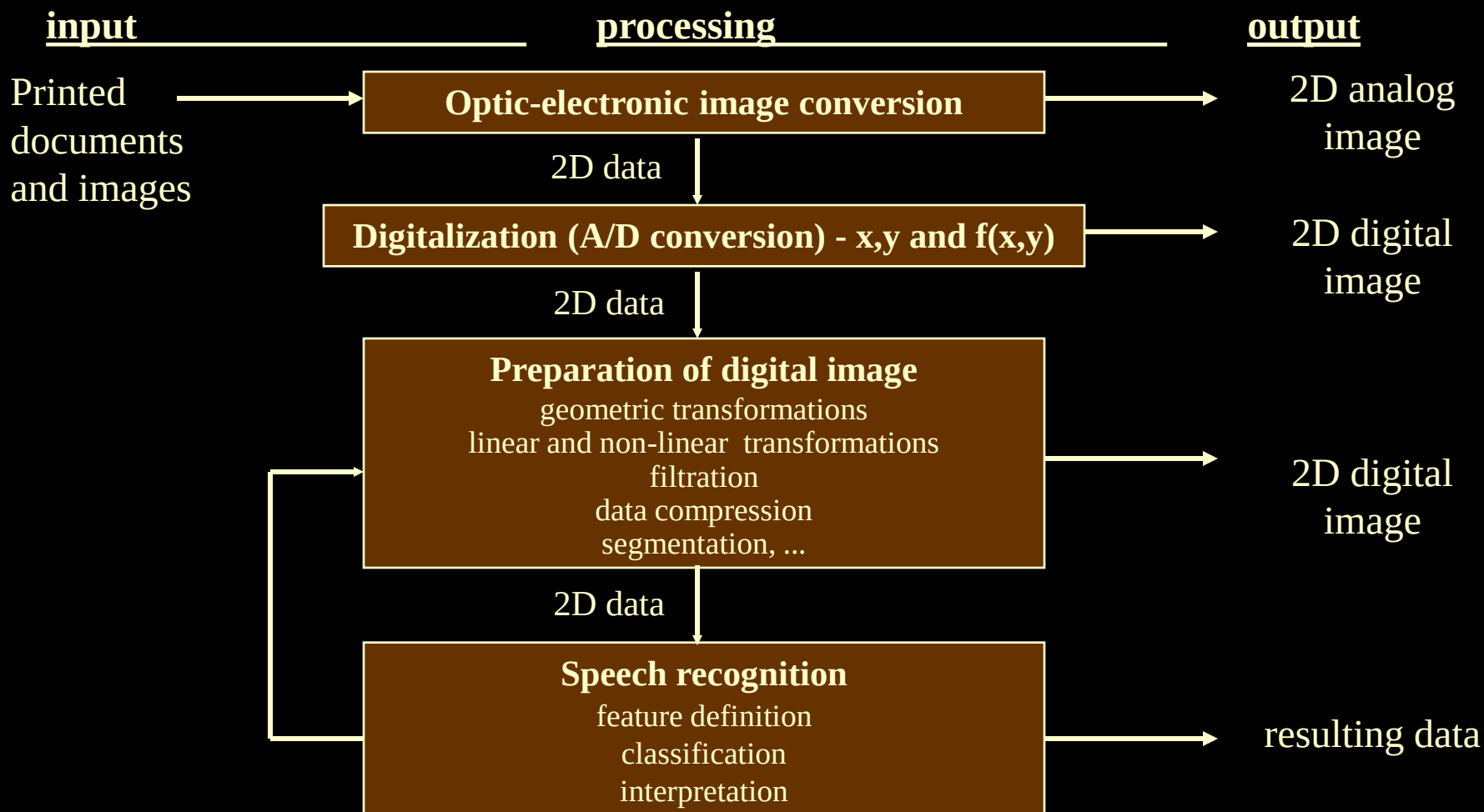
- specialised programs to convert file formats
- ACDSee, ACD Systems, Ltd.

Editors

- create and modify images
- many specialised tools
- Photoshop, Corel PhotoPaint Imaging, Paintbrush



- Image and document processing and analysis



- Audio
 - Input
 - microphone – Sampling (digitalisation)
 - Storage
 - any digital media storage device
 - stored as audio files
 - if not compressed, are represented as bit streams (WAV)
 - for safe storage amount, compression is commonly applied
 - Output
 - speakers, earphone



- Processing

- Audio file formats

- WAV (Waveform data)
 - Microsoft standard
 - MP3
 - quality loss compression
 - details remove (psycho-acoustic method)
 - RA (Real Audio)
 - for real time transmission
 - streaming format
 - for playing info about whole file not needed
 - VOC (Sound Blaster)



Encoding (Compression)

- PCM (Pulse Code Modulation)
- ADPCM (Adaptive Differential Pulse Code Modulation)

Converters and Editors

- audio applications usually are able to read, edit (process) and save (convert) many audio formats
- Sound Forge, Cool Edit, ...

Sampling

- Analog-to-Digital converting
- quality depends on Sampling Rate



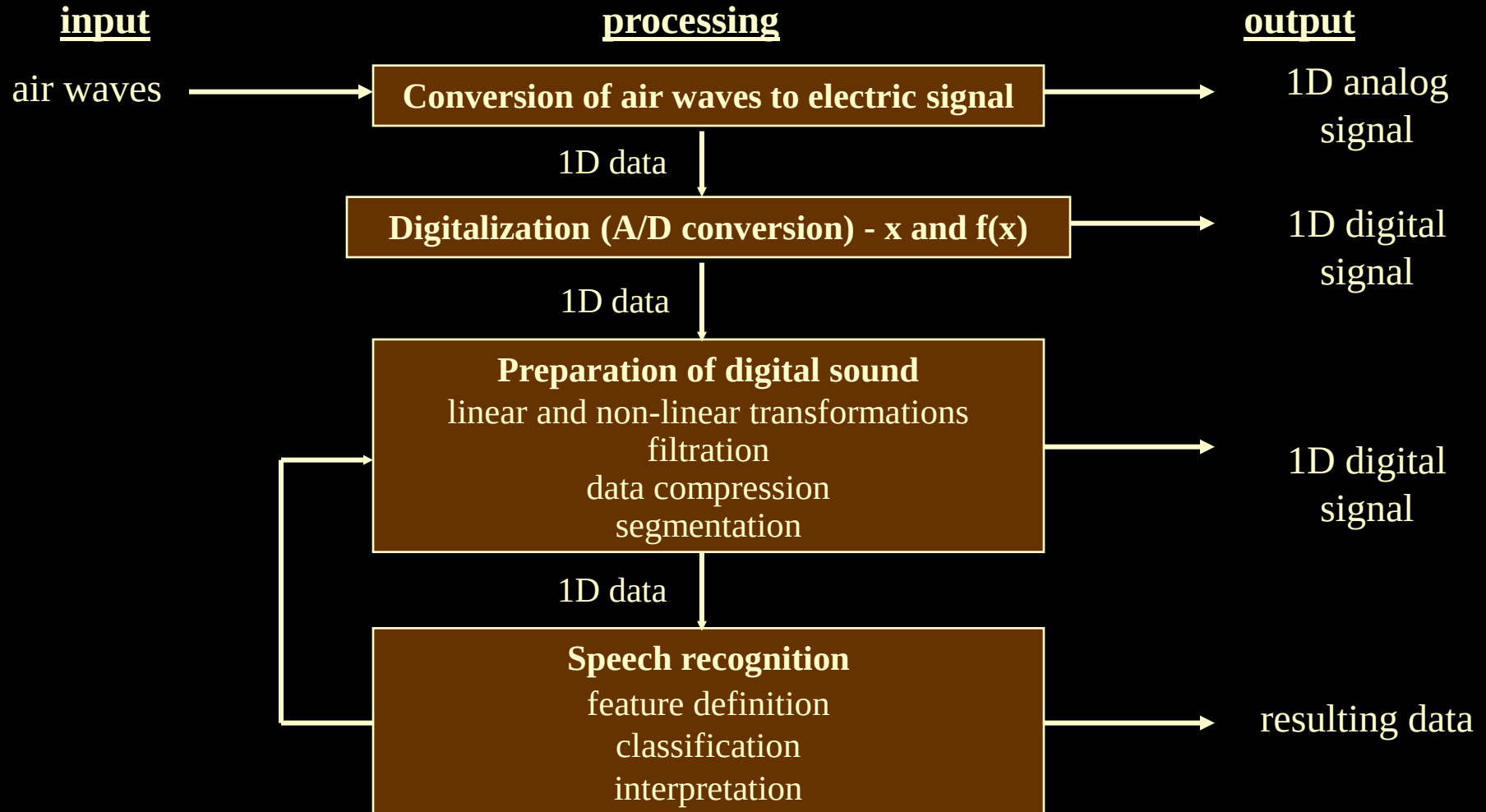
- Examples of different Sampling Rates and Bits per Sample:

Quality	Sample Rate (kHz)	Bits per Sample	Mono/ Stereo	Data Rate (Kbytes/sec)	Frequency
Telephone	8	8	Mono	8	
AM Radio	11.025	8	Mono	11.0	 
FM Radio	22.050	16	Stereo	88.2	 
CD	44.1	16	Stereo	176.4	 
DAT	48	16	Stereo	192.0	

- Memory required for 1 Minute of Digital Audio



- Sound processing



- Video
 - Input
 - video or digital cameras
 - Storage
 - any digital media storage device
 - stored as video files
 - if not compressed are represented as bitmaps sequences
 - for safe storage amount, compression is commonly applied
 - Output
 - projector, monitor, speakers, earphone



– Processing

Video file formats

- FLI, FLC
- Animated GIF
- AVI (Audio Video Interleave)
 - dependent upon "codecs" (an acronym for **compressor** / **decompressor**)
 - can handle 16.7 million color
 - has more advanced transparency
 - DV AVI, is used to create Digital Video - transferred losslessly (without loss of quality) between computers and camcorders



- MPG
 - MPEG - **M**oving **P**icture **E**xperts **G**roup
 - Better compression, image and sound quality
 - Decoding and playing an MPG is generally harder on system resources than AVI
 - MPEG-1 – for web and net distribution (Data Rate 391 – 2000 kB)
 - MPEG-2 – high quality – DVD & Digital Satellite TV (391 and 14,648 kB)
 - MPEG-4 – transmission of video over low bandwidth connections (4,8-64kbs)

M-JPEG



MPEG



- NTSC VCD and PAL VCD
 - These are both variations on the MPEG 1 format
 - used to create Video Compact Disks which can be played back on TV
 - fixed at 1500
- QT (QuickTime - Apple Computer)
- MOV
- Analog Video Formats: VHS, S-VHS, Hi8
- Digital Video format : Digital Betacam, Digital S, Digital 8, DV/DVCPPro



Multimedia Technology & Data

- **Storage Media**

Let us first recap the major problems that affect storage media:

- Large volume of data
 - Real time delivery
 - Data format (compression applied due to previous two)
 - Storage Medium
 - Retrieval mechanisms
- } data format is influenced by this



– Removable Media

- Conventional floppies (not adequate due 1.4 Mb capacity)
- Jaz/Zip Drives
- CD-ROM
- DVD
- Media usually ok for backup, but usually suffer from worse performance than single hard drives

– Single Hard Drives

- SCSI/IDE Drives
 - suitable for desktop multimedia
 - fast enough for direct to disk audio and video capture
- RAID Architecture
 - adequate for commercial/professional Multimedia



– Optical Storage

The most popular storage medium in the multimedia context due its compact size, high density recording, easy handling and low cost per MB.

There are now various formats of CD:

- CD-DA (Compact Disc-Digital Audio) - standard music CD
- CD-ROM (CD-DA for computers - high storage capacity 650 Mb, read only)
- CD-I (Compact Disc-Interactive) - CD-I player - audio & video & interactive
- CD-ROM/XA (eXtended Architecture) - can play audio and display pictures (or other things) simultaneously.
- Photo CD (by Kodak and Philips) - digital pictures on compact disk -standard
- CD-ROM, CD-ROM/XA, and CD-I disks are normally *mastered*
 - WORM (Write Once Read Many)
 - CD-I Bridge disk - readable on both a CD-I player & CD-ROM/XA drive
 - Multisession Disks (brings hardware changes) - to be able to add data
 - CD-R/W disk - able to read and write multiple times



– CD Standards

There are several CD standard for different types of media:

- Red Book
 - Digital Audio: Most Music CDs.
- Yellow Book
 - CD-ROM: Model 1 - computer data, Model 2 - compress audio/video data.
- Green Book
 - CD-I
- Orange Book
 - write once CDs
- Blue Book
 - LaserDisc



DVD - Digital Video Disc

- is the next generation of optical disc storage technology
- Bigger capacity, faster CD
- can hold video as well as audio and computer data
- home entertainment, computers, and business information with a single digital format
- replacing audio CD, videotape, laser disc, CD-ROM, and perhaps even video game cartridges
- DVD has widespread support from all major electronics companies, all major computer hardware companies, and most major movie and music studios
- DVD-Video - holds video programs - played in a DVD player => TV
- DVD-ROM - holds computer data - read by a DVD-ROM drive => computer
(The difference is similar to that between Audio CD and CD-ROM)



The main features of DVD include:

- Over 2 hours of high-quality digital video (8 hours)
- Support for widescreen movies on standard or widescreen TVs (4:3 and 16:9)
- 8 tracks of digital audio (multiple languages), each with as many as 8 channels
- Up to 32 subtitle/karaoke tracks
- Branching of video (for multiple story lines or ratings on one disc)
- Up to 9 camera angles (different viewpoints can be selected during playback)
- Menus and simple interactive features (for games, quizzes, etc.)
- Multilingual identifying text for title name, album name, song name, cast, etc.
- Instant rewind, fast forward, search to title, chapter, track, and time code
- Durability (no wear from playing, only from physical damage)
- Not susceptible to magnetic fields

Most discs do not contain all features (multiple audio/subtitle tracks, seamless branching, parental control, searching or skipping, ...)



Most players support a standard set of features:

- Language choice (automatic selection of video scenes, audio tracks, ...)
 - must be supported by additional content on the disc
- Special effects playback
 - freeze, step, slow, fast, and scan (no reverse play or reverse step).
- Parental lock (for denying playback of discs or scenes - password needed)
- Programmability (playback of selected sections in a desired sequence)
- Digital audio output (PCM stereo and Dolby-Digital)
- Compatibility with audio CDs
- Component (YUV or RGB) output for highest-quality picture
- Compatibility with Video CDs
- Multilingual on-screen display



– Sizes and capacities of DVD

- Kinds of DVDs

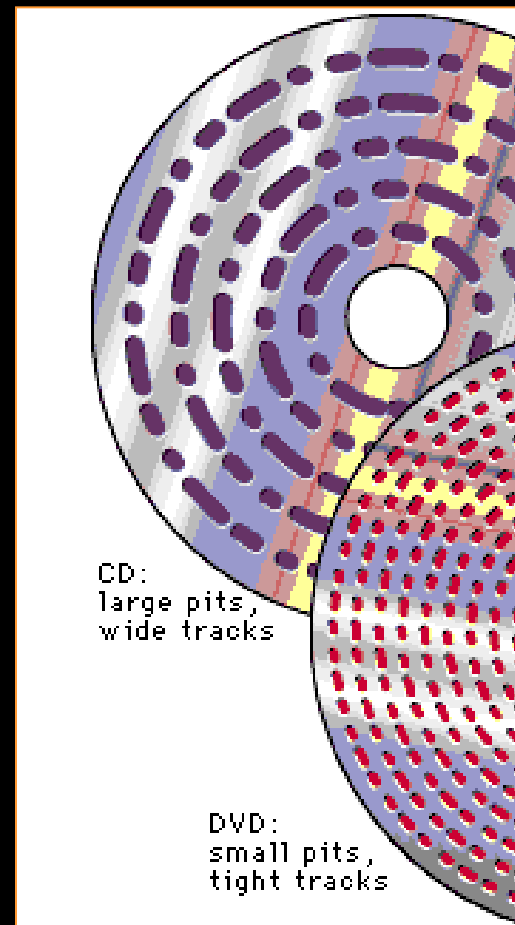
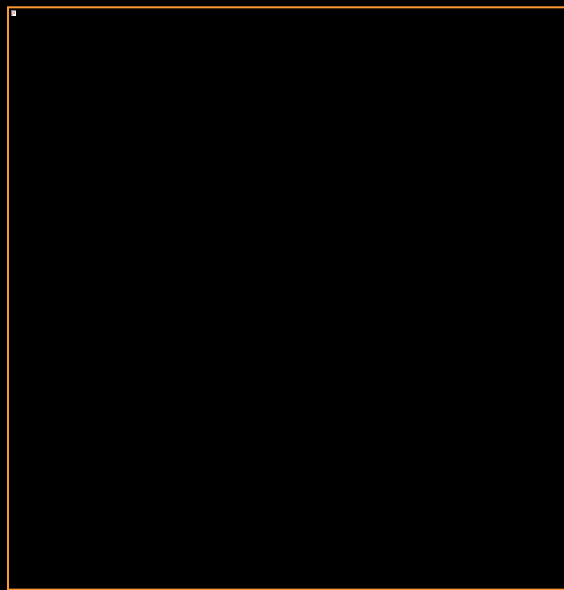
- 12 cm (4.7 inches) and 8 cm (3.1 inches), both 1.2 mm thick
- single-sided or double-sided
- each side can have one or two layers of data
- a single layer can actually hold up to 9 hours of video and audio if it's compressed to VHS quality

- Capacities of DVD:

- | | |
|-------------------------|---------------------------------------|
| • DVD-5 (12cm, SS/SL): | 4.38 GB (4.7 G) over 2 hours of video |
| • DVD-9(12cm, SS/DL): | 7.95 GB (8.5 G), about 4 hours |
| • DVD-10 (12cm, DS/SL): | 8.75 GB (9.4 G), about 4.5 hours |
| • DVD-18 (12cm, DS/DL): | 15.90 GB (17 G), over 8 hours |
| • DVD-1 (8cm, SS/SL): | 1.36 (1.4 G), about half an hour |
| • DVD-2 (8cm, SS/DL): | 2.48 GB (2.7 G), about 1.3 hours |
| • DVD-3 (8cm, DS/SL): | 2.72 GB (2.9 G), about 1.4 hours |
| • DVD-4 (8cm, DS/DL): | 4.95 GB (5.3 G), about 2.5 hours |



- The increase in capacity from CD-ROM is due to:
 - smaller pit length (2.08x) , tighter tracks (2.16x),
 - discs single or double sided
 - another data layer added to each side
- dual-layer disc $\Leftrightarrow$ double sided disk



- www.dvddigital.com

Multimedia Technology & Data

- **Output Devices**

The output devices for a basic multimedia system include

- Graphics Output
 - A High Resolution Colour Monitor
 - Colour Printer
 - projectors
- Audio Output
 - loud-speaker (mono, stereo, kvadro, surround system)
- Video Output (recorders, projectors, DVD-ROM device)
- Storage Medium (Hard Disk, Removable Drives, CD-ROM, DVD-Disk)



Areas of information processing

output input	description	image	sound	smell	taste	touch
description	Symbolic manipulation	Computer graphics	Sound synthesis	Smell synthesis	Taste synthesis	Touch synthesis
image	Image recognition	Image processing	Sonification			
sound	Sound recognition		Sound processing			
smell	Smell recognition			Smell processing		
taste	Taste recognition				Taste processing	
touch	Touch recognition					Touch processing



END

