Introduction
Multimedia and Authoring

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Introduction

• **Multimedia Authoring and Data Representations**, we will
  - introduce notions included in the term multimedia and look at its history and present.
  - carry out multimedia projects using software tools, so that get down to multimedia authoring.
  - look at the most important data representations, examining image data, video data, and audio data in detail.
  - see how color impacts multimedia issues, since color is vitally important in multimedia programs

• **Multimedia Data Compression**, we will
  - consider how to make all this data fly onto the screen and speakers, by data compression, e.g. lossless & lossy compression methods
  - introduce standards for
    - Still image: JPEG2000
    - video: MPEG (MPEG-1, MPEG-2, MPEG-4, MPEG-7)
    - audio: MPEG Audio (MP3)
• **Multimedia Communication and Retrieval** (we will not discuss)
  - consider the great demands multimedia places on networks and systems.
  - consider network technologies and protocols that make interactive multimedia possible
  - discuss applications, e.g., multimedia on demand, multimedia over IP, multimedia over ATM, multimedia over wireless networks, content-based retrieval
What is multimedia? The history and the present
Hypermedia and multimedia
What is multimedia authoring?
Multimedia authoring and editing tools (Left for assignment)
Multimedia

- Multimedia is
  - a PC that has sound capability, a DVD-ROM drive, and perhaps the superiority of multimedia-enabled microprocessors that understand additional multimedia instructions -- a PC vendor
  
  - interactive cable TV with hundreds of digital channels available, or a cable TV-like service delivered over a high-speed Internet connection -- a consumer entertainment vendor
  
  - applications that use multiple modalities, including text, images, drawings (graphics), animation, video, audio, and interactivity. -- computer Science (CS) people

- Multimedia and Computer Science:
  - graphics, HCI, visualization, computer vision, data compression, graph theory, networking, database systems.
Multimedia Research Topics

- **Multimedia processing and coding**: multimedia content analysis, content-based multimedia retrieval, multimedia security, audio/image/video processing, compression, etc.

- **Multimedia system support and networking**: network protocols, Internet, operating systems, servers and clients, quality of service (QoS), and databases.

- **Multimedia tools, end-systems and applications**: hypermedia systems, user interfaces, authoring systems.

- **Multi-modal interaction and integration**: “ubiquity” — web-everywhere devices, multimedia education including Computer Supported Collaborative Learning, and design and applications of virtual environments.
History of Multimedia

Newspaper

Motion pictures

Television

Wireless radio transmission
Hypermedia and Multimedia

- **Hypertext**: a non-linear text medium

- **HyperMedia**: can include text, graphics, images, and especially the continuous media – sound and video.
  - e.g., The World Wide Web (WWW)
  - can be considered one particular multimedia application.

- **Multimedia** means that computer information can be represented through text, graphics, images, audio, video, and animation.
  - e.g., digital video editing and production systems, electronic newspapers/magazines, World Wide Web, online reference works, e.g. encyclopedia, games, home shopping, interactive TV, multimedia courseware, video conferencing, video-on-demand, interactive movies
Multimedia Software Tools

• Music Sequencing and Notation
  - Cakewalk, Cubase, Macromedia SoundEdit

• Digital Audio
  - Cool Edit, Sound Forge, Pro Tools

• Graphics and Image Editing
  - Adobe Illustrator, Adobe Photoshop, Macromedia Fireworks, Macromedia FreeHand

• Video Editing
  - Adobe Premiere, Adobe After Effects, Final Cut Pro

• Animation
  - Multimedia APIs: Java3D, DirectX, OpenGL
  - Rendering Tools: 3D Studio Max, Softimage XSI, Maya, RenderMan

• Multimedia Authoring
  - Macromedia Flash, Macromedia Director, Authorware, Quest
Multimedia Authoring

- **Multimedia authoring**: creation of multimedia productions, sometimes called 'movies' or 'presentations'.
  - We are mostly interested in **interactive** applications.
  - Practically, we also have a look at still-image editors (Adobe Photoshop), and simple video editors (Adobe Premiere).
- **Multimedia Authoring Metaphors**: for easier understanding of the methodology employed to create multimedia applications.
- **Multimedia Production**: how to produce multimedia
- **Multimedia Presentation**: effects for presenting multimedia content as well as guidelines for content design
- **Automatic Authoring**: an advanced helper for creating new multimedia presentations or a mechanism to facilitate automatic creation of more useful multimedia documents from existing sources
Multimedia Authoring Metaphors

- **Scripting Language Metaphor**: use a special language to enable interactivity (buttons, mouse, etc.), and to allow conditionals, jumps, loops, functions/macros etc.

```plaintext
-- load an MPEG file
extFileName of MediaPlayer "theMpegPath" = "c:\windows\media\home33.mpg"

-- play
extPlayCount of MediaPlayer "theMpegPath" = 1;

-- put the MediaPlayer in frames mode (not time mode)
extDisplayMode of MediaPlayer "theMpegPath" = 1;

-- if want to start and end at specific frames:
extSelectionStart of MediaPlayer "theMpegPath" = 103;
extSelectionEnd of MediaPlayer "theMpegPath" = 1997;

-- start playback
get extPlay() of MediaPlayer "theMpegPath";
```

- **Slide Show Metaphor**: A *linear* presentation by default, although tools exist to perform jumps in slide shows (e.g., PPT)
• **Hierarchical Metaphor:** User-controllable elements are organized into a *tree* structure — often used in menu-driven applications.

• **Iconic/Flow-control Metaphor:** Graphical icons are available in a toolbox, and authoring proceeds by creating a *flow chart* with icons attached.
• **Frames Metaphor**: Like Iconic/Flow-control Metaphor; however *links* between icons are more *conceptual*, rather than representing the actual flow of the program.

• **Card/Scripting Metaphor**: Uses a simple *index-card structure* - easy route to producing applications that use hypertext or hypermedia.
• **Cast/Score/Scripting Metaphor:**
  - Time is shown horizontally; like a spreadsheet: rows, or **tracks**, represent instantiations of characters in a multimedia production (e.g. Movie Maker).
  - Multimedia elements are drawn from a **cast** of characters, and **scripts** are basically event-procedures or procedures that are triggered by timer events.
  - Director, by Macromedia, is the chief example of this metaphor. Director uses the **Lingo** scripting language, an object-oriented event-driven language.
Multimedia Production

- Multimedia projection can easily involve an art director, graphic designer, production artist, producer, project manager, writer, user interface designer, sound designer, videographer, and 2D and 3D animators, as well as programmers.

- The design phase consists of storyboarding, flowcharting, frame-by-frame walk-through, prototyping, user testing, as well as a parallel production of media.
Multimedia Presentation

- **Graphics Styles**: Human visual dynamics impact color schemes and lettering.
  - **Color principles and guidelines**: Some color schemes and art styles are best combined with a certain theme or style (hint: not to use *too many* colors) Some color combinations are more pleasing than others.

- **Fonts**: For effective visual communication in a presentation, it is best to use large fonts (i.e., 18~36 points), and < 6~8 lines per screen (*fewer than on this screen!*).

- **A color contrast program**: If the text color is (R,G,B), a legible background color is
  \[(R, G, B) \rightarrow (1-R, 1-G, 1-B)\]
A 15 second clip of music from a compact disc was digitized at three different sampling rates (11 kHz, 22 kHz, and 44 kHz) with 8-bit precision. The effects of the different sampling rates are clearly audible. This is a demonstration of the **Nyquist Theorem**.

**Nyquist Theorem:**

The minimum sampling frequency of an A/D converter should be at least twice the frequency of the signal being measured.
Colour wheel, with opposite colours equal to (1-R, 1-G, 1-B)
- **Sprite Animation**

Original  Mask Image M  Sprite S  Background B

B && M  B && M || S
- **Video Transitions:** to signal “scene changes”.
  - **Cut:** an abrupt change of image contents formed by abutting two video frames consecutively.
  
  - **Wipe:** a replacement of the pixels in a region of the viewport with those from another video. Each video frame is held in place.
- **Dissolve**: replaces every pixel with a mixture over time of the two videos, gradually replacing the first by the second.
  - **cross dissolve**: every pixel is affected gradually, e.g., fade-in, fade-out
    \[
    \mathbf{D} = (1 - \alpha(t)) \cdot \mathbf{A} + \alpha(t) \cdot \mathbf{B}
    \]
    \[
    \alpha(t) = kt, \quad kt_{\text{max}} \equiv 1
    \]
  - **dither dissolve**: Determined by \(\alpha(t)\), increasingly more and more pixels in video A will abruptly (instead of gradually as in **cross dissolve**) change to video B, e.g., wipe
Build-your-own-transition: e.g., push

\[ x_T = \left( \frac{t}{t_{\text{max}}} \right) x_{\text{max}} \]

\[ x_L = x + (x_{\text{max}} - x_T) \]
- Pseudocode for slide video transition

```plaintext
for t in 0..t_{max}
    for x in 0..x_{max}
        if (x/x_{max} < t/t_{max})
            R = R_L (x + x_{max} * [1 - t/t_{max}], t)
        else
            R = R_R (x - x_{max} * t/t_{max}, t)
```

• **Some Technical Design Issues**
  
  - **Computer Platform**: 'portable' cross-platform software may not work well across systems.
  
  - **Video format and resolution**: The most popular video formats — NTSC (National Television System Committee), PAL (Phase Alternating Line), and SECAM (Sequentiel Couleur A Memoire) — are not compatible, requiring conversion; video capture card; 16, 24, 32-bit pixels; a resolution of 1,280*1,024 pixels
  
  - **Memory and Disk Space Requirement**: >= 128 MB of RAM and 20 GB of hard-disk space.
  
  - **Delivery Methods**: Rewriteable DVD drives are not the norm; CD-ROMs may lack sufficient storage and access time is longer; electronic delivery depends on network bandwidth; a streaming option may be available, depending on the presentation.
Automatic authoring

- **Hypermedia documents**: how much of the steps can be automated?
  - **Capture of media**: From text or using an audio digitizer or video frame-grabber, it is highly developed and well automated.

  - **Authoring**: It is most under consideration. Standard data structures are advised (lists, trees, networks). We consider how best to structure the data in order to support multiple views of the available data, rather than a single, static view.

  - **Publication**: i.e. Presentation, is the objective of the multimedia tools we have been considering.
• **Externalization versus linearization:**
  - the essential problem is without using a hypermedia mechanism
  - hyperlinks allow us the freedom (i.e., externalization).
Automated layout creates a hypertext version of a document

- e.g., MS Word's chapters, headings, and so on.
- Problems arise when automatically extracting **semantic** content and finding *links* and anchors.
- Once a dataset becomes large, we should employ database methods. The issues become focused on scalability (to a large dataset), maintainability, addition of material, and reusability.

**Complexity: Manageable**

**Complexity: Overwhelming**
• **Semi-automatic migration of hypertext**
  - 'nodes' represent semantic information and these are anchors for links to other pages.
  - e.g., www.xxx
  xxx@xxx

• **Hyperimages**
  - We need an automated method to help us produce true hypermedia
• Editing and Authoring Tools
  - Adobe Premiere
  - Macromedia Director
  - Macromedia Flash
  - Dreamweaver
  - Cakewalk Pro Audio

• VRML
Thank you! Q&A