

Multimedia Systems

DCAP303

Edited by:
Dr. Anil Sharma



LOVELY
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MULTIMEDIA SYSTEMS
Edited By
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SYLLABUS

Multimedia Systems

Objectives: To impart the skills needed to develop multimedia applications. Students will learn:

- how to combine different media on a web application,
- various audio and video formats,
- multimedia software tools that helps in developing multimedia application.

| S. No. | Description |
|--------|---|
| 1. | Multimedia: Meaning and its usage, Stages of a Multimedia Project & Multimedia Skills required in a team |
| 2. | Text: Fonts & Faces, Using Text in Multimedia, Font Editing & Design Tools, Hypermedia & Hypertext. |
| 3. | Sound: Multimedia System Sounds, Digital Audio, MIDI Audio, Audio File Formats, MIDI vs Digital Audio, Audio CD Playback, Audio Recording, Voice Recognition & Response. |
| 4. | Images: Still Images – Bitmaps, Vector Drawing, 3D Drawing & rendering, Natural Light & Colors, Computerized Colors, Color Palettes, Image File Formats, Macintosh & Windows Formats, Cross – Platform format. |
| 5. | Animation: Principle of Animations, Animation Techniques, Animation File Formats. |
| 6. | Video: How Video Works, Broadcast Video Standards: NTSC, PAL, SECAM, ATSC DTV, Analog Video, Digital Video, Digital Video Standards – ATSC, DVB, ISDB, Video recording & Shooting Videos, Video Editing, Optimizing Video files for CD-ROM, Digital display standards. |
| 7. | Hardware: Macintosh versus Windows, Connections: IDE, SCSI, UIDE, ATA, USB, Firewire etc. Storage devices, Input , Output devices for Multimedia Projects. |
| 8. | Multimedia Software Tools: Text Editing & Word processing tools, OCR S/W, Painting & Drawing Tools, 3D Modelling & Animation Tools, Image editing tools, Sound Editing tools, Animation, Video & Digital movie tools, Overview of various types of Multimedia Authoring tools. |
| 9. | Compression: CODEC, Types of Compression & redundancies, GIF, JPEG & MPEG Standards Overview, Fractals. |
| 10. | Multimedia tools for WWW & Designing for WWW: Plug Ins, Text, Images, Sound & Animation for the Web. |

CONTENT

| | | |
|-----------------|---|-----|
| Unit 1: | Multimedia <i>Anil Sharma, Lovely Professional University</i> | 1 |
| Unit 2: | Text <i>Anil Sharma, Lovely Professional University</i> | 13 |
| Unit 3: | Sound <i>Manish Kumar, Lovely Professional University</i> | 29 |
| Unit 4: | Image <i>Anil Sharma, Lovely Professional University</i> | 43 |
| Unit 5: | Video <i>Anil Sharma, Lovely Professional University</i> | 73 |
| Unit 6: | Hardware <i>Anil Sharma, Lovely Professional University</i> | 95 |
| Unit 7: | Multimedia Software Tools <i>Dinesh Kumar, Lovely Professional University</i> | 119 |
| Unit 8: | Fundamental of Animations <i>Dinesh Kumar, Lovely Professional University</i> | 131 |
| Unit 9: | Working with Animation <i>Dinesh Kumar, Lovely Professional University</i> | 144 |
| Unit 10: | 3D Modelling and Animation Tools <i>Sandeep Kumar, Lovely Professional University</i> | 159 |
| Unit 11: | Compression <i>Anil Sharma, Lovely Professional University</i> | 181 |
| Unit 12: | Image Format <i>Anil Sharma, Lovely Professional University</i> | 194 |
| Unit 13: | Multimedia Tools for WWW <i>Dinesh Kumar, Lovely Professional University</i> | 215 |
| Unit 14: | Designing for World Wide Web (WWW) <i>Dinesh Kumar, Lovely Professional University</i> | 230 |

Unit 1: Multimedia

Notes

CONTENTS

- Objectives
- Introduction
 - 1.1 Meaning and its Usage
 - 1.1.1 Categories of Multimedia
 - 1.1.2 Features of Multimedia
 - 1.1.3 Applications of Multimedia
 - 1.2 Stages of Multimedia Project
 - 1.2.1 Pre Production
 - 1.2.2 Production
 - 1.2.3 Post Production
 - 1.3 Multimedia Skills Required in a Team
 - 1.4 Summary
 - 1.5 Keywords
 - 1.6 Review Questions
 - 1.7 Further Reading

Objectives

After studying this unit, you will be able to:

- Understand the meaning and usage of multimedia system
- Discuss the stages of multimedia projects
- Explain the skills required for a multimedia team

Introduction

Multimedia has become an inevitable part of any presentation. It has found a variety of applications right from entertainment to education. The evolution of Internet has also increased the demand for multimedia content.

Multimedia is the media that uses multiple forms of information content and information processing (e.g. text, audio, graphics, animation, video, and interactivity) to inform or entertain the user. Multimedia also refers to the use of electronic media to store and experience multimedia content. Multimedia is similar to traditional mixed media in fine art, but with a broader scope, the term "rich media" is synonymous for interactive multimedia.

1.1 Meaning and its Usage

As the name implies, multimedia is the integration of multiple forms of media. This includes text, graphics, audio, video, etc. For example, a presentation involving audio and video clips would

Notes be considered a “multimedia presentation.” Educational software that involves animations, sound, and text is called “multimedia software.” The CDs and DVDs are often considered to be “multimedia formats” since they can store a lot of data and most forms of multimedia require a lot of disk space.

1.1.1 Categories of Multimedia

Multimedia may be broadly divided into linear and non-linear categories. Linear active content progresses without any navigation control for the viewer such as a cinema presentation. Non-linear content offers user interactivity to control progress as used with a computer game or used in self-paced computer based training. Non-linear content is also known as hypermedia content.

Multimedia presentations can be live or recorded. A recorded presentation may allow interactivity via a navigation system. A live multimedia presentation may allow interactivity via interaction with the presenter or performer.

1.1.2 Features of Multimedia

Multimedia presentations may be viewed in person on stage, projected, transmitted, or played locally with a media player. A broadcast may be a live or recorded multimedia presentation. Broadcasts and recordings can be either analog or digital electronic media technology. Digital online multimedia may be downloaded or streamed. Streaming multimedia may be live or on-demand.

Multimedia games and simulations may be used in a physical environment with special effects, with multiple users in an online network, or locally with an offline computer, game system, or simulator.

Enhanced levels of interactivity are made possible by combining multiple forms of media content. But depending on what multimedia content you have, it may vary online. Multimedia is increasingly becoming object-oriented and data-driven, enabling applications with collaborative end-user innovation and personalization on multiple forms of content over time. Examples of these range from multiple forms of content on websites like photo galleries with both images (pictures) and title (text) user-updated, to simulations whose co-efficient, events, illustrations, animations or videos are modifiable, allowing the multimedia “experience” to be altered without reprogramming.



In Europe, the reference organization for Multimedia industry is the European Multimedia Associations Convention (EMMAC).

1.1.3 Applications of Multimedia

Multimedia finds its application in various areas including, but not limited to, advertisements, art, education, entertainment, engineering, medicine, mathematics, business, scientific research and spatial, temporal applications.

A few application areas of multimedia are listed below:

Creative Industries

Creative industries use multimedia for a variety of purposes ranging from fine arts, to entertainment, to commercial art, to journalism, to media and software services provided for any of the industries listed below. An individual multimedia designer may cover the spectrum throughout their career, request for their skills range from technical to analytical and to creative.

Commercial**Notes**

Much of the electronic old and new media utilized by commercial artists is multimedia. Exciting presentations are used to grab and keep attention in advertising. Industrial, business to business, and interoffice communications are often developed by creative services firms for advanced multimedia presentations beyond simple slide shows to sell ideas or liven-up training. Commercial multimedia developers may be hired to design for governmental services and nonprofit services applications as well.

Entertainment and Fine Arts

In addition, multimedia is heavily used in the entertainment industry, especially to develop special effects in movies and animations. Multimedia games are a popular pastime and are software programs available either as CD-ROMs or online. Some video games also use multimedia features. Multimedia applications that allow users to actively participate instead of just sitting by as passive recipients of information are called *Interactive Multimedia*.

Education

In Education, multimedia is used to produce computer-based training courses (popularly called CBTs) and reference books like encyclopedia and almanacs. A CBT lets the user go through a series of presentations, text about a particular topic, and associated illustrations in various information formats. Edutainment is an informal term used to describe combining education with entertainment, especially multimedia entertainment.

Engineering

Software engineers may use multimedia in computer simulations for anything from entertainment to training such as military or industrial training. Multimedia for software interfaces are often done as collaboration between creative professionals and software engineers.

Industry

In the Industrial sector, multimedia is used as a way to help present information to shareholders, superiors and coworkers. Multimedia is also helpful for providing employee training, advertising and selling products all over the world via virtually unlimited web-based technologies.

Mathematical and Scientific Research

In mathematical and scientific research, multimedia is mainly used for modeling and simulation. For example, a scientist can look at a molecular model of a particular substance and manipulate it to arrive at a new substance. Representative research can be found in journals such as the journal of multimedia.

Medicine

In Medicine, doctors can get trained by looking at a virtual surgery or they can simulate how the human body is affected by diseases spread by viruses and bacteria and then develop techniques to prevent it.

Multimedia in Public Places

In hotels, railway stations, shopping malls, museums, and grocery stores, multimedia will become available at stand-alone terminals or kiosks to provide information and help. Such installation reduce demand on traditional information booths and personnel, add value, and they can work around the clock, even in the middle of the night, when live help is off-duty.

Notes



In 1992, Tandy Radio Shack becomes one of the first companies to release a computer based on the Multimedia PC standard with its introduction of the M2500 XL/2 and M4020 SX computers.

1.2 Stages of Multimedia Project

A multimedia product is made up of many ingredients from existing print products or from a multitude of software. Each product has its own set of requirements.

Multimedia projects with a well thought out three-stage process involving:

1. Pre Production
2. Production
3. Post Production.

1.2.1 Pre Production

Idea

The first question we ask is “why” you want to develop a multimedia project?

- Is multimedia the best option, or would a print product being more effective?
- Is the idea marketable?

Project Goals

We determine what the product needs to accomplish. The goals have to be measurable and behaviour-based from the visitor’s standpoint.

Demographics of Target Audience

Who is your product speaking to?

- Age
- Gender
- Educational background
- Socioeconomic level
- Ethnic background
- Language
- Profession
- Expectations.

Product Concept

The core idea is born after several rounds of brainstorming.

Delivery Medium

How will your message or information reach the audience?

- CD-ROM
- Disks
- Web

- Intranet
- Computer kiosks
- What types of equipment your audience have?
- What obstacles must be overcome?

Notes

Authoring Tools

We determine the authoring tool to be used in the project. This is the vehicle for integrating all the pieces:

- Text
- Graphics
- Animation
- Sound
- Video.

Planning

Planning is the crucial factor determining success and failure. If you fail to plan, you are planning to fail.

We determine:

- What building blocks go into your multimedia project?
- How long will each task take?
- How much will the product cost?
- Who is going to do the work?

Resource Organization

The product's content is arranged into categories or groups. From this organization, comes the interface, which leads the user to the information.

Flowcharting

The flowchart is a visual outline of the content. Each level or link represents a screen and/or control that must be created. This "roadmap" is essential for the production phase.

Orientation

The opening screens are the graphic and verbal directions to enable the user to find his way around the content.

Navigation

The flowchart is the roadmap, and the navigation is the signposts. Remember, the shortest path between two points is a straight line.

Defining Screen Action

The screen or interface action directs how the interface responds to the user.

Think of your users:

- What they will want or need?
- What their expectations may be?
- What assumptions they may make while using your product?

Notes

Designing Interface Controls

At this step, the interface controls (how the user interacts with the computer screen) for each portion of the projects is designed. The functionality is analyzed and evaluated individually and as a whole throughout the product.

Storyboards

The storyboards are the blueprints for your multimedia project. These rough sketches bring together all the elements with the controls and depict the sequence of the action.

Theme Development

The visual theme or style is determined by the content and the audience. The best theme is broad enough to incorporate various media without imposing stylistic limitations but narrow enough to ensure consistency across screens.

Interface Layouts

Each object on the screen serves a purpose and communicates a visual message about the content to the user. The goal is to keep users oriented and draw them into the product.

Creating Interface Elements

The interface design is broken down into individual components, which are constructed using a variety of methods and tools. These components may include images, graphics, text, video, sound, and animation.

Creating Access Controls

The interface controls designed earlier are now created and constructed. They should be self-explanatory and contribute to the overall screen design. These controls can be buttons, icons, images, or text.

Integrating Media Elements

The authoring tool is used to pull together and blend all the media elements into a cohesive whole. As the elements come together, the storyboards come to life.

Creating Prototype Interfaces

The shells become the prototype screens and provide the foundation for production. These prototypes are your first experiment in using your creation.



Create an interface using interface controls.

1.2.2 Production

Scriptwriting

The scripts for the text, transitions, audio narrations, voice-overs, and video are written. Even existing material needs to be rewritten and reorganized for an electronic medium.

Editing

All the scripts, interfaces, and text content are edited for clarity, grammar, and consistency.

Creating Original Art**Notes**

Illustrations, graphics, buttons, and icons are created using the prototype screens as a guide.

Digitizing Art

Existing photographs, illustrations, and graphics are digitized for use in an electronic medium. Electronically generated art as well as digitized art must be prepped for use; number of colours, palettes, resolution, format, and size are addressed.

The 3D Modeling and Animation

The 3D artwork is created, rendered, and then prepared for use in the authoring tool. The 3D animations require their own storyboards and schedules.

Shooting and Digitizing Video

The edited scripts are used to plan the identify location, performers, time schedules and budget, then the shoot is scheduled.

Recording and Digitizing Audio

Similarly, the edited scripts (or a composer, if using music) are used to plan the budget, performers and time schedules after which the recording session is scheduled.

Authoring

All the pieces come together in the authoring tool. Functionality is programmed, and 2D animation is developed. From here, the final working product is created.

Proofreading

Every word on the screen is proofread and checked for consistency of formatting. In addition, the proofreader reviews all video and audio against the edited scripts.

Quality Control

Quality control goes on throughout the process. The storyboards are helpful for checking the sequencing.



Caution The final step checks should be done for the overall content functionality and usability of the product.

1.2.3 Post Production**Testing**

The product is tested on multiple computers and monitors.

Mastering

Mastering can be as simple as writing a CD-ROM or floppy disk. Or it can be as complex as sending the files to a service that will create a pre-master from which the master is made.

Archiving

The original files, including audio, video, and the native software formats, are archived for future upgrades or revisions.

Duplication

The duplicates are created from the original and packaged accordingly.

| Notes | Distribution |
|-------|---|
| | <p>The final step in the process is distributing your multimedia project.</p> <div data-bbox="420 300 1289 332" style="border: 1px solid black; padding: 10px;"><p data-bbox="501 332 546 339">Task</p><p data-bbox="598 332 1259 339">Create a design for a multimedia project using the animation.</p></div> |

Self Assessment

Choose the correct answer:

1.3 Multimedia Skills Required in a Team

A multimedia team consists of the following:

- Project manager
 - Multimedia designer
 - Interface designer
 - Writer
 - Video specialist
 - Audio specialist
 - Multimedia programmer
 - Producer for the Web
 - Computer programmers.

The project manager is responsible for:

- The overall development, implementation, and day-to-day operations of the project.
 - The design and management of a project.
 - Understanding the strengths and limitations of hardware and software.

- Ensuring people and organizational skills.
- Conveying information between the team and the client.

Notes

Multimedia designer – This team consists of:

- *Graphics designers, illustrators, animators, and image processing specialists*, who deal with visuals, thereby making the project appealing and aesthetic.
- *Instructional designers*, who make sure that the subject matter is presented clearly for the target audience.
- *Interface designers*, who devise the navigational pathways and content maps.
- *Information designers*, who structure content, determine user pathways and feedback, and select presentation media.

An interface designer is responsible for:

- Creating a software device that organizes content. It allows users to access or modify content, and presents that content on the screen.
- Building a user-friendly interface.

A multimedia writer is responsible for:

- Creating characters, actions, point of view, and interactivity.
- Writing proposals and test screens.
- Scripting voice-overs and actors' narrations.

A video specialist needs to understand:

- The delivery of video files on CD, DVD, or the Web.
- How to shoot quality video?
- How to transfer the video footage to a computer?
- How to edit the footage down to a final product using digital non-linear editing system (NLE)?

An audio specialist is responsible for:

- Locating and selecting suitable music talent.
- Scheduling recording sessions.
- Digitizing and editing recorded material into computer files.

A Multimedia programmer is also called a software engineer who:

- Integrates all the multimedia elements into a seamless project, using authoring systems or programming language.
- Writes codes for the display of multimedia elements, and to control various peripheral devices.
- Manages timings, transitions, and record keeping.

Multimedia producer for the Web or Website producer:

- put together a coordinated set of pages for the Web.
- they also co-ordinate updates and changes.

Notes

Caution

Debugging is necessary before launching a new multimedia product.



Case Study

History of Multimedia

Since the late 1970s, desktop computers used in the home and office have evolved into sophisticated systems that help us get our jobs done, deliver information, and provide entertainment. Now a timeline of some of the key technologies that have contributed to the evolution of multimedia computers are generated.

Multimedia technology has changed the way we look at computers. The first computers were seen as single-purpose machines that solved incredibly complex mathematical problems. During the 1960s, mainframe computers were used to manage large corporate databases and financial systems. The 1970s saw computer terminals throughout an organization being used for.

Publishing and information management: The 1980s brought the desktop computer so everyone could have a computer at his or desk for word processing, spreadsheets, and even games. Bringing the computer to the individual in the office, the home, and the classroom meant looking at the computer as more than just a fancy typewriter or automated bookkeeper.

In the mid 1980s and into the 1990s, computer developers started looking at how computers could be used as never before. At the same time, advances in technology brought about:

1. Faster desktop computers
2. Increased working memory capacity in computers
3. Higher data storage capacity in disk drives and CD-ROMs
4. Digital audio and video
5. Graphic operating systems that worked by pointing and clicking at objects on the screen instead of having to remember cryptic command sequences such as "dir .exe" to find a program
6. Local and wide area networks that connected users to the world
7. Thousands of applications ranging from word processors to a myriad of multimedia products that have changed the workplace, classroom, and the home.

Computer developers started looking to multimedia – the delivery of information using text, pictures, audio, and video—as a way to utilize computers in a uniquely personal way. Multimedia computers could be used to increase efficiency and productivity on the job, provide information at our fingertips in the home, and help students learn more effectively both in and out of the classroom. These personal gains meant that people would see computers as practical and useful tools in their everyday lives.

Since the late 1980s, multimedia technology and applications have found many places in our lives:

- At home where a wide variety of games and reference products such as encyclopedias and cookbooks are put to use.
- At the office where marketing presentations and training are essential how to get a new job done.

Contd...

- At school where interactive software programs assist students in learning mathematics, science, and new languages.
- In shopping malls where interactive computer terminals, called kiosks, help us to design greeting cards or to find out where specific stores are located.

Notes

As you can see, the impact of multimedia technology on our daily lives is often more than we realize. The bottom line is that, if there is a need to inform, teach, or entertain multimedia technology can play a key role.

Questions:

1. What is the main reason of developing multimedia technology?
2. How the multimedia has affected our daily life?

Self Assessment**Choose the correct answer:**

5. The work not done by project manager is
 - (a) The design and management of a project
 - (b) Building a user-friendly interface
 - (c) Ensuring people skills
 - (d) Ensuring organizational skills
6. A multimedia writer is responsible for
 - (a) Creating characters, actions, point of view, and interactivity
 - (b) Writing proposals and test screens
 - (c) Scripting voice-overs and actors' narrations
 - (d) All of these
7. Multimedia programmer is also called as software engineer.
 - (a) True
 - (b) False
8. From below list which is not the process of post production

| | |
|------------------|------------------|
| (a) Distribution | (b) Flowcharting |
| (c) Mastering | (d) Duplication |

1.4 Summary

- Multimedia is a woven combination of text, audio, video, images and animation.
- Multimedia systems finds a wide variety of applications in different areas such as education, entertainment etc.
- The categories of multimedia are linear and non-linear.
- The main stages for multimedia application development are planning and costing, designing and producing, testing and delivery.

Notes

1.5 Keywords

Archiving: The original files, including audio, video, and the native software formats are archived for future upgrades or revisions.

Flowcharting: The flowchart is a visual outline of the content. Each level or link represents a screen and/or control that must be created. This “roadmap” is essential for the production phase.

Mastering: Mastering can be as simple as writing a CD-ROM or floppy disk or it can be as complex as sending the files to a service that will create a pre-master from which the master is made.

Multimedia: A medium that uses multiple forms of information content and information processing to inform or entertain the user.

Proofreading: Every word on the screen is proofread and checked for consistency of formatting. In addition, the proofreader reviews all video and audio against the edited scripts.

Storyboards: The storyboards are the blueprints for your multimedia project. These rough sketches bring together all the elements with the controls and depict the sequence of the action.



Lab Exercise

1. Create a multimedia project using the authoring tools.

2. List the criteria on the basis of which we select a multimedia project team.

1.6 Review Questions

1. What is the meaning of multimedia system?
2. What are the features and scope of multimedia system?
3. Explain the different applications of multimedia.
4. What are the stages of multimedia project?
5. Differentiate between pre and post production of multimedia projects.
6. Explain the different delivery medium and authoring tools for a multimedia project.
7. What are the skills required for good multimedia team?
8. Explain the roles of a multimedia project manager.
9. What are the responsibilities of an interface designer and a multimedia programmer?
10. What are the roles of an audio and video specialist in a multimedia project?

Answers to Self Assessment

- | | | | | |
|--------|--------|--------|--------|--------|
| 1. (a) | 2. (d) | 3. (c) | 4. (c) | 5. (b) |
| 6. (d) | 7. (a) | 8. (b) | | |

1.7 Further Reading



Books

Multimedia Systems, by Ralf Steinmetz, Klara Nahrstedt



Online link

<http://books.google.co.in/books>

Unit 2: Text

Notes

CONTENTS

- Objectives
- Introduction
- 2.1 Fonts and Faces
 - 2.1.1 Installation of Fonts
 - 2.1.2 Selecting Text Fonts
- 2.2 Using Text in Multimedia
 - 2.2.1 Use of Text in Webs
 - 2.2.2 Use of Text in Films Such as Titles and Credits
 - 2.2.3 Use of Text in Subtitles in a Film or Documentary
 - 2.2.4 Use Text in Advertisements
- 2.3 Font Editing and Design Tools
 - 2.3.1 Fontographer
 - 2.3.2 FontMonger
 - 2.3.3 Cool 3D Text
- 2.4 Hypermedia and Hypertext
 - 2.4.1 Linear and Non-linear Media
 - 2.4.2 Nodes, Links and Navigation
 - 2.4.3 Information Structures
 - 2.4.4 Node-link Diagrams, Sketches and the Design Process
 - 2.4.5 Future Developments
- 2.5 Summary
- 2.6 Keywords
- 2.7 Review Questions
- 2.8 Further Readings

Objectives

After studying this unit, you will be able to:

- Understand different fonts and faces
- Describe text in multimedia
- Explain font editing and design tools
- Understand hypermedia and hypertext

Introduction

All multimedia content consists of texts in some form. Even a menu text is accompanied by a single action such as mouse click, keystroke or finger pressed in the monitor (in case of a touch

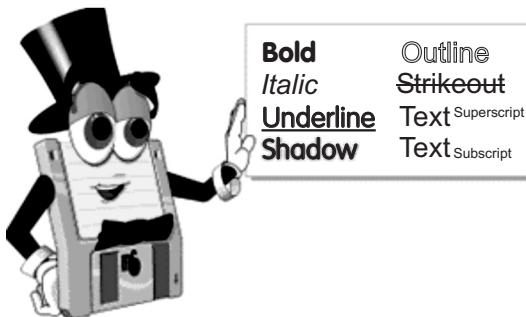
Notes

screen). The text in the multimedia is used to communicate information to the user. Proper use of text and words in multimedia presentation will help the content developer to communicate the idea and message to the user.

Text is simply another name for words. Text provides information to the reader. It is everywhere; and a part of our daily lives. We see it in newspapers, books, signs, on websites, on TV, on computer screens and many more places. Text in multimedia is generally combined with other types of media such as video, graphics, photography, animation and sounds. Text is the most widely used and flexible means of presenting information on screen and conveying ideas. For a public system, where the eyesight of its users will vary considerably, a clear and reasonably large font should be used. Users will also be put off by the display of large amounts of text and will find it hard to scan. To present tourist information about a hotel, for example, information should be presented concisely under clear separate headings such as location, services available, prices, contact details, etc.

2.1 Fonts and Faces

A font is a collection of characters of a single size and style belonging to a particular typeface family. Typical font styles are **boldface** and *italic*. Other style attributes, such as underlining, outlining and strikeout of characters, may be added by your computer software.



A typeface is family of graphic characters that usually includes many types of sizes and styles.

The size of a text is usually measured in points. One point is approximately 1/72 of an inch i.e., 0.0138. The size of a font does not exactly describe the height or width of its characters. This is because the x-height (the height of lower case character x) of two fonts may differ.

Typefaces of fonts can be described in many ways, but the most common characterization of a typeface is *serif* and *sans serif*. The serif is the little decoration at the end of a letter stroke. Times, Times New Roman, Bookman are some fonts which come under serif category. Arial, Optima, Verdana are some examples of sans serif font. The following fonts show a few categories of serif and sans serif fonts.

F

(Serif Font)

F

(Sans serif font)



Serif fonts are generally used for body of the text for better readability whereas

Did u know? sans serif fonts are generally used for headings.



In HTML documents the fonts you are using, be warned that if someone else does not have the same font, they would not be able to view your text in that font when they open the HTML document.

Notes

2.1.1 Installation of Fonts

If you have Windows, you can usually just copy the font into your c:\windows\font\directory and it will install automatically. Another method is to go to Start > Settings > Control Panel > Fonts, then go to File > Install New Font. If you already have too many fonts on your computer, or you have an older operating system, these would not work. Instead, you will have to get a program like Adobe Type Manager, and use it to add fonts to your system.

Usage

Once the font is installed on your system, you should be able to change the font of your text in any text editing program. You can also use this font in HTML documents, but be warned that if someone else does not have the same font, they would not be able to view your text in that font when they open the HTML document. Make sure you know what the font's exact name is before you try to use it. A font's name is not the same as the file name of the .ttf file. You can find out the font's name either by going through your font list after the font is installed, or by double-clicking on the .ttf font file and looking at the information that pops up.

2.1.2 Selecting Text Fonts

It is a very difficult process to choose the fonts to be used in a multimedia presentation.

Following are a few guidelines which help to choose a font in a multimedia presentation:

- As many number of typefaces can be used in a single presentation, this concept of using many fonts in a single page is called ransom-note topography.
- For small type, it is advisable to use the most legible font.
- In large size headlines, the kerning (spacing between the letters) can be adjusted.
- In text blocks, the leading for the most pleasing line can be adjusted.
- Drop caps and initial caps can be used to accent the words.
- The different effects and colours of a font can be chosen in order to make the text look in a distinct manner.
- Anti-aliased can be used to make a text look gentle and blended.
- For special attention to the text the words can be wrapped onto a sphere or bent like a wave.
- Meaningful words and phrases can be used for links and menu items.
- In case of text links (anchors) on web pages the messages can be accented.



Task

Using the process of font installation install font software in your system.

2.2 Using Text in Multimedia

Text is a basic element of many multimedia titles. Wherever possible, this text should be kept to a minimum unless the application includes a great deal of reference material. Reading volumes of text on a computer screen is difficult and tiring. Moreover, it may not be the best way to communicate an idea, concept, or even a fact.

Notes

The saying “A picture is worth a thousand words” (and perhaps more when audio, video and animation are added) is as true in multimedia as on the printed page.

Although there are certain titles where text predominates, such as reference works like encyclopaedias, combining other elements with text can often reduce the amount of text needed to convey a concept.

Examples of Multimedia Titles that Includes a Great Deal of Reference Material



From a design standpoint, text should fill less than half the screen.

Text can be used in many ways in multimedia:

- in a website
- in films such as titles and credits
- as subtitles in a film or documentary that provide a translation
- it may be used in advertisements
- it is used in text messaging.

2.2.1 Use of Text in Webs

Text has more benefits, other than simply driving visitors' attention to itself, other than spending time and energy on graphical elements that do not contribute to understanding of the page.

To improve website speed

When a website is built primarily of text (such as this one), it loads much faster, than the one, which uses:

- excessive images, graphics
- JavaScript (for menus, including various stat tracking scripts, such as Google Analytics)
- table-based layouts (which are twice larger in file size, than the ones built in CSS)
- internal code (not placed in external CSS, JS, etc. files and linked to)
- sound and video on the page (especially without transcripts, which hurts accessibility if you do use audio/video, do not auto-launch it and have a button to turn it on/off)

Though website loading speed is not the only factor that influences conversions, it is one of the most important ones, considering that visitors start to leave, when the page loads slower than in 8 seconds.

Another, more important factor, is how well visitors can find what they want on the website. Though relevant, clear images can draw visitors' eyes to it, the text, containing the information the people were hunting for, draws much more attention. That is why text should be the cornerstone of the web page design, not graphics (which it seems to be right now). Especially, when text can boost search engine traffic and conversions greatly.

In that respect, it is of primary importance to format the text for the web to make it readable and write it for the people.

Notes

An alternative to graphics, white space and carefully styled with CSS text can replace most graphics (especially text in images).

2.2.2 Use of Text in Films Such as Titles and Credits

Most movies start with titles and end with credits. The text is sometimes over some background video or pictures, and at other times it is over a plain coloured background. It has been traditional since the days of silent movies.

Decisions that you make, when incorporating text in multimedia, depend on a number of factors including:

- the content of the information
- the amount of text needed
- the theme or look of the multimedia product
- the placement of the text (is it a heading or body text or a logo?)
- the format of the project (is it a video, website, blog, video, slideshow, etc?)

Consider, how different the typography can look in different formats such as a poster, a website, an essay and subtitles in a film or the titles in a film.

It is a Good Idea to use Text that Suits the Picture and Style



2.2.3 Use of Text in Subtitles in a Film or Documentary

If you are starting the process of adding subtitles to your film, you will need to take into consideration font styles, spacing, and font colour and font size.

There are certain fonts that lend themselves well to web design, others that work better in print and others that are optimal for use against dynamic content such as moving images.

While web fonts such as Tahoma, Verdana and Georgia are great for use in web media, they were designed to work well in static design environments where the background does not change.

There are three fonts that are widely used for subtitles in films and documentaries. They are:

- Univers45
- Antique Olive
- Tiresias.

Notes These three fonts work well as subtitles over dynamic content and will allow you to communicate most effectively with your audience.

When you design your subtitles, you will need to keep in mind that moving images interact with your top layer subtitles. For example, if your subtitles are white and they rest on top of a similar white tone in your image, the text will be difficult and impossible to read. To ensure this does not happen, you should use a black outline around your text. This helps ensure your text will be viewable even against common black and white backgrounds.

Alternatively, some filmmakers use a yellow font for their subtitles. However, even if you decide to use yellow subtitles you should nevertheless use a black outline (and possibly even a soft shadow) around the text to ensure its readability. If you experiment with fonts for your subtitles ensure you experiment with Sans Sheriff fonts. They are much more readable than their sheriff cousins.

2.2.4 Use Text in Advertisements

Text message advertising may be more obvious to some businesses than others. For example, if somebody has a restaurant and he is a prime candidate for using this medium. He has free ad space at each and every table to tell his customers about his texting program and get them coming in for more frequent visits, same with dentist or a singer. Can they really use text message advertising to their advantage? The answer is a resounding yes. Let's take a quick look at all the ways to use text message advertising, no matter who you are.

Any local business, such as a restaurant or bookstore, coffee shop, boutique or convenience store: You can place flyers and table tents around your business to show your current customers how to get great text coupons. Or add a one-liner in your other advertising to outside potential customers to give them even more incentive to walk into your business. Before you know it, you are attracting new customers and building repeat business with your current customers.

Event planners and party organizers: Tell your event guests to text your keyword and their name to your short code. Now you have a list of attendees that you can instantly reach with last minute changes, updates to the schedule or great deals on merchandise.

Speakers, performers, bands, artists: Let your followers know about your text program. They sign up and now you can update them regarding shows, concerts, new releases, showings, guest appearances or anything.

Schools, churches, and organizations: You have 100s or even 1000s of people that you need to communicate with. How many trees do you kill with all of the flyers you have to mail out? Imagine if you told your congregation you were going green, they sign up for your text program, and you still keep in touch with all of them at the touch of a few buttons. Cut your tree usage in half and your mailing expenses too!

Professionals like plumbers and dentists: Have your customers opt-in to your list and you have got an instant way to remind them of their upcoming appointments or fill a hole in your schedule within minutes.

Your personal virtual business card: You are a business person heading to an event where you normally pass out your business card and receive dozens in return. This time, you tell your interested colleagues to text their name to your short code and instantly they get a response that you created. It is your business card in text form. They have all of your information and now you have their name and number too!

You see, the ways that you can use text message advertising is really only limited by your imagination. All you need is a good text message service.

2.3 Font Editing and Design Tools

Notes

There are several softwares that can be used to create customized font. These tools can help multimedia developer to communicate his idea or the graphic feeling. Using these software different typefaces can be created.

In some multimedia projects it may be required to create special characters. Using the font editing tools it is possible to create a special symbol and use it in the entire text.

Following is the list of software that can be used for editing and creating fonts:

- Fontographer
- FontMonger
- Cool 3D text

2.3.1 Fontographer

It is a macromedia product and a specialized graphics editor for both Macintosh and Windows platforms. You can use it to create PostScript, TrueType and bitmapped fonts for Macintosh and Windows.

Easily expand existing fonts to include fractions, symbols, foreign characters and logos in Type 1, Type 3, and TrueType fonts, or create an entire typeface from scratch. Fonts created with Fontographer can be used in any program with a font menu on Windows and Macintosh platforms. Now integrated into the Fontlab line of digital typography tools.

There are following terms for Fontographer:

Ease to use

Fontographer has all the tools to make type manipulation easy for both beginners and professionals. It is easy to add fractions, special symbols, foreign characters, even logos to all your favourite fonts. Print key maps of all your fonts and keep customizations at your fingertips.

Real-time rendering

Fontographer's fast rendering lets you design, edit and manipulate fonts in a variety of editing windows. View your work in the Metrics window to see how your characters will look when printed.

Typographical precision

Fontographer lets you specify, view and print characters. Includes snap-to-guides and snap-to-points. Print samples of characters, keyboard layouts and kerning pairs for future reference.

Compatible file formats Windows version

Fontographer lets you edit PostScript-language Type 1 and TrueType fonts. Drag and drop or import EPS files and bitmap files. Export EPS files for use in your favourite drawing programs.

Compatible file formats Macintosh version

Fontographer lets you edit PostScript-language Type 1, Type 3, TrueType and even Adobe Multiple Master fonts. You can import EPS files (AI 1.1 format) from programs like FreeHand and Illustrator.

An integral part of your software library

Fontographer generates PostScript-language Type 1 fonts, Type 3, TrueType and Multiple Master fonts. Fontographer generates fonts for use on both the Macintosh and Windows platforms. You can also export EPS and PICT files for use in your favourite drawing programs.

Notes**2.3.2 FontMonger**

FontMonger is a new product in the Macintosh market. FontMonger is a font conversion utility, but it goes further, allowing you to customize your fonts to some degree. FontMonger also lets you convert to PICT outlines or EPSF files. Although FontMonger does not allow editing of the actual outlines of a font, it allows you an array of other functions such as the ability to copy characters between fonts, perform various transformations to any or all characters of a font, and create a variety of composite characters such as fractions and accented characters. Suppose you have always wanted to create a narrow version of Times. Open up Times, select all the characters, open up the Alter Characters window, and type 80% in the width box. Save the new font as Times Narrow. FontMonger will also save the previous original characters in the PostScript font so you can modify it further in the future, or, if you wish to save on disk space, compress the font and it will remove the extra information. Similarly, you can expand characters horizontally, modify character widths, or add a slant for obliqued fonts. Creating fractions is equally easy.



Microsoft's free Font properties extension provides access to text entries stored within TrueType and OpenType™ fonts. Since type designers cannot easily edit these entries, we have created the font properties editor.

2.3.3 Cool 3D Text

Cool 3D Production Studio is a program for creating and animating 3D text and graphics, to include in various videos and multimedia products. With this program, you can create titles and 3D graphics, generate animations, and include them in your videos. Includes new modelling tools, animations plugs-in, and new features for animation and video. It runs on Windows 98SE/ME/2000/XP.



Task

Give the steps of using Fontmanager for setting system font.

Self Assessment

Choose the correct answer:

1. A is family of graphic characters that usually includes many type sizes and styles.

| | |
|--------------|-----------------------|
| (a) typeface | (b) boldface |
| (c) serif | (d) None of the above |
2. Verdana is an example of serif font.

| | |
|----------|-----------|
| (a) True | (b) False |
|----------|-----------|
3. is/are widely used for subtitles in films and documentaries.

| | |
|----------------------|-----------------------|
| (a) Univers45 | (b) Tiresias |
| (c) Both (a) and (b) | (d) None of the above |
4. tool is used to create a special symbol and use it in the entire text.

| | |
|---------------------|-------------------|
| (a) Font editing | (b) Style editing |
| (c) Graphic styling | (d) None of these |
5. save the previous original characters in the PostScript font.

| | |
|----------------|-------------------|
| (a) EPSF files | (b) Fontographer |
| (c) FontMonger | (d) None of these |

2.4 Hypermedia and Hypertext

Notes

Both Hypermedia and hypertext refer to web pages and other kinds of on-screen content that employ hyperlinks. Hyperlinks give us choices when we look for information, listen to music, purchase products, and engage in similar activities. They take the form of buttons, underlined words and phrases, and other “hot” areas on the screen.

Hypertext refers to the use of hyperlinks (or simply “links”) to present text and static graphics. Many websites are entirely or largely hypertexts. Hypermedia refers to the presentation of video, animation, and audio, which are often referred to as “dynamic” or “time based” content or as “multimedia.” Non-web forms of hypertext and hypermedia include CD-ROM and DVD encyclopaedias (such as Microsoft’s Encarta), e-books, and the online help systems that we find in software products. It is common for people to use “hypertext” as a general term that includes hypermedia. For example, when researchers talk about “hypertext theory,” they refer to theoretical concepts that pertain to both static and multimedia content.

Starting in the 1940s, an important body of theory and research has evolved and many important hypertext and hypermedia systems have been built. The history of hypertext begins with two visionary thinkers: Vannevar Bush and Ted Nelson. Bush, writing in 1945, recognized the value of technologies that would enable knowledge workers to link documents and share them with others. Nelson, starting in the mid-1960s, spent decades trying to build a very ambitious global hypertext system (Xanadu) and as part of this effort produced a rich (though idiosyncratic) body of theory.

2.4.1 Linear and Non-linear Media

A “linear” communication medium is one, we typically experience straight through beginning to end. There is little or no choosing as we go. Cinema is a linear medium. In the world of print, novels are linear, but newspapers, magazines and encyclopaedias are somewhat non-linear. They encourage a certain amount of jumping around. The web and other hypertextual media are strongly non-linear. Indeed, the essence of hypertext and hypermedia is choice—the freedom to decide what we will experience next. You can build a website, in which the hyperlinks take the user on a single path from beginning to end, but this would be a strange website, and one can question whether it is really hypertext.

2.4.2 Nodes, Links and Navigation

Web designers and others who are interested in hypertext often use the term “node” to refer to chunks of content. Much of the time a “node” is simply a web page. But there are times when we want to envision a cluster of closely related web pages as a single unit. Also, there are times in which one physical web page really behaves like two or more separate chunks of content. Furthermore, the “page” is not the fundamental unit of content in websites built with Flash (an animation technology from Macromedia) and in many non-web hypertext systems. Therefore, we do well to use the term “node” as the fundamental unit of hypertext content. Links (or hyperlinks) are the pathways between nodes.

When we click links and thereby display a succession of web pages (nodes), we are in a sense “navigating” the website. Navigation is only a metaphor; no one, of course, travels anywhere. Navigation, however, is a very natural and useful metaphor because exploring a website (or a non-web hypertext) is much like finding our way through a complex physical environment such as a city. In both hypertext navigation and physical navigation, we choose the most promising route and keep track of where we go. If we get lost, we may backtrack to familiar territory or even return to our home base and start over. In the best case, we gain a mental picture of the overall structure of the environment (a bird’s eye or map-like view).

At the same time, the concepts of nodes, links and navigation have limitations, and their relevance and usefulness are being called into question due to the growing sophistication of web technologies. If clicking a link plays an audio sequence, is the audio sequence then a node? Does it matter whether the audio sequence is a single word or a 3-minute popular song? If clicking a link on a web page begins a video sequence on a portion of that same page, how do we describe what has happened? Is the video sequence a kind of sub-node embedded within the node that is the page as a whole?

Notes

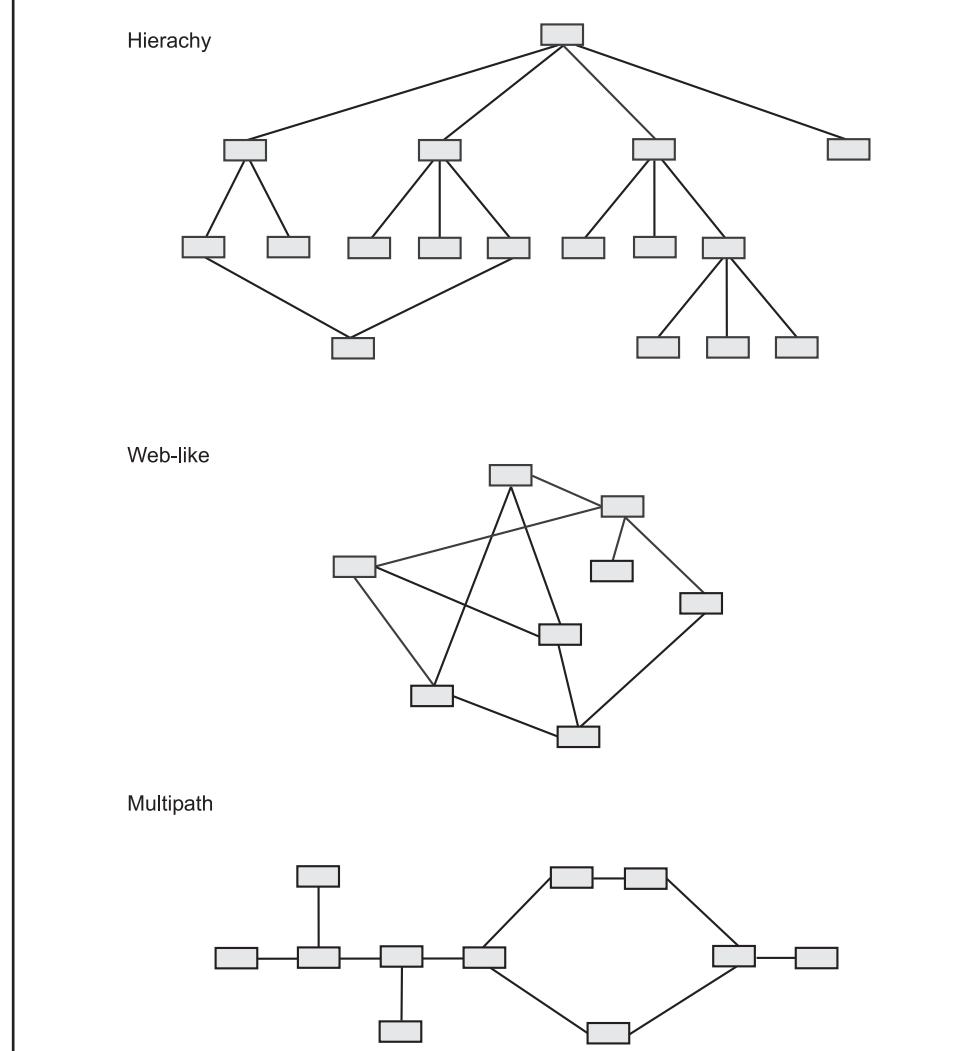
In early hypertext systems links were just simple electronic pathways with a fixed origin and destination. But now, if you revisit an e-commerce website, you may find an automatically generated, personalized link inviting you to buy a new book by an author whose books you have previously purchased. Furthermore, this link may be gone the next time you visit the site. Do we need to distinguish between links that everyone sees and links that only appear under specific circumstances?

A limitation of the navigation paradigm is that it does not correspond to the full range of user behaviour. At times users do not think spatially; they just click the most promising links they see. Designers, in fact, have begun employing a different metaphor for web use—the metaphor of the “information scent.” The idea is that users, like animals foraging or hunting for food, look for strong and distinct scents that point them toward their desired goals. Designers, therefore, should strive to create links that give off these strong and unambiguous scents.

2.4.3 Information Structures

Designers of websites and other hypertexts must work hard to decide which nodes will be linked to which other nodes. Only with thoughtful linking will users be able to navigate successfully. Fortunately there are well-known arrangements of nodes and links—often called “information structures”—that guide designers as they work. By far the most important of these structures is the hierarchy. Also important are the web-like and the multipath structures. These information structures are shown in Figure 2.1.

Figure 2.1: The Hierarchical, Web-like and Multipath, Information Structures



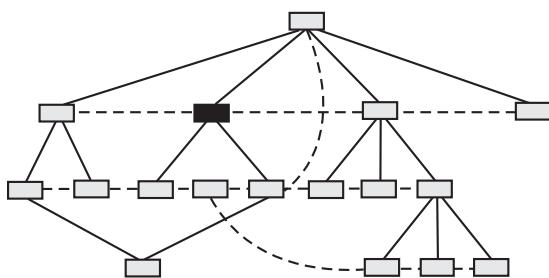
The Hierarchical Structure

Notes

The hierarchy is by far the most important structure because it is the basis of almost all websites and most other hypertexts as well. Why is this so? Because hierarchies are orderly (so users can grasp them) and yet they provide ample navigational freedom. The node-link diagram in Figure 2.1 shows the orderly nature of hierarchies. Users start at the home page, descend the branch that most interests them, and make further choices as the branch divides. At each level, the information on the nodes becomes more specific. Notice that branches may also converge.

The flexibility of the hierarchical structure is apparent in the more richly linked hierarchy shown in Figure 2.2. Here the basic hierarchical structure (the primary links shown as solid lines) is supplemented by secondary links (shown as dotted lines). The secondary links function mainly as shortcuts; they let users jump around more freely. For example, users can move laterally along the sibling nodes of a single branch and can jump from one branch to another, without having to first move up to a higher-level node. Although not shown in the figure, there is almost always a link from every node back to the home page (the top of the hierarchy) and other kinds of upward links.

Figure 2.2: A Node-link Diagram of a Website and a Mock-up of One of the Pages in this Website



Search

World leader in rotary brushes

[Products](#) | [Support](#) | [Locations](#) | [About Us](#)

Three-Tiered Product Support

| | |
|-----------------------|--|
| Tier 1 Support | You will find that our Tier 1 support is prompt, comprehensive and expert. |
| Tier 2 Support | For a significantly higher level of support, choose Tier 2, available on a 24/7 basis. |
| Tier 3 Support | Tier 3 support is recommended only for customers with special needs. You get direct access to our engineering staff. |

Especially when designing larger hypertexts, designers must choose between making the hierarchy wider (putting more nodes on each level) or deeper (adding more levels). One well-established design principle is that users more easily navigate a wide hierarchy (in which nodes have as many as 32 links to their child nodes) than a deep hierarchy.

You may have recognized that a great many print documents are hierarchies in one significant respect. They are often divided into hierarchical divisions like parts, chapters, sections and subsections. These divisions create a logical hierarchy that the user encounters while reading linearly. Cross references in print invite the reader to jump from one part of the document to another and so are analogous to links in hypertext.

Notes

Web-like Structures

In the web-like structure any node can be linked to any other. There are no rules—although designers must take great care in deciding which links will be most helpful to users. Relatively few web-like websites and non-web hypertexts are built. This is because many subject areas seem to break naturally into a hierarchical structure, and users are apt to have trouble navigating unsystematic structures. Many web-like hypertexts are short stories and other works of fiction, in which artistic considerations may over ride the desire for efficient navigation.

Chains and Multipath Structures

As noted earlier, content linked as a linear sequence of nodes—a simple chain structure—probably does not qualify as hypertext because the user's choice is highly restricted. Linear sequences, however, are regularly included within a hierarchical websites, often taking the form of a tutorial, demo or tour.

As shown in Figure 2.1, it is possible to build a sequence of nodes that is in large part linear but offers various alternative pathways. This is the multipath structure. Often we find multipath sections within hierarchical websites. For example, a corporate website might include a historical section with a page for each decade of the company's existence. Each of these pages has optional digressions that allows the user to explore events and issues of that decade. Another example of the multipath structure is an instructional CD-ROM in which learners are offered different pathways through the subject matter, depending on their interests or mastery of the material.

2.4.4 Node-link Diagrams, Sketches and the Design Process

Since they show the overall structure of a website, web developers often create node-link diagrams as part of the design process. Some web authoring tools create these diagrams automatically. Using both node-link diagrams and mock-ups of web pages, designers can effectively plan out how the site as a whole should be linked and how to design the linking of individual pages.

Figure 2.2 shows both a node-link diagram of a small website and a mock-up of a web page of that same website. (The mocked-up page is represented by the darkened node in the node-link diagram.) On the mock-up, the four buttons on the navigation bar correspond to the four second-level nodes in the node-link diagram. The three links below the navigation bar correspond to this page's three child nodes. As the mockup shows, the designer intends to use highlighting ("Support") to indicate the currently displayed page.

When web pages are well designed, the placement of the links on the page along with the phrasing of the links enables the user to grasp, at least in part, the overall site structure, the user's current location, and whether the user is moving down, across, or up in the hierarchy.

Many websites provide site maps for users. Although site maps differ greatly in appearance and usefulness, they resemble node-link diagrams in which they provide the user with a bird's eye view of the site structure.

2.4.5 Future Developments

Computing and the web will continue to evolve in a great many ways. Monitors may give way to near-eye displays, at least for mobile computing. Virtual reality may become more widespread and may be routinely incorporated into the web. We may make greater use of voice commands and commands issued by hand gestures.

These and other advancements will surely change hypertext and hypermedia. For example, websites may provide much improved site maps consisting of a 3D view of the site structure,

Notes

perhaps using the metaphor of galaxies and solar systems. The web may well become more intelligent, more able to generate personalized links that really match our interests. The web may also become more social—we may routinely click links that open up live audio or video sessions with another person.

As a communications medium changes, theory must keep pace. Otherwise, it becomes increasingly difficult to understand the medium and design successfully for it.



Multimedia Kiosk

Case Study

Company worked on a project to develop a kiosk-based integrated multimedia service for the general public. The purpose of the kiosk was to provide users with information about unemployment benefits, and job and training opportunities. It was specifically aimed at the unemployed, and made no assumptions about the users' having knowledge of computers or technology in general. The company had no experience of usability and a limited budget, but felt that usability issues were important and hired the services of a usability consultancy.

Usability testing and evaluation was carried out during the development of the kiosk, with the intention of identifying any significant design problems and providing timely and concise input into the development process. The methods used were:

- User survey and profiling
- Walkthrough evaluation
- Usability testing
- User field trials.

The user survey and profiling provided important preliminary information about the users that was useful at the design stage. For example, it confirmed that the target audience would be capable of interacting with a computer system that had basic text information, and it provided information about features that the target audience would see as important if they were going to use the system instead of queuing to talk to an information officer.

The walkthrough evaluation consisted of an expert evaluation and a user walkthrough with a usability expert. Several difficulties were identified and, as a result, the design team realized the danger of assuming the users' level of domain knowledge, and recognized the need for screen layout consistency, the simplification of user tasks, and giving the users a model of the system structure (e.g., a menu structure overview).

The first usability test was carried out in the consultant's usability testing lab and the participants completed a predefined set of task scenarios that reflected the intended usage of the system. The results of the test provided a focus for future design efforts, by identifying the characteristics of the system that the users felt were most important; and provided a baseline against which the quality of the kiosk could be assessed. The design team was able to improve the quality of the application from the detailed design recommendations that were made and broke down the complex procedural tasks into simple units of work with immediate access to support information.

The system was redesigned on the basis of the results of the first usability test. The tasks in the second usability test were identical to those of the first test. The second usability test

Contd...

| Notes | <p>results showed that the redesign of the system resulted in 70% reduction of the number of problems experienced by participants in the first usability test. This showed that the redesign of the user interface had significantly improved the usability of the system, supporting the positive contribution that can be made by usability testing as part of an iterative design process.</p> <p>The third usability test was conducted in the Department of Social Welfare. The participants performed identical tasks, but half of them used the system with the aid of an online user assistant agent. The results of the tests clearly showed the benefits of the online assistant in helping the participants achieve their goals, and that there were no usability problems that prevented the respondents from using the system when they had access to the online assistant. The improved attitude towards the system, and the respondents' ability to use the system without direct help provided reassurance to the development team that, with minor redesigns, the system was ready for User Trials.</p> <p>User Trials confirmed that the general public perceived the kiosk as a useful method of distributing Social Welfare, job search and training services. It provided background information for how the system might be used in a public location.</p> <p>In conclusion, the usability consultants' involvement throughout the development process helped influence the design as problems were identified and fixed at an early stage. Each test showed an improvement in the efficiency of the system, so the usability testing made a positive contribution to the quality of the product.</p> |
|------------|---|
| Questions: | <ol style="list-style-type: none"><li data-bbox="450 1001 1298 1026">1. Explain the features of kiosk-based integrated multimedia service.<li data-bbox="450 1026 1298 1053">2. What do you mean by user field trials method? |

Self Assessment

Choose the correct answer:

2.5 Summary

- Text in multimedia is combined with other types of media such as video, graphics, photography, animation and sounds.
 - The size of a text is usually measured in points.
 - Text is an essential factor of many multimedia titles.

- Fonts created with Fontographer are used in any program with a font menu on Windows and Macintosh platforms.
- Hypermedia and hypertext refer to web pages and other kinds of on-screen content that employ hyperlinks.

Notes

2.6 Keywords

Font: It is a collection of characters of a single size and style belonging to a particular typeface family.

FontMonger: It is a font conversion utility, allowing you to customize your fonts to some degree.

Fontographer: It can be used in any program with a font menu on Windows and Macintosh platforms.

Hyperlinks: They give us choices when we look for information, listen to music, purchase products, and engage in similar activities.

Hypertext: It refers to the use of hyperlinks to present text and static graphics.

Text: It is the most widely used and flexible means of presenting information on screen and conveying ideas.



1. Create a node-link diagram for websites.

Lab Exercise

2. Create a multipath structure for hypertext and websites.

2.7 Review Questions

1. What do you understand by the term text?
2. Define fonts and faces.
3. What are the different types of fonts available? Give some examples.
4. Explain the term hypertext.
5. Describe nodes and navigation in hypertext.
6. Explain cool 3D text.
7. What are the different editing and designing font tools?
8. Explain the importance of text in respect of advertisement.
9. Describe the guidelines to choose a font in a multimedia presentation.
10. Distinguish between serif and sans serif font.

Answers to Self Assessment

- | | | | | |
|--------|--------|--------|--------|--------|
| 1. (a) | 2. (b) | 3. (c) | 4. (a) | 5. (c) |
| 6. (a) | 7. (b) | 8. (a) | | |

Notes

2.8 Further Readings



Books

Multimedia Making it Work, by Tay Vaughan

Multimedia in Practice: Technology and Applications, by Jeffcoat



Online link

http://books.google.co.in/books?id=mIX-Y2mgtL0C&printsec=frontcover&dq=multimedia+text&hl=en&ei=ZVDDTsvyA4nQrQfp-e32Cw&sa=X&oi=book_result&ct=result&resnum=4&ved=0CD0Q6AEwAw#v=onepage&q=multimedia%20text&f=false

Unit 3: Sound

Notes

CONTENTS

- Objectives
- Introduction
- 3.1 Multimedia System Sounds
- 3.2 Digital Audio
 - 3.2.1 Preparing Digital Audio Files
 - 3.2.2 Editing Digital Recordings
- 3.3 The MIDI Audio
- 3.4 Audio File Formats
 - 3.4.1 List of Audio File Formats
- 3.5 MIDI versus Digital Audio
- 3.6 Audio CD Playback
- 3.7 Audio Recording
 - 3.7.1 Selecting a Good Location
 - 3.7.2 Using the Appropriate Microphone
 - 3.7.3 Different Media Formats and Choices
 - 3.7.4 Monitoring the Recording
- 3.8 Voice Recognition and Response
- 3.9 Summary
- 3.10 Keywords
- 3.11 Review Questions
- 3.12 Further Reading

Objectives

After studying this unit, you will be able to:

- Understand multimedia system sounds
- Explain digital audio
- Define the MIDI audio
- Discuss audio file formats
- Understand MIDI versus digital audio
- Explain audio CD playback
- Discuss audio recording
- Describe voice recognition and response

Notes

Introduction

Sound is perhaps the most important element of multimedia. It is meaningful “speech” in any language, from a whisper to a scream. It can provide the listening pleasure of music, the startling accent of special effects or the ambience of a mood-setting background. Sound is the terminology used in the analogue form, and the digitized form of sound is called as audio.

Sound is produced when waves of varying pressure travel through a medium, usually air. It is inherently an analogous phenomenon, meaning that the changes in air pressure can vary continuously over a range of values.

Modern computers are digital, meaning they operate on discrete values, essentially the binary ones and zeroes that are manipulated by the Central Processing Unit (CPU). In order for a computer to manipulate sound, then, it needs to convert the analogue sound information into digital format.

3.1 Multimedia System Sounds

The multimedia application user can use sound right off the bat on both the Macintosh and on a multimedia PC running Windows because beeps and warning sounds are available as soon as the operating system is installed. On the Macintosh you can choose one of the several sounds for the system alert.

There are still more choices of audio if Microsoft Office is installed. Windows makes use of WAV files as the default file format for audio and Macintosh systems use SND as default file format for audio.



Did u know? In windows system sounds are WAV files, reside in the Windows\Media subdirectory.

3.2 Digital Audio

Digital audio is created when a sound wave is converted into numbers—a process referred to as digitizing. It is possible to digitize sound from a microphone, a synthesizer, existing tape recordings, live radio and television broadcasts, and popular CDs. You can digitize sounds from a natural source or pre-recorded.

Digitized sound is sampled sound. Every nth fraction of a second, a sample of sound is taken and stored as digital information in bits and bytes. The quality of this digital recording depends upon how often the samples are taken.

3.2.1 Preparing Digital Audio Files

Preparing digital audio files is fairly straight forward. If you have analogue source materials, music or sound effects that you have recorded on analogue media such as cassette tapes.

- The first step is to digitize the analogue material and recording it into a computer readable digital media.
 - It is necessary to focus on two crucial aspects of preparing digital audio files: Balancing the need for sound quality against your available RAM and Hard disk resources.
 - Setting proper recording levels to get a good and clean recording.

Remember that the sampling rate determines the frequency at which samples will be drawn for the recording. Sampling at higher rates more accurately captures the high frequency content of your sound. Audio resolution determines the accuracy with which a sound can be digitized.

Formula for determining the size of the digital audio**Notes**

Monophonic = Sampling rate * duration of recording in seconds * (bit resolution / 8) * 1

Stereo = Sampling rate * duration of recording in seconds * (bit resolution / 8) * 2

- The sampling rate is how often the samples are taken.
- The sample size is the amount of information stored. This is called as bit resolution.
- The number of channels is 2 for stereo and 1 for monophonic.
- The time span of the recording is measured in seconds.

3.2.2 Editing Digital Recordings

Once a recording has been made, it will almost certainly need to be edited. The basic sound editing operations that most multimedia procedures needed are described in the paragraphs that follow:

1. **Multiple Tasks:** Able to edit and combine multiple tracks and then merge the tracks and export them in a final mix to a single audio file.
2. **Trimming:** Removing dead air or blank space from the front of a recording and an unnecessary extra time off the end is your first sound editing task.
3. **Splicing and Assembly:** Using the same tools mentioned for trimming, you will probably want to remove the extraneous noises that inevitably creep into recording.
4. **Volume Adjustments:** If you are trying to assemble ten different recordings into a single track there is a little chance that all the segments have the same volume.
5. **Format Conversion:** In some cases your digital audio editing software might read a format different from that read by your presentation or authoring program.
6. **Resampling or Downsampling:** If you have recorded and edited your sounds at 16 bit sampling rates but are using lower rates you must resample or downsample the file.
7. **Equalization:** Some programs offer digital equalization capabilities that allow you to modify a recording frequency content so that it sounds brighter or darker.
8. **Digital Signal Processing:** Some programs allow you to process the signal with reverberation, multitap delay, and other special effects using DSP routines.
9. **Reversing Sounds:** Another simple manipulation is to reverse all or a portion of a digital audio recording. Sounds can produce a surreal, other wordly effect when played backward.
10. **Time Stretching:** Advanced programs let you alter the length of a sound file without changing its pitch. This feature can be very useful but watch out because most time stretching algorithms will severely degrade the audio quality.

3.3 The MIDI Audio

The Musical Instrument Digital Interface (MIDI) is a communication standard developed for electronic musical instruments and computers.

Using MIDI, a musician can easily create and edit digital music tracks. The MIDI system records the notes played, the length of the notes, the dynamics (volume alterations), the tempo, the instrument being played, and hundreds of other parameters, called control changes.

3.4 Audio File Formats

Notes

A file format determines the application that is to be used for opening a file. There are a number of different types of Audio files. The most common are Wave files (WAV) and MPEG Layer-3 files (MP3). There are, however, many other audio file types discussed below. The type is usually determined by the file extension (what comes after the “.” in the file name). For example, “.wav”, “.mp3” or “.dct”.

The way the audio is compressed and stored is called the codec which determines how small the file size is. Some file types always use a particular codec. For example, “.mp3” files always use the “MPEG Layer-3” codec. Other files like “.wav” and “.dct” files support selectable codecs.

Some file types just contain the audio. But other file types can contain additional header information which can contain other information about the file (for example, .dct files have information about the sender, priority, notes and other data in the file itself).

If you have a file which you cannot open in your program, try to convert it with the Switch Audio File Format Converter. If it fails, you could also try by using the SoundTap Direct Streaming Audio Recorder that can capture any audio you play.



Caution A “.wav” file can be encoded with the “PCM”, “GSM6.10”, “MPEG3” and many other codec’s. Be careful not to confuse the file type with the codec, a “MPEG Layer-3” encoded “.wav” file.

3.4.1 List of Audio File Formats

Open File Formats (supported by and most likely to work with our software)

- .wav – standard audio file format used mainly in Windows PCs. Commonly used for storing uncompressed (PCM), CD-quality sound files, which means that they can be large in size – around 10 MB per minute of music. A list of common wave file codecs can be found here. Sample .wav file.
- .mp3 – the MPEG Layer-3 format is the most popular format for downloading and storing music. By eliminating portions of the audio file that are essentially inaudible, mp3 files are compressed to roughly one-tenth the size of an equivalent PCM file while maintaining good audio quality. We recommend the mp3 format for music storage. It is not that good for voice storage.
- .ogg – a free, open source container format supporting a variety of codecs, the most popular of which is the audio codec Vorbis. Vorbis files are often compared to MP3 files in terms of quality. But the simple fact mp3 are so much more broadly supported makes it difficult to recommend ogg files.
- .gsm – designed for telephony use in Europe, gsm is a very practical format for telephone quality voice. It makes a good compromise between file size and quality. We recommend this format for voice. Note that wav files can also be encoded with the gsm codec.
- .dct – a variable codec format designed for dictation. It has dictation header information and can be encrypted (often required by medical confidentiality laws).
- .flac – a lossless compression codec. You can think of lossless compression as like zip but for audio. If you compress a PCM file to flac and then restore it again it will be a perfect copy of the original.
- .au – the standard audio file format used by Sun, Unix and Java. The audio in au files can be PCM or compressed with the ulaw, alaw or G729 codecs.

Notes

- .aiff – the standard audio file format used by Apple. It is like a wav file for the Mac.
- .vox – the vox format most commonly uses the Dialogic ADPCM (Adaptive Differential Pulse Code Modulation) codec. Similar to other ADPCM formats, it compresses to 4-bits. Vox format files are similar to wave files except that the vox files contain no information about the file itself so the codec sample rate and number of channels must first be specified in order to play a vox file. Vox is a very old file type and is pretty poor. We do not recommend it for anything except for supporting legacy systems.
- .raw – a raw file can contain audio in any codec but is usually used with PCM audio data. It is rarely used except for technical tests.



Did u know? Wave files encoded with a variety of codecs to reduce the file size (for example the GSM or mp3 codec's).

Proprietary Formats (supported by our software)

- wma – the popular Windows Media Audio format owned by Microsoft. Designed with Digital Rights Management (DRM) abilities for copy protection.
- .aac – the Advanced Audio Coding format is based on the MPEG4 audio standard owned by Dolby.
- atrac (.wav) – the older style Sony ATRAC format. It always has a .wav file extension. To open these files simply install the ATRAC3 drivers.
- .ra – a Real Audio format designed for streaming audio over the Internet. The .ra format allows files to be stored in a self-contained fashion on a computer, with all of the audio data contained inside the file itself.
- .ram – a text file that contains a link to the Internet address where the Real Audio file is stored. The .ram file contains no audio data itself.
- dss – Digital Speech Standard files are an Olympus proprietary format. It is a fairly old and poor codec. Prefer gsm or mp3 where the recorder allows.
- msv – a Sony proprietary format for Memory Stick compressed voice files. You might need a Sony plugin to load this.
- dvf – a Sony proprietary format for compressed voice files; commonly used by Sony dictation recorders. You might need a Sony plugin to load this.

Formats not supported at this stage

- none

Other Formats

- atrac (.oma, .omg, .atp) – the newer style Sony proprietary format designed for minidisc use. It always has a .oma, .omg or .atp file extension. It is similar to mp3 and probably only useful if you are reading files from minidisks or writing for minidisks. Note most of these files are rights managed so you cannot open them in any software programs.
- mid – the midi file is not an audio file format at all. It is just a list of musical notes which a synthesizer can play.
- ape – the file format from Monkey's Audio is claimed to give about 50% compression without loss in audio quality.



Change the quality of a sound file to PCM Format and 11.025 kHz 16 bit stereo.
Compare the original file with the changed file.

3.5 MIDI versus Digital Audio

Notes

The MIDI has several advantages and disadvantages over digital audio.

Advantages

- MIDI files are much more compact than digital audio files, and the size of MIDI file is completely independent of playback quality. In general, MIDI files will be 200 to 1000 times smaller than CD-quality digital audio files. Because MIDI files are small, they do not take up as much RAM, disk space, and CPU resources.

MIDI files are small

| Name | Size | Type |
|-----------|------|---------------|
| America | 4KB | MIDI Sequence |
| Cannon_d | 29KB | MIDI Sequence |
| Entitanr | 23KB | MIDI Sequence |
| Hellomyb | 10KB | MIDI Sequence |
| Maplerag | 19KB | MIDI Sequence |
| Minwltz | 21KB | MIDI Sequence |
| Jamal01 | 26KB | MIDI Sequence |
| Pete&wlf | 13KB | MIDI Sequence |
| Prelude#3 | 13KB | MIDI Sequence |
| Saintsgo | 10KB | MIDI Sequence |

Digitized audio files size

| Name | Size | Type |
|----------|---------|-------------------|
| Effects | 675KB | Wave Sound |
| Flute8 | 559KB | Sound Clip (AIFF) |
| Flute8 | 559KB | Wave Sound |
| Harmguit | 3,011KB | Wave Sound |
| Nyguit1 | 2,773KB | Wave Sound |

- In some cases, MIDI files may sound better than digital audio files if the MIDI sound source you are using is of high quality.
- You can change the length of a MIDI file (by varying its tempo) without changing the pitch of the music or degrading the audio quality.

Disadvantages

- Since MIDI data is not sound, you can be certain that playback will be accurate only if the MIDI playback device is identical to the device used for production.
- MIDI cannot easily be used to play back spoken dialog, although expensive and technically tricky digital samples are available.

There are two additional and often more compelling reasons to work with digital audio:

- A wider selection of application software and system support for digital audio is available for both the Macintosh and Windows platforms.
- The preparation and programming required for creating digital audio do not demand knowledge of music theory; working with MIDI data usually requires a modicum of familiarity with musical scores as well as audio production.



Be sure to look in the manual and online help for your software for topics about mix down and converting MIDI to digital audio.

Notes

3.6 Audio CD Playback

In this era of digital music, playing a music CD on your computer has become very common. The best part is that you can sort the order in which you want to listen the tracks and continue playing without interruption. If you have a good CD of 650 MB, you can play 140-150 songs at a stretch.

Instructions

1. Check the compatibility of the drive in your computer. All CD drives in a desktop computer are located at the top of the CPU. If you have a laptop, you will see the CD slot on one side of the machine.
2. Take the CD out of its cover and place it in the CD drive.
3. Switch on your computer and wait till all applications are ready.
4. Click on the “Start” menu and choose “Programs.”
5. Click on “Programs” and choose “CD player” from the Entertainment menu of Accessories. You can also choose the Media player from the “Programs” menu and open the file location to play music.
6. Choose the “Play” option in the CD player window (a single right pointing arrow in the top row).
7. Use the “Stop,” “Pause,” “Skip next track” and “Previous track” buttons to set your preferences while playing the CD.
8. Select from the Edit play list from the Disc menu in order to change the sequence of the tracks.
9. Adjust the volume by clicking on the “Speakers” icon on the task bar of your computer.
10. Adjust the bass, treble and other options on the Equalizer for a perfect and melodious sound from the CD.



Task

Change the length of a MIDI file (by varying its tempo) without changing the pitch of the music or degrading the audio quality.

3.7 Audio Recording

Traditional microphones capture sound in what is called analogue form in waves. The first problem of getting sound into a computer is that you must have some sort of go-between gizmo to convert this analogue source into the digital format recognized by computers. The second problem of getting sound into a computer is that most microphones record at a low level and then use some sort of amplifier to boost the sound. Even if you have a digitizing gizmo, you may also need an amplifying gizmo. Sound is difficult. It is the most difficult and expensive part of this process.

Following steps are used for recording audio:

1. Selecting a good location
2. Using the appropriate microphone
3. Different media formats and choices
4. Monitoring the recording

The basic properties of a good recording depend on what kind of recording you are doing. For the most part, you want a recording with a fair dynamic range—low background noise and clear, audible audio of the subject of your recording be it a speaker or frog calls. The basics to remember are: selecting a good location, using the appropriate equipment and microphone, and getting good levels.

Notes

3.7.1 Selecting a Good Location

If it is possible to control where you do your recording, try to find a location that has low noise levels and has a lockable door so people cannot walk in on you. Computers and air conditioning with the low level hum of electricity and fans are your enemy when trying to get a good recording. Access to a sound recording studio is, of course, the best case scenario! However, many of us do not have access to high end recording studios and cannot completely control the location. To some extent, this can be alleviated by using an appropriate microphone or in post when you are editing.

3.7.2 Using the Appropriate Microphone

When you buy a stereo, they say the most important component is the speakers because it is the speakers that are actually physically reproducing the sound. For recording audio, the most important component is the microphone because it determines what the audio sounds like when it is recorded.

Omni

The simplest microphone design will pick up all sound, regardless of its point of origin, and is, thus, known as an omni directional microphone. They are very easy to use and generally have well to outstanding frequency response.

Cardioid

This pattern is popular for sound reinforcement or recording lectures where class noise is a possible problem. The concept is great a microphone that picks up sounds it is pointed at. The reality is different. The first problem is that sounds from the back are not completely rejected, but merely reduced in volume. This can surprise novice users. Another issue is that the microphone will emphasize the low frequency components of any source that is very close to the diaphragm. This is known as the “proximity effect”, and many singers and radio announcers rely on it to add depth or “chest” to a basically light voice.

Shotgun

It is possible to exaggerate the directionality of cardioid type microphones, if you don't mind exaggerating some of the problems. The shotgun is extremely sensitive along the main axis, but possesses pronounced extra lobes which vary drastically with frequency. In fact, the frequency response of this microphone is so bad it is usually electronically restricted to the voice range, where it is used to record dialogue for film and video.

Lavalier

The lavalier (or lav) microphone is commonly used with wireless systems; so a speaker can move around freely without being tied to a microphone stand or podium. The pickup range is small and the mic is usually clipped to a shirt or lapel.

3.7.3 Different Media Formats and Choices

Some of the common choices available to faculty and staff will be tape decks, mini disc recorders, video cameras (You can still record audio to a video tape even if you do not want to use the video!) and recording directly to a computer.

Notes

Audio Tape

There are both low and high end tape decks available on campus. Everyone knows how to use a tape deck - push record. In addition, the higher end Marantz decks allow you to monitor the recording both with a set of headphones and level meters. The disadvantage is that audio tape is not especially sturdy, degrades over time as it is played, and has background tape hiss.

MP3 Player/Recorder

With digital formats becoming more popular, certain mp3 players have the ability to record audio directly into a digital audio format. These devices are small, reliable, and can store massive amounts of audio without the need to switch tapes. Certain models can store upwards of 5 hours of audio to a wav or mp3 format. This would be idea if you will need the audio to be used on a computer because you wouldn't need to capture it on the computer in real time, thus saving your time. Even with certain advantages, high end mp3 recorders are expensive and the internal hard drives may stop working after extreme shock.

Mini Disc

Mini disc recorders and discs are both compact, easily portable, sturdy and high quality. Using the mini disc recorder for lectures or interviews with an appropriate microphone attachment works well. One disadvantage is that recordable mini discs are somewhat harder to find than audio tapes. The second disadvantage is that the audio recorded to a mini disc is compressed in order to fit on the smaller media. For some audio recording purposes in which the audio has to be analyzed scientifically for certain frequencies, the mini disc recorder is not appropriate because the compression artificially degrades the audio signal. While many people cannot hear the difference, the audio compression would definitely colour any scientific analysis of the sound.

Videotape

An often overlooked source and somewhat more common resource for doing audio recording are video cameras. While not built specifically for audio recording, they nonetheless can record good audio given an appropriate microphone attachment. The disadvantage is that you cannot monitor the recording with some consumer video cameras to tell if the signal is too soft or too loud. The only way to combat this is to do a short test recording and then rewind and play it back with headphones connected to the camera to tell if you are getting decent audio levels.

Recording to a Computer

The advantage of recording directly to a computer, of course, is that there is no intermediary media to deal with and you save time. This would most commonly be a choice if you have a laptop or a controlled location like a sound studio. One disadvantage is often actually the computer itself. The fan creates background noise and often the microphones that come with computer are extremely low end. You should use good microphone, if you want to record directly to a computer. The other disadvantage is you will have to know how to use the software to record the files to your computer whereas with a tape deck most people know how to push record.

3.7.4 Monitoring the Recording

It is a good idea to always bring headphones with you to monitor the audio. If the equipment you are using has the ability to monitor the recording, as with the Marantz tape decks or higher end video cameras do so. If you cannot do this, it is important to take test recordings before you begin your program recording to make sure that you are getting a recording with enough level to produce a clear recording without being too loud. When a track gets too loud it over saturates and clips, producing a very poor sound reproduction. The wireless microphone base stations also have a level adjuster so that can be used if no other method is available.

Levels**Notes**

If the equipment or software you are using for your audio has level meters, you basically want to have the meters just brushing near the red without going into them. This is the 0 dB marker. Going over this will cause clipping and distortion of your recording.

What good is the video you shot if you cannot understand what the subject is saying? You have probably seen a few home videos with either low fidelity audio which sounded tinny or noisy or which was too low in volume to make out. This is not the videotape's fault. It is the camera's built in microphone. As noted above, higher quality audio compresses more cleanly. An added side benefit is that the more you can compress your audio, the more space you have for video, resulting in higher quality video!

3.8 Voice Recognition and Response

Voice recognition and voice response promise to be the easiest method of providing a user interface for data entry and conversational computing, since speech is the easiest, most natural means of human communication. Voice input and output of data have now become technologically and economically feasible for a variety of applications.

Voice recognition systems analyze and classify speech or vocal tract patterns and convert them into digital codes for entry into a computer system. Most voice recognition systems require "training" the computer to recognize a limited vocabulary of standard words for each user. Operators train the system to recognize their voices by repeating each word in the vocabulary about 10 times. Trained systems regularly achieve a 99% plus word recognition rate. Speaker-independent voice recognition systems, which allow a computer to understand a voice it has never heard before, are used in a limited number of applications.

Voice recognition devices are used in work situations where operators need to perform data entry without using their hands to key in data or instructions. For example, voice recognition systems are being used by manufacturers for the inspection, inventory, and quality control of a variety of products, and by airlines and parcel delivery companies for voice-directed sorting of baggage and parcels. Voice recognition is also available for some microcomputer software packages for voice input of data and commands. However, voice input is expected to become very popular for most word processing applications in the next few years.

Voice response devices range from mainframe audio-response units to voice-messaging minicomputers to speech synthesizer microprocessors. Speech microprocessors can be found in toys, calculators, appliances, automobiles, and a variety of other consumer, commercial, and industrial products. Voice-messaging minicomputer and mainframe audio response units use voice-response software to verbally guide an operator through the steps of a task in many kinds of activities. They may also allow computers to respond to verbal and touch-tone input over the telephone. Examples of applications include computerized telephone call switching, telemarketing surveys, bank pay-by-phone bill-paying services, stock quotations services, university registration systems, and customer credit and account balance inquiries.



History of Computer Sound

Case Study

In the 1940s, the transistor allowed the construction of computers that were sophisticated for their time. A computer is unique among machines in that its function is not inherent in its structure, but rather determined by a set of instructions entered into it. It made sense, therefore, that someone would develop a program that would allow computers not only to store and transmit music, but also to compose and perform it. Performance is facilitated by

Contd...

| | |
|---|---|
| Notes | <p>the fact that computers can be interfaced (connected by translating circuits) to other kinds of electronic devices such as recording devices, synthesizers, audio-visual appliances etc.</p> <p>In 1957, Max V. Mathews of AT&T Bell Laboratories became the first person to program a computer to make musical sounds, but most early computer music was of poor quality because it was created by computer programmers rather than by musicians who had a working knowledge of music and sound. Early experiments in computer-generated sound were made in the form of collaborations between computer experts or engineers, and computer-friendly musicians. This phenomenon led, in the 1970s, to the establishment of music research centres that were dedicated to the advancement of research in the field of computer music. These research centres included the Institut de Recherche et Coordination d'Acoustique et Musique (IRCAM) in France, the Center for Music Experiment and Related Research (now the Center for Research in Computing and the Arts) at the University of California at San Diego, the Center for Computer Research in Music and Acoustics (CCRMA) at Stanford University and the Electronic Music Studio at the Massachusetts Institute of Technology (MIT).</p> <p>By the 1980s, the technology that was developed for creating computer music was applied to the recording industry, and digital sound recording became widespread. The commercial introduction of the personal computer, which was a great improvement on the giant computers of previous decades, brought about the design of user-friendly interfaces which were aimed at non-specialists in music. One such interface which was developed to fulfil the needs of musicians was MIDI (Musical Instrument Digital Interface).</p> <p>Over the past ten years, the desktop computer has developed from a device capable of handling small amounts of text, games and basic programs, to a device which is capable of processing full-colour broadcast-quality video, hours of CD-quality audio in real time, and complete volumes of text and graphics to publishing standard. This has been made possible by the development of the digital microchip - hundreds of thousands of transistors etched onto thin layers of crystalline silicon. The microchip has allowed the home computer to become a powerful music-making machine, capable of recording, manipulating and storing digital audio data, and interpreting and playing back audio from the Internet in a wide variety of audio file formats. The two leading personal computer systems, Apple Macintosh OS (Operating System) and MS-DOS (Microsoft Disc Operating System)/Windows for IBM PC, have developed new programs and file formats while allowing compatibility with older software. It is this compatibility and standardization, rather than technical innovation, which establishes systems as market leaders.</p> |
| Questions: | |
| <ol style="list-style-type: none">1. In which year the music research centres were established?2. Who was the first person to program a computer to make musical sounds? | |

Self Assessment

Choose the correct answer:

3.9 Summary

- Sound is produced when waves of varying pressure travel through a medium, usually air.
 - The MIDI keyboard is useful to simplify the creation of musical scores.
 - Traditional microphones capture sound in what is called analogue form in waves.
 - Music is a useful way to add mood and meaning to your story.
 - Voice recognition systems analyze and classify speech or vocal tract patterns and convert them into digital codes for entry into a computer system.

3.10 Keywords

Codec: The way in which the audio is compressed and stored is called the codec, which determines how small the file size is. Some file types always use a particular codec.

Digitizing: Digital audio is created when a sound wave is converted into numbers.

Equalization: It offers digital equalization capabilities that allow you to modify recording frequency content so that it sounds brighter or darker.

Musical Instrument Digital Interface (MIDI): It is a communication standard developed for electronic musical instruments and computers.

Trimming: It removes dead air or blank space from the front of a recording and an unnecessary extra time off the end is your first sound editing task.

Notes



Lab Exercise

1. Compress a PCM (Pulse Code Modulation) file to flac and then restore it again.
2. Convert wma (Windows Media Audio) format to mp3 format.

3.11 Review Questions

1. Define different types of audio files format.
2. What do you understand by codec?
3. Define the following terms:

| | |
|---------|---------|
| (a) wma | (b) vox |
| (c) mp3 | (d) gsm |
4. What are the basic sound editing operations that most multimedia procedures needed? Explain each of them.
5. What are the circumstances in which digital audio file format is preferred?
6. What are the problems we face while getting sound into a computer?
7. Differentiate between voice response devices and voice recognition devices.
8. Describe multimedia system sounds in brief.
9. What are the advantages and disadvantages of MIDI and digital audio?
10. What is DRM? What is the importance of DRM in music?

Answers to Self Assessment

- | | | | | |
|--------|--------|--------|--------|---------|
| 1. (c) | 2. (b) | 3. (a) | 4. (b) | 5. (d) |
| 6. (d) | 7. (b) | 8. (a) | 9. (c) | 10. (a) |

3.12 Further Reading



Books

Multimedia Making it Work, by Tay Vaughan.



Online link

http://www.w3schools.com/html/html_media.asp

Unit 4: Image

Notes

CONTENTS

- Objectives
- Introduction
- 4.1 Bitmaps
 - 4.1.1 Colour Depth
 - 4.1.2 Resolution
 - 4.1.3 Colour Depth Conversion
 - 4.1.4 Bitmap Storage
- 4.2 Vector Drawing
- 4.3 Three Dimensional (3D) Drawing and Rendering
- 4.4 Natural Light and Colour
- 4.5 Computerized Colours
 - 4.5.1 How Computers see colour?
 - 4.5.2 Colours in Images
- 4.6 Colour Palettes
 - 4.6.1 Colour Palette Generator
- 4.7 Image File Formats
 - 4.7.1 Graphics Interchange Format (GIF)
 - 4.7.2 Joint Photographic Experts Group (JPEG)
 - 4.7.3 Portable Network Graphics (PNG)
- 4.8 Macintosh Image Format
 - 4.8.1 File Organization
 - 4.8.2 File Details
- 4.9 Windows Imaging File Format (WIM)
 - 4.9.1 WIM File Structure
 - 4.9.2 WIM File Layout
 - 4.9.3 Benefits of Leveraging WIM
 - 4.9.4 WIMGAPI Tool for Windows Image Deployment
- 4.10 Cross-platform Formats
 - 4.10.1 Cross-platform Problems in Current Scenario
- 4.11 Summary
- 4.12 Keywords
- 4.13 Review Questions
- 4.14 Further Reading

Notes

Objectives

After studying this unit, you will be able to:

- Discuss the bitmap images
- Explain the vector drawing
- Explain 3D drawing and rendering
- Discuss natural lights and colours
- Explain about computerized colours
- Define the colour palettes
- Discuss the image file formats
- Explain Macintosh image format
- Discuss the windows imaging file format
- Define the cross-platform formats

Introduction

An image is an optical representation of an object produced by light rays from the object being refracted or reflected by a lens or mirror.

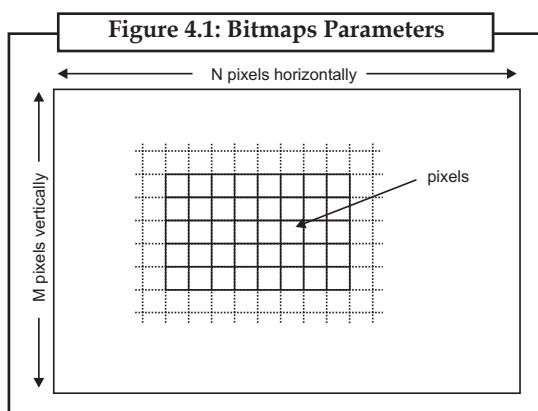
An imitation, representation, or similitude of any person, thing, or act, sculptured, drawn, painted, or otherwise made perceptible to the sight; a visible presentation; a copy; a likeness; an effigy; a picture; a semblance. The Image Format is a base topic for topics describing a defined way of coding information for storage or transfer of images.

Rendering is the process of adding realism to a computer graphics by adding three-dimensional qualities such as shadows and variations in colour and shade. One technique for rendering graphics is called *ray tracing*. Another type of rendering is scanline rendering, which renders images one vertical line at a time instead of object-by-object as in ray tracing. In general, scanline rendering does not produce as good results as ray tracing, but it is used frequently in animation packages where the image quality of each individual frame is not so important.

Still images are the important element of a multimedia project or a website. In order to make a multimedia presentation look elegant and complete, it is necessary to spend ample amount of time to design the graphics and the layouts. Competent, computer literate skills in graphic art and design are vital to the success of a multimedia project.

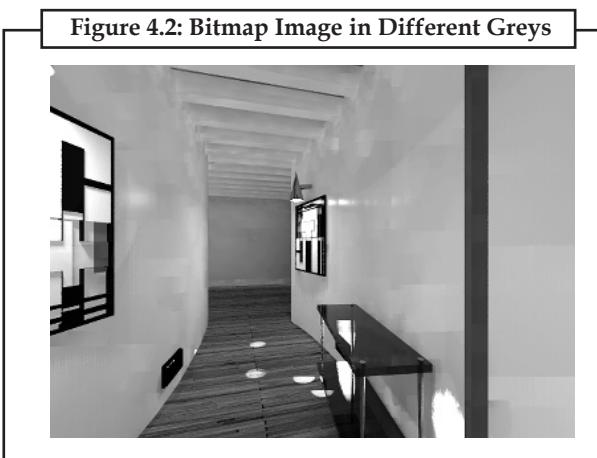
4.1 Bitmaps

Bitmaps are defined as a regular rectangular mesh of cells called pixels, each pixel containing a colour value. They are characterized by only two parameters (See Figure 4.1), the number of pixels and the information content (colour depth) per pixel. There are other attributes that are applied to bitmaps but they are derivations of these two fundamental parameters.



Note that bitmaps are always orientated horizontally and vertically. Pixels should be considered square although they may have other aspect ratios in practice. In the majority of situations bitmaps are used to represent images on the computer. For example, the figure given below is a bitmap which has 397 pixels horizontally, 294 pixels vertically, and each pixel contains a grey value from a possible 256 different greys.

Notes



4.1.1 Colour Depth

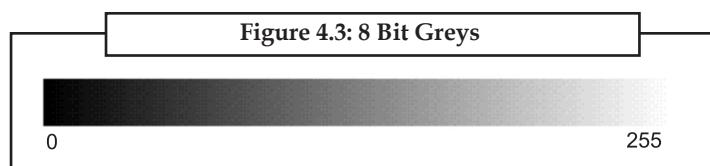
Each pixel in a bitmap contains certain information, usually interpreted as colour information. The information content is always the same for all the pixels in a particular bitmap. The amount of colour information could be whatever the application requires but there are some standards, the main ones are described below.

1 bit (black and white)

This is the smallest possible information content that can be held for each pixel. The resulting bitmap is referred to as monochrome or black and white. The pixels with a 0 are referred to as black and pixels with a 1 are referred to as white. Note that while only two states are possible they could be interpreted as any two colours, 0 is mapped to one colour, 1 is mapped to another colour.

8 bit greys

In this case each pixel takes 1 byte (8 bits) (See Figure 4.3) of storage resulting in 256 different states. If these states are mapped onto a ramp of greys from black to white, the bitmap is referred to as a greyscale image. By convention, 0 is normally black and 255 white. The grey levels are the numbers in between, for example, in a linear scale 127 would be a 50% grey level.

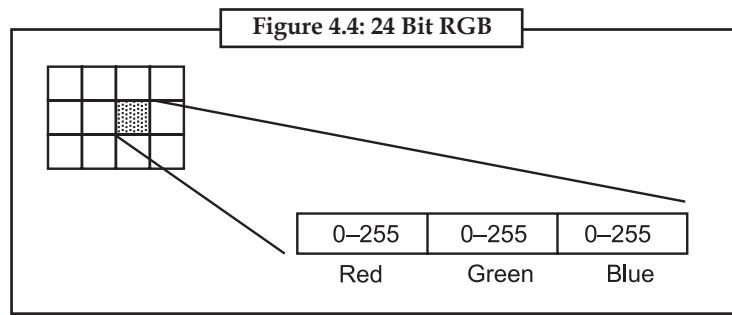


In any particular application, the range of grey values can be anything, it is most common to map the levels 0-255 onto a 0-1 scale but some programs will map it onto a 0-65535 scale.

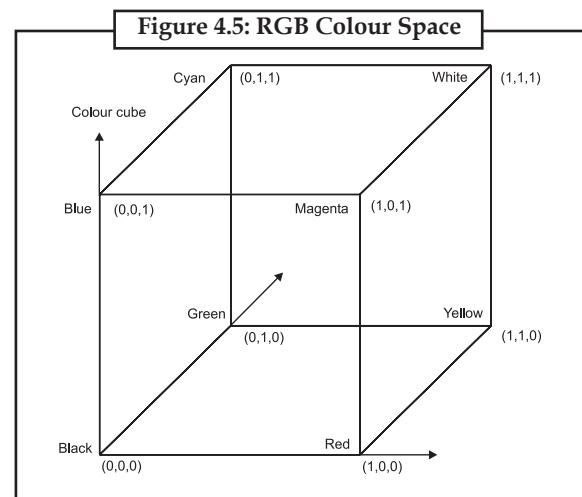
24 bit RGB

This is the next step from 8 bit grey, now there is 8 bits allocated to each red, green, and blue component. In each component the value of 0 refers to no contribution of that colour, 255 refer to fully saturated contribution of that colour. Since each component has 256 different states there are a total of 16777216 possible colours (See Figure 4.4).

Notes



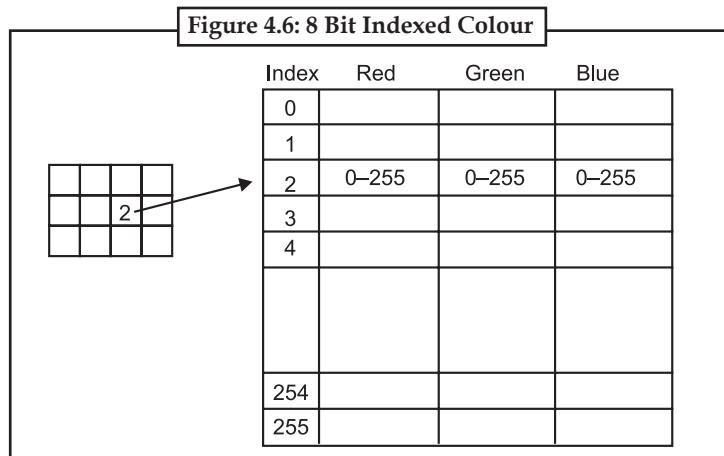
This idea of RGB colour space is a fundamental concept in computer graphics. In RGB space any colour is represented as a point inside a colour cube with orthogonal axes R, G, B (See Figure 4.5).



Note that grey values form a straight line from black to white along the diagonal of the cube, $r = g = b$.

8 bit indexed colour

Indexed colour (See Figure 4.6) is a more economical way of storing colour bitmaps without using 3 bytes per pixel. As with 8 bit grey bitmaps, each pixel has one byte associated with it only now the value in that byte is no longer a colour value but an index into a table of colours, called *a palette* or *colour table*.



There are a number of interesting attributes of such a colour indexing system. If there are less than 256 colours in the image then this bitmap will be the same quality as a 24 bit bitmap but it can be stored with one third the data. Interesting colouring and animation effects can be achieved by simply modifying the palette, this immediately changes the appearance of the bitmap and with careful design can lead to intentional changes in the visual appearance of the bitmap.

Notes

A common operation that reduces the size of large 24 bit bitmaps is to convert them to indexed colour with an optimized palette, that is, a palette which best represents the colours available in the bitmap.

4 bit indexed colour

This is identical to 8 bit colour except now only half a byte; 4 bits are used for the index. This supports a table of up to 16 colours (See Figure 4.7).

| Index | Red | Green | Blue |
|-------|-------|-------|-------|
| 0 | | | |
| 1 | | | |
| 2 | 0–255 | 0–255 | 0–255 |
| 3 | | | |
| 4 | | | |
| | | | |
| 14 | | | |
| 15 | | | |

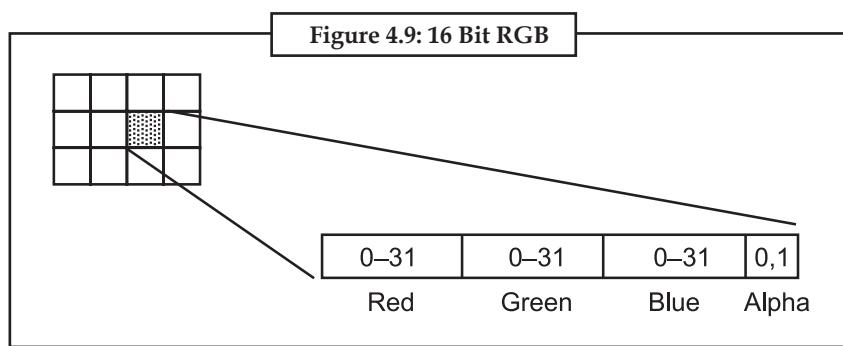
32 bit RGB

This is normally the same as 24 bit colour but with an extra 8 bit bitmap known as an alpha channel. This channel can be used to create masked areas or represent transparency (See Figure 4.8).

| Figure 4.8: 32 Bit RGB | | | |
|------------------------|-------|-------|-------|
| | 0–255 | 0–255 | 0–255 |
| | Red | Green | Blue |
| | 0–255 | 0–255 | 0–255 |
| | Alpha | | |

16 bit RGB

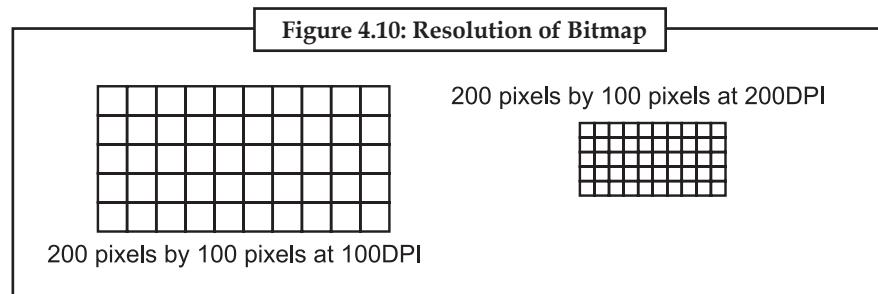
This is generally a direct system with 5 bits per colour component and a 1 bit alpha channel (See Figure 4.9).

Notes**4.1.2 Resolution**

Resolution is an attribute of a bitmap that is necessary when visually viewing or printing bitmaps because pixels by themselves have no explicit dimensions. Resolution is normally specified in pixels per inch but could be in terms of any other unit of measure. Most printing processes retain the pixels per inch (PPI) units for historical reasons. On devices with non-rectangular pixels, the resolution may be specified as two numbers, the horizontal and vertical resolution.

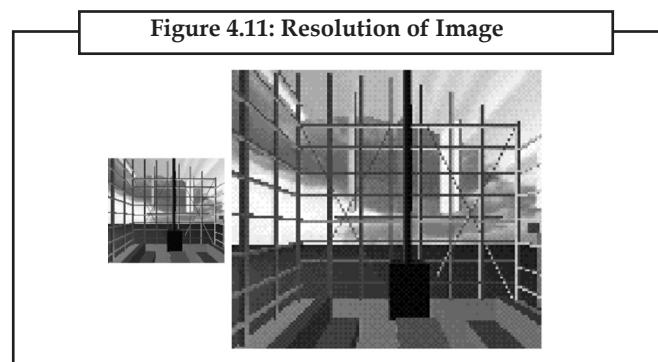
The concept of resolution being independent of the information content of a bitmap is very important, given a constant colour depth then the information content between different bitmaps is only related to the number of pixels vertically and horizontally. The quality however, when the bitmap is displayed or printed, does depend on the resolution. Since the resolution determines the size of a pixel, it can also be used to modify the size of the overall image.

As an example, consider one bitmap which is 200 pixels horizontally and 100 pixels vertically. If this bitmap was printed at 100 DPI then it would measure 2 inches by 1 inch. If, however, the same bitmap was printed at 200 DPI (See Figure 4.10) then it would only measure 1 inch by half an inch.



Whenever a bitmap is displayed on a computer monitor resolution need to be considered. Most computer monitors have a range of resolution from 60 DPI at the low resolution end to 120 DPI for high resolution displays. As with printed matter the higher the resolution, the less apparent the pixel nature of the bitmap will be.

As a further example the following (See Figure 4.11) two images are identical in information content, they do however have different resolutions and hence different pixel sizes. The smaller is 80 DPI, the larger is 30 DPI. The pixels are much more evident in the larger version.

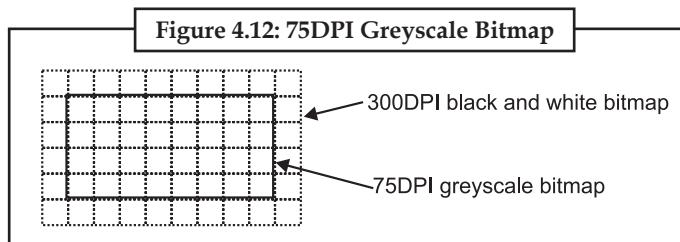
**Notes**

This is not the whole story when it comes to representing bitmaps on physical devices because different devices have different colour depth capabilities.

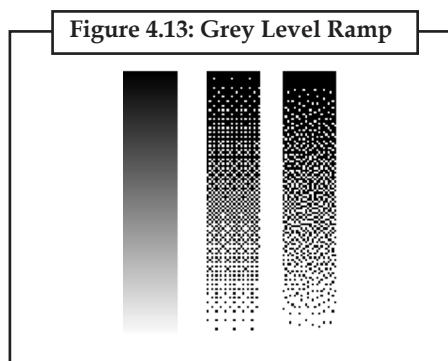
4.1.3 Colour Depth Conversion

Very often it is necessary to represent a bitmap with one colour depth onto a device with different colour depth capabilities. Of course, if the destination device has better colour than the bitmap then there is no issue since the bitmap can be exactly represented. In the reverse situation where the destination has different and lower capabilities, then the bitmap has to be converted into something that gives the best possible representation.

As an example, consider the problem of representing greyscale images on monochrome (black and white) devices. This is achieved by using a variable number of black and white pixels to represent a grey level. Fortunately the black and white device usually has much higher resolution than the bitmap so there are a number of pixels available to create the greyscale approximation. Consider a 75 DPI greyscale bitmap (See Figure 4.12) to be displayed on a 300 DPI black and white printer. There is a matrix of 4x4 black and white pixels that can be used to represent each greyscale pixel.



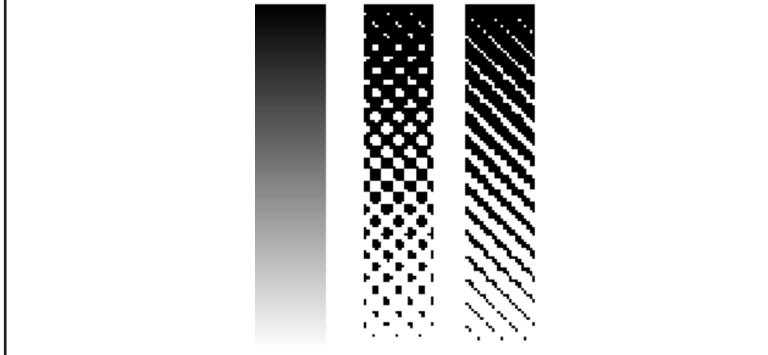
There are a number of techniques that can be used to form the corresponding arrangement of black and white pixels, one technique is called *dithering*. Even using dithering, there are lots of possible algorithms for deciding the dithered pixel arrangement. The following shows a grey level ramp (See Figure 4.13) with the corresponding black and white dithered examples (greatly enlarged) using pattern and diffusion dithering.



Notes

There are other methods of converting bitmaps of high colour depth into those of lower colour depth but higher resolution, one such technique used in the printing industry is called screening. Screening will not be discussed here except to say that it approximates grey levels by different size objects (the size of the object is proportional to the grey level) the objects are arranged on in a regular matrix which is at some angle to the horizontal. The most commonly used imaging objects are dots, lines and rectangles. Figure 4.14 shows a grey level ramp with the corresponding black and white screened examples (greatly enlarged) using dot and line screens.

Figure 4.14: High Colour Depth Images to Low Colour Depth



The above discussion and examples of colour depth conversion have been made with respect to greyscale images. Converting high colour depth images to low colour depth (See Figure 4.14) representations is no different in concept, generally the process is just done three times, one for each colour component.



Task Select an image and convert it from high colour depth images to low colour depth.

4.1.4 Bitmap Storage

The most straightforward way of storing a bitmap is simply to list the bitmap information, byte after byte, row by row. Files stored by this method are often called RAW files. The amount of disk storage required for any bitmap is easy to calculate given the bitmap dimensions ($N \times M$) and colour depth in bits (B). The formula for the file size in kBytes is:

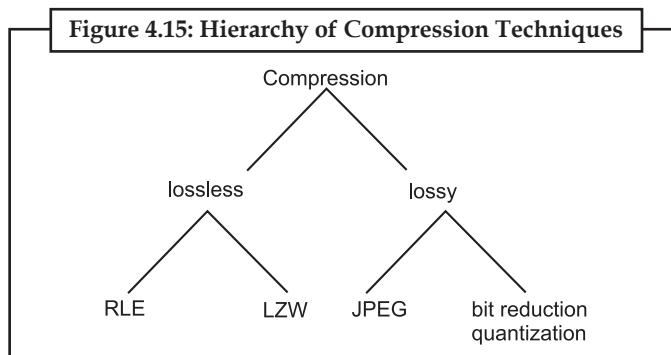
$$\text{Size (kB)} = \frac{N * M * B}{8 * 1024}$$

where, N and M are the number of horizontal and vertical pixels, B is the number of bits per pixel. The following table shows the file sizes of a few bitmap types if they are stored in RAW format.

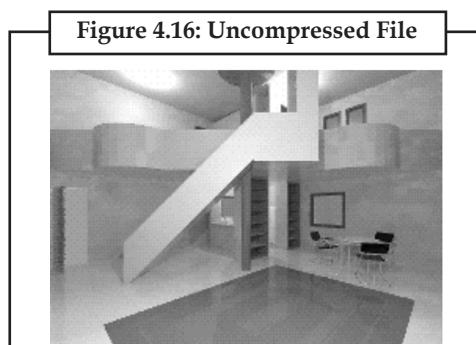
| Image dimensions | Colour depth | File size |
|------------------|--------------|-----------|
| 128 × 128 | 1 bit | 2 kB |
| | 8 bits | 16 kB |
| | 24 bits | 48 kB |
| 256 × 256 | 1 bit | 8 kB |
| | 8 bits | 64 kB |
| | 24 bits | 192 kB |
| 1K × 1K | 1 bit | 128 kB |
| | 8 bits | 1 MB |
| | 24 bits | 3 MB |

As it can be seen from this table, large 24 bit images will result in very large files. This is why compression becomes important. There are a large number of file formats used for storing compressed bitmaps from the trivial to the very complicated. The complicated formats exist because of the very large bitmap files that would exist, if compression was not used. There are two broad categories of compressed file format, those which are lossless (retain the bitmaps perfectly) and those which are lossy. The following shows the main hierarchy of compression techniques (See Figure 4.15).

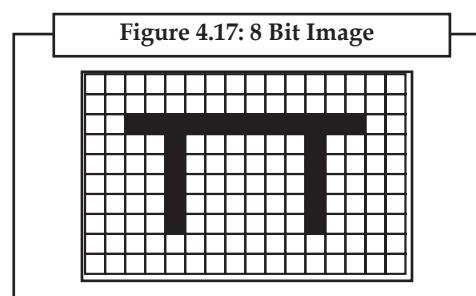
Notes



The crudest way of reducing the size of bitmap files is to reduce the colour information; this is called bit reduction or quantization. For example, one could convert 24 bit bitmaps to 8 bit indexed bitmaps using dithering to simulate the lost colours. The most common lossy format by far is JPEG, a description of how it works is well outside the scope of this discussion. Its main advantage is that it can offer vastly better compression ratios than the lossless formats. For example, consider the following bitmap the original of which is 500×350 pixels at 24 bit colour. Using the formula given earlier the uncompressed file size is $500 \times 350 \times 24 / 8 / 1024 = 513$ K (See Figure 4.16)



Saved in greyscale (bit depth reduction) the file is 171 K (3 times smaller), saved and compressed using RLE, it is 388 K (75% of the original), saved using LZW compression, it is 188K (36% of the original), saved as JPEG, it is 30 K (a compression ratio of 17 : 1). The following is a description of the simplest lossless compression technique called run length encoding (RLE) that is used with good effect for bitmaps with only a few colours. Consider the following small, 17×10 pixel, and 8 bit image (See Figure 4.17).



Notes If this was to be stored in RAW form, it would need 16 bytes per row for all 10 rows. However the first two rows are all the same level so it is more efficient to simply save the number of same colours in a run along with the run colour. The first two rows instead of needing 16 bytes only need 2 bytes each.

In raw format the first three rows would be

```
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0  
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0  
0 0 1 1 1 1 1 1 1 1 1 1 1 1 0 0
```

Using run length encoding the first three rows would be

```
16 0  
16 0  
2 0 1 2 1 2 0
```

While there are more details involved in actual implementations of RLE than described here, this is the basic principle behind run length encoding. In order for RLE to achieve some degree of compression there needs to be runs of the same colour, for this reason it is unlikely to be useful for highly coloured images such as 24-bit photographs.

The following is a list and brief comments of some specific file formats that are widely used for saving bitmaps.

Format: TIFF (Tagged Image File Format)

Platforms: Commonly supported on Mac/DOS-WINDOWS/UNIX

Owner: Aldus

Notes: It is almost always supported by major applications that provide bitmap manipulation. The format consists of items called tags which are defined by the standard. Each tag is followed by a tag dependent data structure. Supports most colour spaces and compression methods.

Format: PCX

Platforms: Primarily DOS-WINDOWS

Owner: ZSoft Corp

Notes: The oldest and most commonly supported format on DOS machines. Can support indexed or full 24 bit colour. Run length encoding only.

Format: GIF

Platforms: Commonly supported on Mac/DOS-WINDOWS/UNIX

Owner: CompuServe

Notes: The GIF is a rather under featured but quite popular format. It is used the most on bulletin boards and on the worldwide internet. It is limited to 8 bit indexed colour and uses LZW compression can include multiple images and text overlays. Also contains support for layers and animation.

Format: PICT

Platforms: Exclusively Mac

Owner: Apple

Notes: The PICT is a Macintosh only format, indeed it is virtually impossible for it to exist on any machine but the Macintosh. The interpretation of a PICT is handled by the Macintosh operating system and thus is supported by almost all Macintosh applications. This format is responsible for the successful transfer of image data on the Macintosh and is used in cut/copy/paste operations. Supports most colour spaces and compression methods including JPEG.

Notes

Format: PNG (Portable Network Graphics)

Platforms: Commonly supported on Mac/DOS-WINDOWS/UNIX

Owner: None, patent free

Notes: Very powerful format which slowly seems to be adopted for the WWW. Supports colour upto 48 bits, grey upto 16 bits. Supports multiple compression schemes and bit depths including user defined ones.

Format: RAW

Platforms: Any

Owner: None

Notes: This is the simplest of all ways to store images, just as "raw" bytes. For example, one byte per pixel for grey scale or 3 bytes per pixel for RGB colour. There is no standard header and so even the size of the image needs to be specified for programs that might read the image.

Format: PPM (Portable PixMap)

Platforms: Any, originally UNIX

Owner: None

Notes: This is little more than the raw format with a few semi-agreed upon header fields. Typically used for 8 bits grey or 24 bits RGB colour images.

Format: GEM

Platforms: Almost exclusively DOS/Atari

Owner: Digital Research

Notes: Supported by GEM operating system.

Format: IFF/ILBM

Platforms: Almost exclusively Amiga

Owner: Electronic Arts

Notes: Supports four bit colour map and 24-bit direct colour.

Format: TARGA

Platforms: Mixed support on Mac/DOS-WINDOWS/UNIX

Owner: TrueVision Inc

Notes: Originally designed for VISTA data capture boards. Little more than a RAW format with some extra header information.

Format: BMP/DIB

Platforms: Primarily DOS-Windows

Owner: MicroSoft

| | |
|-------------------|--|
| Notes | <i>Notes:</i> MicroSoft Windows format, rarely supported elsewhere. Support 1, 2, 4, 8 and 32 bit colour images. |
| Format: | Sun raster |
| Platforms: | Primarily Sun |
| Owner: | Sum MicroSystems |
| <i>Notes:</i> | Only supported by Sun. Use RLE and either 8 bit greyscale or 24/32 bit colour. |
| Format: | XBM |
| Platforms: | Primarily X systems |
| Owner: | MIT X Corp |
| <i>Notes:</i> | Specifically for X windows system bitmap routines used for cursors and icons. |
| Format: | XWD |
| Platforms: | Primarily X systems |
| Owner: | MIT X Corp |
| <i>Notes:</i> | Screen save format under X windows. Implement black and white through to 24 bit direct colour. |



The TIFF is an international standard for storing and interchanging bitmaps between applications and hardware platforms.

4.2 Vector Drawing

In a vector drawing, you create control points. The lines in a vector drawing are created by the software and join up the control points that the user has drawn. There are four control points in the drawing above (three are little white squares; the last one is dark to indicate that it is being worked on). There is far more to be explained about vector graphics.

Vector based applications such as CorelDraw and Adobe Illustrator treat images as collections of vectors and shapes. A line would have a starting point, direction and length, a rectangle would have a starting point, width and height, and circles would have a centre and radius, and so on. After drawing a rectangle, you can go back and change its width and height, bring it to the foreground or send it to the background, even after other shapes had been drawn on top of it later. When saved to file, vector images also take up less disk space, for example, in the case of a rectangle, the program is only storing four numbers no matter what its size: the x and y starting point, plus the width and height. In comparison, a bitmap application would have to store colon information for the 10,000 pixels that make up a 100×100 pixel rectangle.

Advantages of Vectors

- pretty much resolution-independent. It is possible to rescale up a whole chunk of animation without the blockiness you would get from doing this with bitmaps
- for painting, you can specify that the bounding lines are automatically closed even when not visible, so avoiding problems of paint flooding out
- shapes easily edited
- smaller output files for Internet use
- shapes can be made to animate automatically from one to another, providing they have the same number of control points.

Self Assessment**Notes****Choose the correct answer:**

1. Regular rectangular mesh of cells called

| | |
|---------------|-------------------|
| (a) images | (b) pixels |
| (c) RAW files | (d) None of these |

2. With files stored by bitmap storage method are called

| | |
|---------------|-------------------|
| (a) images | (b) pixels |
| (c) RAW files | (d) None of these |

3. are created by the software and join up the control points that the user has drawn.

| | |
|----------------------|--------------------|
| (a) Vector drawing | (b) Bitmap storage |
| (c) Specific formats | (d) None of these |

4.3 Three Dimensional (3D) Drawing and Rendering

Drawing in 3D adds a third axis to the X and Y-axis used in 2D. The Z-axis allows you a third dimension, to create objects with a 3-dimensional thickness, or shape. These shapes can be put together to create either simple or complex objects, which are called models.

Rendering is the process of generating an image from a model (or models in what collectively could be called a scene file), by means of computer programs. A scene file contains objects in a strictly defined language or data structure; it would contain geometry, viewpoint, texture, lighting, and shading information as a description of the virtual scene. The data contained in the scene file is then passed to a rendering program to be processed and output to a digital image or raster graphics image file. The term "rendering" may be by analogy with an "artist's rendering" of a scene. Though the technical details of rendering methods vary, the general challenges to overcome in producing a 2D image from a 3D representation stored in a scene file are outlined as the graphics pipeline along a rendering device, such as a GPU. A GPU is a purpose-built device able to assist a CPU in performing complex rendering calculations. If a scene is to look relatively realistic and predictable under virtual lighting, the rendering software should solve the rendering equation. The rendering equation does not account for all lighting phenomena, but is a general lighting model for computer-generated imagery. 'Rendering' is also used to describe the process of calculating effects in a video editing file to produce final video output.

Rendering is one of the major sub-topics of 3D computer graphics, and in practice always connected to the others. In the graphics pipeline, it is the last major step, giving the final appearance to the models and animation. With the increasing sophistication of computer graphics since the 1970s, it has become a more distinct subject.

Rendering has uses in architecture, video games, simulators, movie or TV visual effects, and design visualization, each employing a different balance of features and techniques. As a product, a wide variety of renderers are available. Some are integrated into larger modelling and animation packages, some are stand-alone, some are free open-source projects. On the inside, a renderer is a carefully engineered program, based on a selective mixture of disciplines related to: light physics, visual perception, and mathematics and software development.

In the case of 3D graphics, rendering may be done slowly, as in pre-rendering, or in real time. Pre-rendering is a computationally intensive process that is typically used for movie creation, while real-time rendering is often done for 3D video games which rely on the use of graphics cards with 3D hardware accelerators.

| | |
|--------------|---|
| Notes | A rendered image can be understood in terms of a number of visible features. Rendering research and development has been largely motivated by finding ways to simulate these efficiently. Some relate directly to particular algorithms and techniques, while others are produced together. |
| | <ul style="list-style-type: none">• shading – how the colour and brightness of a surface varies with lighting• texture-mapping – a method of applying detail to surfaces• bump-mapping – a method of simulating small-scale bumpiness on surfaces• fogging/participating medium – how light dims when passing through non-clear atmosphere or air• shadows – the effect of obstructing light• soft shadows – varying darkness caused by partially obscured light sources• reflection – mirror-like or highly glossy reflection• transparency (optics), transparency (graphic) or opacity – sharp transmission of light through solid objects• translucency – highly scattered transmission of light through solid objects• refraction – bending of light associated with transparency• diffraction – bending, spreading and interference of light passing by an object or aperture that disrupts the ray• indirect illumination – surfaces illuminated by light reflected off other surfaces, rather than directly from a light source (also known as global illumination)• caustics (a form of indirect illumination) – reflection of light off a shiny object, or focusing of light through a transparent object, to produce bright highlights on another object• depth of field – objects appear blurry or out of focus when too far in front of or behind the object in focus• motion blur – objects appear blurry due to high-speed motion, or the motion of the camera• non-photorealistic rendering – rendering of scenes in an artistic style, intended to look like a painting or drawing |

Many rendering algorithms have been researched, and software used for rendering may employ a number of different techniques to obtain a final image.

Tracing every particle of light in a scene is about completely impractical and would take a stupendous amount of time. Even tracing a portion large enough to produce an image takes an inordinate amount of time if the sampling is not intelligently restricted.

Therefore, four loose families of more-efficient light transport modelling techniques have emerged: rasterization, including scanline rendering, geometrically projects objects in the scene to an image plane, without advanced optical effects; ray casting considers the scene as observed from a specific point-of-view, calculating the observed image based only on geometry and very basic optical laws of reflection intensity, and perhaps using Monte Carlo techniques to reduce artifacts; and ray tracing is similar to ray casting, but employs more advanced optical simulation, and usually uses Monte Carlo techniques to obtain more realistic results at a speed that is often orders of magnitude slower. The fourth type of light transport technique, radiosity is not usually implemented as a rendering technique, but instead calculates the passage of light as it leaves the light source and illuminates surfaces. These surfaces are usually rendered to the display using one of the other three techniques.

4.4 Natural Light and Colour

Notes

Natural light can be used, augmented or even combated by using a number of different techniques. Depending on the kind of sunlight that enters your room, that is, depending on whether it is direct or indirect, the light will bring out different tones within your room.

Indirect sunlight that enters a room from a north-facing window will be a cooler, bluer light than direct sunlight. As a result, you have the choice of whether or not to augment this coolness or to combat it using other colours. On the one hand, if you want to bring out the coolness, either white colours (which will reflect more of the light without alteration), reflective metal surfaces (which will do the same) or bluish colours will all bring out the blue-end of the lighting spectrum in the natural light.

On the other hand, if you want to combat the cooling effects of indirect light, you have a number of options. Indirect light is white enough that the blueness can be filtered out without significantly hurting the overall brightness of your light. It can be filtered in a number of ways. First, you may filter it out directly through the use of very thin, warm curtains placed over your windows. Second, it may be filtered out by not allowing it to reflect. This is done by avoiding the use of blue and white colours within your room, absorbing all the blueness.

Direct sunlight will be a yellower and warmer light, and again, one may choose to either augment or combat this effect. Since direct light is warm, white will bring out these warming properties. The yellowness can also be brought out by using warmer tones within the decoration of your room. The yellowness will actually highlight the warm tones in your objects, providing an overall sense of comfort and vibrancy to your room.

On the other hand, the warmth of direct light may be combated. Direct sunlight is white enough that, if you do not use warm colours or white, the bluer colours in the light will stand out. Be aware, though, that white will not appear as a cool colour in direct sunlight, but will become warm, as it is reflecting those properties of the light.

Depending on the kind of sunlight you are dealing with, colours can either augment or combat the natural features of that light.

4.5 Computerized Colours

Image that looks good on one computer might look completely different on another. Consider this: If you visit a clothing store on the Web and see a blue shirt, you are out of luck if you think that the shirt is really that shade of blue. Also, if you are visiting a museum on the Web to view Matisse's paintings, or researching skin diseases, or analyzing a satellite weather photo, you may not be seeing the correct colours and you may be getting incorrect information.

4.5.1 How Computers see colour?

The following components work together to create colour on your computer:

- 1. The computer hardware on the motherboard**

In the simplest terms, deep inside your computer is a "brain." It may or may not be able to see and recreate accurate colours.

- 2. Graphic cards or video cards/boards**

You may have a graphic card or video card/board installed. If so, this helps your computer to see better colours and more colours. (Note: This is built into all Macintosh computers.)

Notes

3. Your monitor

There are several factors that may cause colour distortions:

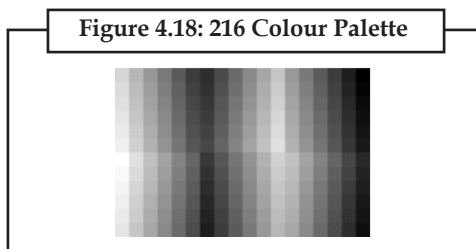
- Old monitors can be burning out. For example, the mechanics that generate the colour green may be weakening.
- Cheap monitors deliver terrible colour. You get what you pay for. A monitor that is of lower cost may have poor colour accuracy.
- Anti-glare screens lower the radiant emissions and this affects the colours generated on your monitor. Colours will appear darker than the actual colour and you may see a grey haze over the whole monitor screen (similar to how colours appear when wearing sunglasses). A better solution is placing your monitor away from glare sources. This will give you better colour and optimum visual conditions. Regarding electromagnetic field emissions, it is represented that good monitors are properly shielded and that emissions are restrained to the sides and back. The validity of these reports is subject to further questioning.

Therefore, the monitor can be the major cause of good or bad colour, or the monitor can be part of the combination of several Components that creates good or bad colour. In other words, if you have a good video card, good operating system software, and good application software, a bad monitor can still create inaccurate colours. Even if you have a fantastic monitor, the other Components can still create bad colours. So you are looking at a case-by-case kind of situation.

4. The Web browser (Firefox, Explorer, Safari etc.)

Consider the browser to be the messenger who delivers the collared graphics to your computer.

At the present time, most Web browsers support graphic file formats that contain essential information about colour (such as PNG). The past standard (which is still valid for full accessibility) is the 216 web-safe colour palette that is based on the colours that are known to exist in the colour vocabulary of all computers (from 8 bit and up). See the 216 colour palette below. You may also download the graphic and enlarge it to see each separate colour square (See Figure 4.18).



4.5.2 Colours in Images

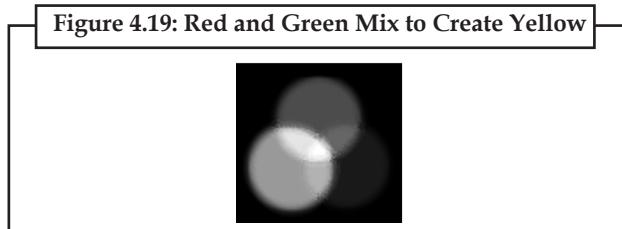
The images you see on the Web are GIF, JPEG, or PNG images. In simple terms, these file formats refer to the computer language that is at work within graphic images. It can be compared to how some people speak Mandarin, some speak French and some speak English. Some graphic images speak GIF, some speak JPEG, some speak PNG, some speak TIFF, etc.

These GIF, JPEG, and PNG images can be viewed by all “brands” of computers, PCs, Macintosh, and UNIX. They also contain colour information and this information is based on RGB, on how much (R) red (G) green and (B) blue is in the image.

Here's some background on RGB colour theory: Computers create colours based on a special

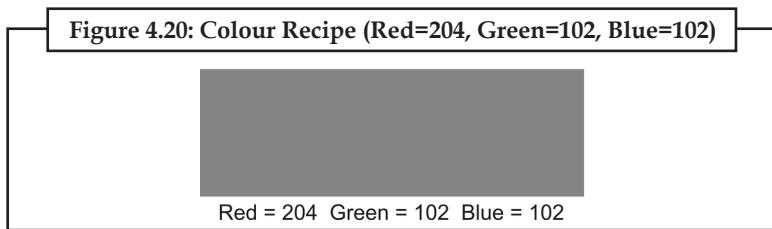
set of 3 primary colours: red, green, and blue. So does your television. If you go up close to your TV, (put your eye right on top of the screen) you will see little dots of red, green and blue. In computers and television, light transmissions are creating the colour. Red and green mix to create yellow (See Figure 4.19).

Notes



This is called "Additive Colour" and is completely different from how colours are mixed in the tangible world of paints and pigments. When we mix red and green paint, we get muddy browns. This is "Subtractive Colour" and is based on the primaries, red, yellow, and blue (or red-based/magenta, yellow-based/yellow, blue-based/cyan).

Let's take a look at the colour below (See Figure 4.20) and analyze the processes it passed through before it reached your eyes.



First, the colour was created in Adobe Photoshop. The recipe for the colour you see is: red=204, green=102, blue=102. The true colour could be called a muted coral or dull salmon.

Here is the path that the graphic took to get to you:

1. The image was placed in an html script (Web page) that can be read by all Web browsers. This script was sent to the Colour Matters' Web server.
2. Your Web browser software connected your computer to our server and brought the image into your computer. The colours in this gif image passed through the browser and brought this information into your computer operating system.
3. The colours in the image also passed through your operating system hardware. If you have a graphic card or video card it also interpreted the colour.
4. Your monitor took all the information and sent it to your eyes.

In conclusion, remember that different computers do different things, many "systems" have different configurations of all of the above things, and browsers used to view the World Wide Web are part of the overall picture.

4.6 Colour Palettes

A device which converts the logical colour numbers stored in each pixel of video memory into physical colours, normally represented as RGB triplets, which can be displayed on the monitor. The palette is simply a block of fast RAM which is addressed by the logical colour and whose output is split into the red, green and blue levels which drive the actual display (e.g. CRT).

Notes

The number of entries (logical colours) in the palette is the total number of colours which can appear on screen simultaneously. The width of each entry determines the number of colours which the palette can be set to produce.

A common example would be a palette of 256 colours (i.e. addressed by eight-bit pixel values) where each colour can be chosen from a total of 16.7 million colours (i.e. eight bits output for each of red, green and blue). Changes to the palette affect the whole screen at once and can be used to produce special effects which would be much slower to produce by updating pixels.

The following are some of the widely used meanings for colour palette in computing:

- The total number of colours that a given system is able to generate or manage (though, due to video memory limitations, it may not be able to display them all simultaneously):
 - *Full palette*: For example, high colour displays are said to have a 16-bit RGB palette.
- The limited selection of colours that can be displayed simultaneously:
 - *On the whole screen*:
 - ❖ *Fixed palette selection*: A given display adapter can offer a fixed colour selection when its hardware registers are appropriately set. For example, the Colour Graphics Adapter (CGA), is one of the standard graphics mode, can be set to show the so-called palette #1 or the palette #2: two combinations of three fixed colours and one user-defined background colour each.
 - ❖ *Selected colours or picked colours*: In this case, the colour selection, generally from a wider explicitly available full palette, is always chosen by software, both by the user or by a program. For example, the standard VGA display adapter is said to provide a palette of 256 simultaneous colours from a total of 262,144 different colours.
 - ❖ *Default palette or system palette*: The given selected colours have been officially standardized by some body or corporation. For example, the well known Web-safe colours for use with Internet browsers, or the Microsoft Windows default palette.
 - *On an individual image*:
 - ❖ *Colour map or colour table*: The limited colour selection is stored inside the given indexed colour image file. For example, GIF
 - ❖ *Image palette or image colours*: The limited colour selection is assumed to be the full list of the colours the given digital image has, even when the image file does not employ indexed colour pixel encoding.
- The underlying hardware that may be used to hold those simultaneous colours:

Hardware palette or Colour Look-Up Table (CLUT): In order to show them, the selected colours' values must be loaded in the colour hardware registers of the display subsystem. For example, the hardware registers of the Commodore Amiga are known both as their colour palette and their CLUT, depending on sources.

4.6.1 Colour Palette Generator

A colour generator or colour scheme selector is a tool for anyone in need of a colour scheme. In most cases these online tools are code driven and full of features to help someone build the perfect colour scheme. There is somewhere around 50 online generators available for you to use.

Kuler**Notes**

Kuler is an Adobe Labs colour palette generator and explorer. You can use the Flash-based app to either create your own colour scheme by setting your own hex values or you can search through, rate, and tag, and comment on the schemes that have already been created by others. All the colour schemes can then be downloaded in the Adobe Swatch Exchange (.ASE) format which works with any of Adobe's Creative Suite applications.

Colour Hunter

Colour Hunter is a colour palette generator that uses flickr photos to create a palette. To find colour palettes on Colour Hunter, enter a search term in the box at the top of the page. You can search by tag or hex colour code or the image URL from flickr's Web site. If you have an image that you saved on your computer, you can upload it and get a colour palette generated based on the colours in the image. You can also use Colour Hunter to search by tag.

Colour Palette Generator

The Colour Palette Generator is a simple tool that also lets you use a photo from the Web as the inspiration. It is a bit more basic than Colour Hunter, above, but sometimes that's just what you need. Just enter in the photo's URL from any place on the Web and the generator will create a colour scheme based on the photo.

ColourJack

ColourJack is an online generator that lets you hover over a colour on the site's grid to see themes that use that colour. You can select which format you want to see your colour scheme in (hsv, rgb, or hex) and you can then export it to Illustrator, Photoshop, or ColourJack Studio. Other ColourJack tools include the Colour Sphere and the Colour Galaxy, which provide alternative UIs for generating colour schemes. A Mac OSX widget is also available.

Daily Colour Scheme

Daily Colour Scheme is an "everyday colour resource" that provides you with the colour schemes used by other websites like 9Rules, for example, using those sites as inspiration, you can bookmark their schemes, download them in your preferred format, or import the schemes into your design program like Photoshop, Illustrator, or Top style. There are many more colour palettes available which are used to create the effective palettes.

4.7 Image File Formats

Choosing the right file format to save your images is of vital importance. There are three image formats in constant use on the net—GIF, JPG and PNG. Each is suited to a specific type of image, and matching your image to the correct format should result in a small, fast-loading graphic. Saving and exporting into these formats will require a decent image editor.

4.7.1 Graphics Interchange Format (GIF)

CompuServe's 8-bit GIF format has long been the most popular, mainly because of its small size. It is ideal for small navigational icons and simple diagrams and illustrations where accuracy is required, or graphics with large blocks of a single colour. The format is lossless, meaning it does not get blurry or messy. The GIFs use a simple technique called LZW compression to reduce the filesizes of images by finding repeated patterns of pixels, but this compression never degrades the image quality.

GIF files can be saved with a maximum of 256 colours: This makes it a poor format for photographic images. Since this can sometimes be tight, GIFs have the option to dither, and will mix pixels of two different available colours to create a suggestion of another colour.

Notes

GIFs can be animated: It is another reason they became so successful. Most animated banner ads are GIFs. You will need an animation program to make your own animations.

The GIFs allow single-bit transparency, which means when you are creating your image, you can specify one colour to be transparent. This allows the background colours of the Web page to show through the image.

GIFs can also be interlaced, which is a way of saving a graphic so that it loads progressively – first a blurry, low-detail version is loaded, and then successive layers of detail are added. This usually means a larger overall filesize, but it means that a version of the image gets placed onto the viewer's screen much quicker, and so is beneficial in many situations, as it gives the impression of a speedier download.

The GIFs (variously pronounced "gif" or "jif") are a very good format for most of the graphics you will be using on your site, though PNGs below are better in many regards. Experimentation is the key to success.



If an image format is not compatible with the display visual (e.g. JPEG on a colormapped display) then the original image will be altered.

4.7.2 Joint Photographic Experts Group (JPEG)

The 16-bit JPEG format (usually written without the E), was designed with photographs in mind. It is capable of displaying millions of colours at once, without the need for dithering, allowing for the complex blend of hues that occur in photographic images.

The JPGs use a complex compression algorithm, which can be applied on a sliding scale. Compression is achieved by 'forgetting' certain details about the image, which the JPG will then try to fill in later when it is being displayed. You can save a JPG with 0% compression for a perfect image with a large filesize; or with 80% compression for a small but noticeably degraded image. In practical use, a compression setting of about 60% will result in the optimum balance of quality and filesize, without letting the lossy compression do too much damage.

Though, JPGs can be interlaced, they lack many of the other special abilities of GIFs, like animation and transparency. They really are only for photos. Simple graphics with large blocks of colour should not be saved as JPGs because the edges get all smudgy.

4.7.3 Portable Network Graphics (PNG)

The PNG is a format invented specifically for the Web in response to a licensing scheme introduced which meant the creators of any software that supported the GIF format had to pay five thousand dollars for the privilege (this tax has since expired). While they were at it however, the creators of PNG ("ping") went ahead and created a format superior to GIF in almost every way.

One version of the format, PNG-8, is similar to the GIF format. It can be saved with a maximum of 256 colours and supports 1-bit transparency. Filesizes when saved in a capable image editor like Fireworks will be noticeably smaller than the GIF counterpart, as PNGs save their colour data more efficiently.

The PNG-24 is another flavour of PNG, with 24-bit colour support, allowing ranges of colour akin to a high colour JPG. PNG-24 is in no way a replacement format for JPG, however, because it is a lossless compression format. This means that filesizes can be rather big against a comparable JPG.

The PNG's main draw is alpha channels. Instead of the rudimentary transparency options in other formats (where a pixel is either transparent or opaque), an alpha channel can specify the opacity of any pixel from 0–255, where 0 is fully transparent and 255 is fully unclear. This allows you to create a graphic that can be placed on top of any background colour and will retain a translucent effect, with the background showing through the pixels that are not opaque.

The problem with this—and there had to be one—is that IE6 does not support alpha channels. Once a new version of IE comes out with this vital support, you should see the effect springing up on trendy designers' sites across the Web.

Notes

And what of animation? PNG can be made into multi-image files through the MNG extension of the format, but browser support is patchy for this format. Stick with GIFs for your animations.



The GIF was the first image format to be used on the World Wide Web.

Did u know?

4.8 Macintosh Image Format

The Macintosh PICT (Macintosh Picture) format is associated with applications on the Macintosh and is one of the best supported formats on that platform. The PICT files are meant to encapsulate the functionality of QuickDraw, the native graphics drawing protocol on the Macintosh, and consist mainly of QuickDraw calls arranged in no particular order. There have been two major releases of QuickDraw, v1.0 and v2.0 (Colour QuickDraw). There have also been numerous minor QuickDraw revisions, each associated with a corresponding Macintosh PICT version.

QuickDraw v1.0 supports monochrome bitmaps up to 32K in size. Image resolution is fixed at the original Macintosh display resolution, or 72 dpi.

QuickDraw v2.0, sometimes known as Colour QuickDraw, supports 8-bit bitmaps as well as monochrome. There is no compression available for 8-bit Version 2.0 PICT files.

All information in Macintosh PICT files is stored in the data fork of the Macintosh file pair. Although the resource fork may be present, it is left empty. Image data is stored in binary format and consists of a series of operators and associated data.

High-level routines in the Macintosh ToolKit are available to read and write PICT files and are often used when writing applications that translate PICT files to other image file formats.

4.8.1 File Organization

All Macintosh PICT files start with a 512-byte header, which contains information that the Macintosh uses to keep track of the file. This is followed by three fields describing the image size (picSize), the image frame (picFrame), and a version number. In v2.0 files, another header follows. In both versions, the preceding information is followed by the image data. In all versions, the end of the file is signalled by an end-of-file operator.

4.8.2 File Details

QuickDraw, and consequently the Macintosh PICT format, is far too complex for us to do justice to it here, so we will merely note some details about the start of the file. A good deal of information and codes are included on the CD-ROM. Note that most secondary references only give examples of bitmap encoding and ignore the vector nature of the format.

The information following the platform-specific 512-byte header is in the following format:

SHORT File size in bytes

SHORT Frame x-value of top left of image (at 72 dpi)

SHORT Frame y-value of top left of image (at 72 dpi)

SHORT Frame x-value of lower right of image (at 72 dpi)

SHORT Frame y-value of lower right of image (at 72 dpi)

in v1.0 files, this is followed by:

Notes

BYTE Version operator (0x11)

BYTE Version number (0x01)

or, in v2.0 files, by:

SHORT Version operator (0x0011)

SHORT Version number (0x02ff)

Version 2.0 files also have a 26-byte header following the version information:

SHORT Header opcode for Version 2 (0C00)

SHORT FFEF or FFEE

SHORT Reserved (0000)

LONG Original horizontal resolution in pixels/inch

LONG Original vertical resolution in pixels/inch

SHORT Frame upper left x at original resolution

SHORT Frame upper left y at original resolution

SHORT Frame lower right x at original resolution

SHORT Frame lower right y at original resolution

LONG Reserved

picSize and picFrame records follow the header.

picSize

WORD Picture size in bytes

WORD Image top

WORD Image left

WORD Image bottom

WORD Image right

picFrame (PICT v1.0)

BYTE Version (11h)

BYTE Picture version (01h)

This is followed by the image data. Each record in a PICT version 1 file consists of a one-byte opcode followed by the actual data.

picFrame (PICT v2.0)

WORD Version (0011h)

WORD Picture version (02ffh)

WORD Reserved header opcode (0c00h)

WORD Header opcode (0c00h)

DWORD Picture size (bytes)

DWORD Original horizontal resolution (pixels/inch)

| | | Notes |
|-------|--|-------|
| DWORD | Original vertical resolution (pixels/inch) | |
| WORD | x value of top left of image | |
| WORD | y value of top left of image | |
| WORD | x value of lower right of image | |
| WORD | y value of lower right of image | |
| DWORD | Reserved | |

This is followed by the image data. Each record of a PICT v2.0 file consists of a two-byte opcode followed by the actual data.



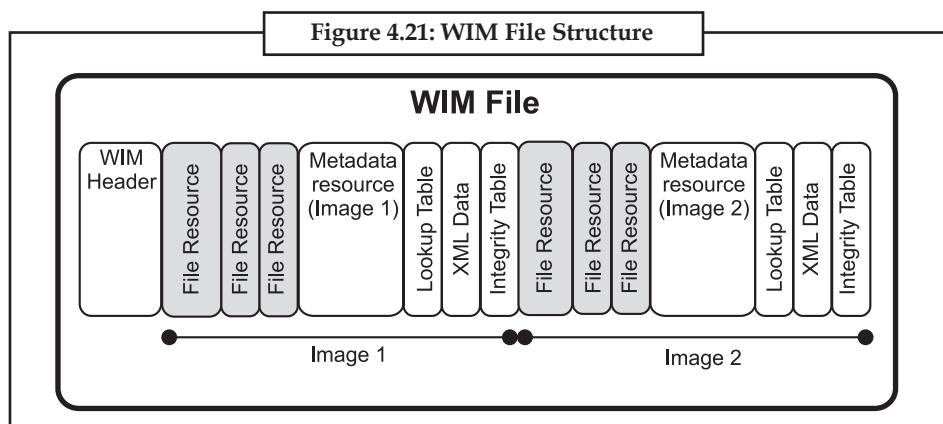
To avoid the collision opcodes, data must be aligned on 16-byte boundaries and that certain opcodes in PICT v1.0 and v2.0 files should be interpreted differently.

4.9 Windows Imaging File Format (WIM)

This topic introduces the Microsoft Windows Imaging (WIM) file format. The WIM is a file-based disk image format that was introduced in Windows Vista. WIM files are compressed packages that contain a number of related files. The format of a WIM file is optimized for maximum compression with LZX, for fast compression with XPRESS, or uncompressed.

4.9.1 WIM File Structure

A WIM file structure (See Figure 4.21) contains up to six types of resources: header, file resource, metadata resource, lookup table, XML data, and integrity table. The following illustration shows the general layout of a WIM file that contains two images.



4.9.2 WIM File Layout

- **WIM Header:** Defines the content of the .wim file, including memory location of key resources (metadata resource, lookup table, XML data), and various .wim file attributes (version, size, compression type).
- **File Resources:** A series of packages that contain captured data, such as source files.
- **Metadata Resource:** Contains information about the files that you are capturing, including directory structure and file attributes. There is one metadata resource for each image in a .wim file.

Notes

- **Lookup Table:** Contains the memory location of resource files in the .wim file.
- **XML Data:** Contains additional data about the image.
- **Integrity Table:** Contains security hash information that is used to verify an image's integrity during an apply operation.

4.9.3 Benefits of Leveraging WIM

There are a number of additional benefits in leveraging the Windows Imaging format over sector-by-sector copying.

Some highlights:

- One WIM file can address different hardware configurations as there is no requirement as in a sector-by-sector copy installs that the destination hardware match the source hardware.
- WIM can store multiple images within a single file as described above in the install.wim of the base operating system; the same can be done for custom *.wim files created by system administrator.
- When you store multiple images within a single file you can do this as just part of a core build for desktop deployments or with the use of Catalog (CLG) files that allow for the option to set up multiple applications to be deployed as part of the operating system build.
- You can service the WIM image offline from its stored location and add or remove certain operating system components, files, updates, and drivers without creating a new image.
- Windows Imaging format has the flexibility to install a disk image on partitions of any size. Sector-by-sector images require deployments of an image to a partition that is the same size or larger than the source disk.
- WIMGAPI is the Windows Imaging API that developers can use to manage WIM image files.
- WIM deployments can be performed non-destructively. Data can be on the existing volume and the image can be deployed without erasing the existing contents of the volume.

4.9.4 WIMGAPI Tool for Windows Image Deployment

The WIMGAPI is the Windows Imaging Application Program Interface that developers can use to manage .wim files.

Developers are able to use WIMGAPI to mount existing WIM files to a folder in order to revise the contents or adding or remove files or settings from the image and then returning the image (unmount) from the folder.

The WIMGAPI can also be used to partition a hard drive and format the volumes ahead of dropping the WIM onto the system as part of the installation being executed.

4.10 Cross-platform Formats

The format of an image to be used on the Web should be a file type that is "cross-platform" which means that several types of operating systems can use that file type. Platforms are operating systems and system configurations such as a Macintosh running OS X on the G4 with dual processors, a PC running Windows XP, or another computer running the Linux operating system. Your images will need to be in a format that all of the computers operating on the Web can use. Popular file formats for Web use are the GIF and JPEG file formats. All graphical browsers support GIF and JPEG file formats. PNG file formats can only be recognized by some of the graphical browsers but not all of them.



Task Select an image to convert it from GIF format to JPEG format.

Notes

4.10.1 Cross-platform Problems in Current Scenario

With existing formats, there are substantial cross-platform differences with image viewing. The images will be displayed, sure, but what people see will be very different.

For example, create a graphic on a Mac, say, and balance it to look just right this picture of two children (See Figure 4.22). In which trouble is, it will look dark and contrasty on a PC, because the default gamma correction is different from that on a Mac. On an SGI workstation, however, it will look pale and washed-out because there the gamma is different again.

Figure 4.22: Cross-platform Differences with Image Viewing



Simple Image

On a PC

On an SGI

The problem is that your browser has no idea where the image was created or how it was originally displayed, so it cannot compensate for these differences. What is needed is for the authoring tools to include this information, which is readily available to them. But existing image formats have no way of storing this information.

How PNG helps

The PNG stores the gamma value used by the source platform which created the image, in a standard place in the file which browsers, image viewers and authoring tools know how to read and adjust for. So the gross lightness and contrast differences we have just seen are compensated for automatically, without the image designer or the reader having to make any adjustments themselves. (See Figure 4.23)

Figure 4.23: Not Identical, but a Lot Better



On a PC

On a Mac

On an SGI

Notes

When you prepare a graphic or a document that you will distribute to others, how much thought do you give to the file format? Do you know which file format is best for a particular application?

Just a few years ago, you probably created and printed a project using only one application. Now, it is common to create an illustration in one program, add to it in another, and then print it in a third. Therefore, in order to freely exchange information between applications, you must know which file formats work in each application. This is especially true when you are working with graphic files.

Two or three years ago, a Mac user would never have heard of a PCX or BMP file, and a PC user would not know a MacPaint file from a PICT file. But now that more applications are becoming cross-platform. Desktop publishers need to familiarize themselves with graphic file formats that were previously platform-specific.

Keeping current on all the graphic file formats available for one platform is difficult enough-for two or more platforms, it is close to impossible. But technology marches on, and in that spirit we are presenting some of the most commonly used graphic file formats on the Mac and Windows platforms. In this, we will first review the basics behind image file format, and then we will outline each of the most popular image file types.

XnView is a cross-platform image viewer used for viewing, converting, organising and editing graphical and video files. It is free of charge for private, educational and non-profit organisations. For commercial use and distribution, the user must register the program.

XnView is highly customizable and multi-lingual, supporting 44 languages in the Windows version. The language can be changed via the options menu. The toolbar buttons can be modified to a certain extent, or be replaced by altering skins.

Also, XnView has been able to support an increasing number of file formats (mainly image file formats). It can read more than 400 image file formats, some audio and video file formats, and write 50 image file formats. XnView also supports ICC profiles in JPEG, PNG and TIFF files.

XnView can show IPTC, Exif and XMP metadata, and write IPTC metadata (but cannot do batch writing of IPTC metadata, and some users are longing for the batch IPTC editing function). A further limitation is that it currently does not allow sorting thumbnails within a folder by a user-defined order.



Picture Library for Multimedia

Case Study

Picture Library for Multimedia

An online product enjoys great success due to its excellent content, ease of use, and established market presence. A large global publisher wishes to enhance the presentation of its articles by adding a large number of high quality photographs and illustrations.

Traditionally, publishers would have contracts with many photo agencies that would present what they had available in the various categories, then editors would select the most promising candidates. Photos would go through a process of review until the winners were selected.

This process was time consuming and expensive. Along with the per photo charges, there are costs to the organization of personnel, researchers, editorial, etc.

The client engaged Value Chain International (VCIL) to source and manage a sizeable number of photos and illustrations in a short timeframe. VCIL was selected due to its knowledge of

Contd...

different types of content, its ability to execute process engineering for advanced and changing workflows, and the expertise and willingness to explore new avenues to achieve the client's goals.

Notes

Business Solution

The client did not have the resources or the expertise to complete this large project alone, so it engaged VCIL to source a number of photos within an aggressive deadline.

VCIL quickly put together a photo research team to populate a huge photographic database to significantly add to the client's collection of quality photographs.

As the photographic database was so large, VCIL developed appropriate management procedures to make sure the database would be populated smoothly, efficiently and effectively. Images were optimally organized in the database to ensure quick and easy access.

VCIL had the industry connections and the expertise to source and sift through mounds of photographic and pictorial materials available to find the hidden gems.

Approach

VCIL supports the publisher throughout its entire lifecycle. VCIL was always available to quickly bring in new functionality and workflow enhancements to meet the particular requirements of the task at hand.

The client wanted a lot of images in a short timeframe. VCIL quickly put together a nimble and agile team of researchers who worked on an accelerated timetable. Engaging VCIL meant that the client didn't have the expense and problems in hiring and managing 30 independent photo researchers, or organizing the photos.

To complete a big project quickly over three different continents - in India, the US, and the UK - there are the usual problems of communication, assignments of roles and responsibilities, and long distance co-ordination over time zones. VCIL had the experience and the skills to implement superior procedures and a reliable model to source, manage and organize all the photos and illustrations. VCIL is uniquely positioned to assemble, train and expand the research team to successfully deliver to the client the results they were looking for.

VCIL provides a departure to how people tend to think of companies in India who just do digital conversion. VCIL has the knowledge and the skills in understanding content; process engineering; and workflow design and execution to build a scalable, highly accurate, and replicable model for the creation of a large amount of content.

Benefits

An image database populated with a large number of photographs and illustrations is proving invaluable for quick and easy access to relevant images for a wide variety of articles. This has saved the company time and money in sourcing quality images from a plethora of suppliers.

The client's articles are enhanced by the addition of high quality photographs and illustrations, which also inspire interest in the article.

Questions:

1. What are the approaches of Picture Library?
2. Discuss in brief picture library in the term of multimedia.

Notes

Self Assessment

Choose the correct answer:

4.11 Summary

- Bitmaps are always orientated horizontally and vertically.
 - Vector based applications such as Corel Draw and Adobe Illustrator treat images as collections of vectors and shapes.
 - Drawing in 3D adds a third axis to the X and Y-axis used in 2D. The Z-axis allows a third dimension, to create objects with a 3-dimensional thickness, or shape.
 - Rendering is one of the major sub-topics of 3D computer graphics, and in practice always connected to the others.
 - Natural light is used, augmented or even combated by using a number of different techniques.
 - Online tools are code driven and full of features to help someone build the perfect colour scheme.
 - The Macintosh PICT (Macintosh Picture) format is associated with applications on the Macintosh and is one of the best supported formats on that platform.
 - Microsoft Windows Imaging (WIM) files are compressed packages that contain a number of related files. The format of a WIM file is optimized for maximum compression with LZ77, for fast compression with XPRESS, or uncompressed.
 - Cross-platform means that several types of operating systems use that file type.

4.12 Keywords

Notes

Colour palette: A device which converts the logical colour numbers stored in each pixel of video memory into physical colours, normally represented as RGB triplets, which can be displayed on the monitor.

Image: An image is an optical representation of an object produced by light rays from the object being refracted or reflected by a lens or mirror.

Pixels: Regular rectangular mesh of cells called pixels.

Raw files: Files stored by bitmap storage method are called RAW files.

Rendering: Rendering is the process of adding realism to a computer graphics by adding three-dimensional qualities such as shadows and variations in colour and shade.

Resolution: Resolution is normally specified in pixels per inch but could be in terms of any other unit of measure.

Vector drawing: Vector drawing is created by the software and joins up the control points that the user has drawn.



Lab Exercise

1. Give the steps to render a 3D Image.
2. Generate a colour palette using online colour palette generator.

4.13 Review Questions

1. What are the bitmap images? Explain in brief.
2. What do you mean by resolution? How it is related with the bitmaps?
3. What is colour depth conversion?
4. Write a short note on bitmap storage.
5. What is the vector drawing? What are its advantages in graphics?
6. What do you mean by rendering? What is the purpose of rendering?
7. Write the brief notes on natural light and colour.
8. What do you understand by computerized colours?
9. What are the colour palettes? Write about some colour palette generators.
10. What are the image file formats? Explain about the widely used image formats.
11. Write the short notes on:
 - (a) Colour depth.
 - (b) Macintosh image.
 - (c) Windows Imaging (WIM) file formats.
 - (d) Cross-platform formats.

Answers to Self Assessment

- | | | | | |
|--------|--------|--------|--------|--------|
| 1. (b) | 2. (c) | 3. (a) | 4. (d) | 5. (b) |
| 6. (c) | 7. (d) | 8. (b) | | |

Notes

4.14 Further Reading



Books

Images: A Reader, by Sunil Manghani, Arthur Piper, Jon Simons.



Online link

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Unit 5: Video

Notes

CONTENTS

- Objectives
- Introduction
- 5.1 How video works?
- 5.2 Broadcast Video Standards
 - 5.2.1 National Television System Committee (NTSC)
 - 5.2.2 Phase Alternating Line (PAL)
 - 5.2.3 Systeme Electronique Pour Couleur Avee Memoire (SECAM)
 - 5.2.4 Advanced Television Systems Committee (ATSC)
 - 5.2.5 Digital Television (DTV)
- 5.3 Analogue Video
 - 5.3.1 Analogue Video Formats
- 5.4 Digital Video
- 5.5 Digital Video Standards – ATSC, DVB, ISDB
 - 5.5.1 Advanced Television Systems Committee (ATSC)
 - 5.5.2 Digital Video Broadcasting (DVB)
 - 5.5.3 Integrated Services Digital Broadcasting (ISDB)
 - 5.5.4 List of Countries used these Standards
- 5.6 Video Recording and Shooting Videos
 - 5.6.1 Videotape Recording Process
 - 5.6.2 Disk-based Recording
 - 5.6.3 High-definition DVDs
 - 5.6.4 Disk-based Camcorders
 - 5.6.5 Solid State Memory
 - 5.6.7 File Servers and File-based Systems
 - 5.6.8 Guidelines for Shooting Quality Videos
- 5.7 Video Editing
 - 5.7.1 Objectives of Video Editing
- 5.8 Optimizing Video Files for CD-ROM
- 5.9 Digital Display Standards
 - 5.9.1 Monochrome Display Adapter (MDA)
 - 5.9.2 Hercules Graphics Card
 - 5.9.3 Colour Graphics Adapter (CGA)
 - 5.9.4 Enhanced Graphics Adapter (EGA)
 - 5.9.5 Video Graphics Array (VGA)
 - 5.9.6 Super VGA (SVGA)
 - 5.9.7 Extended Graphics Array (XGA)

Notes

- 5.10 Summary
- 5.11 Keywords
- 5.12 Review Questions
- 5.13 Further Reading

Objectives

After studying this unit, you will be able to:

- Understand how video works
- Explain broadcast video standards
- Describe analogue video
- Explain digital video
- Understand digital video standards – ATSC, DVB, ISDB
- Describe video recording and shooting videos
- Explain video editing
- Understand optimizing video files for CD-ROM
- Describe digital display standards

Introduction

Video is the technology that captures moving images electronically. Those moving images are really just a series of still images that change so fast that it looks like the image is moving.

The term video commonly refers to several storage formats for moving pictures: digital video formats; including Blu-ray Disc, DVD, QuickTime (QT), and MPEG-4; and analogue videotapes, including VHS and Betamax. Video can be recorded and transmitted in various physical media: in magnetic tape when recorded as PAL or NTSC electric signals by video cameras, or in MPEG-4 or DV digital media when recorded by digital cameras. Quality of video essentially depends on the capturing method and storage used. Digital television (DTV) is a relatively recent format with higher quality than earlier television formats and has become a standard for television video.

5.1 How video works?

When light reflected from an object passes through a video camera lens that light is converted into an electronic signal by a special sensor called a charge-coupled device (CCD). Top-quality broadcast cameras and even camcorders may have as many as three CCDs (one for each colour of red, green and blue) to enhance the resolution of the camera.

The output of the CCD is processed by the camera into a signal containing three channels of colour information and synchronization; pulse (sync). There are several video standards for managing CCD output, each dealing with the amount of separation between the components of the signal. The more separation of the colour information found in the signal, the higher the quality of the image (and the more expensive the equipment).

If each channel of colour information is transmitted as a separate signal on its own conductor, the signal output is called RGB (red, green and blue), which is the preferred method for higher-quality and professional video work. Output can also be split into two separate chroma (colour) channels, Cb/Cr (blue and red chroma components) and a luma component channel (Y), which makes the dark and light part of the video picture. These components are often confused with the YUV colour space in which time=Y, x-axis=U and y-axis=V.

Further confusing things, the non-RGB component cables usually have red, green and blue plugs and jacks, even though the two methods of signal transfer are not compatible. Lower in quality is the Y/C signal that makes up separate video (S-Video), an analogue video signal, used in super VHS and Hi-8 video. As with component video, the Y indicates the brightness (or luminance) information, but in S-Video colour (or chrominance), information is combined and designated by C.

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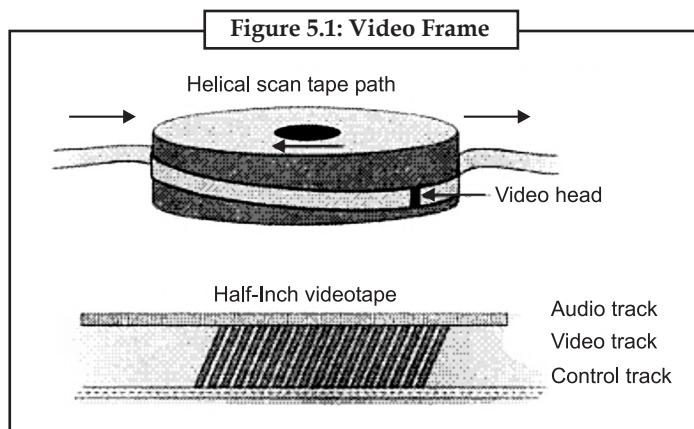
The least separation (and thus the lowest quality for a video signal) occurs when all the signals are mixed together and carried on a single cable as a composite of the three colour channels and the sync signal; this system yields less-precise colour definition, which cannot be manipulated or colour corrected as much as an RGB or component signal.

In analogue systems, the video signal from the camera is delivered to the video in connector(s) of a VCR, where it is recorded on magnetic videotape. A camcorder combines both camera and tape recorder on a single device. One or two channels of sound may also be recorded on the videotape (mono or stereo). The video signal is written to tape by a spinning recording head that changes the local magnetic properties of the tape's surface in a series of long diagonal stripes.

Since the head is canted or tilted at a slight angle compared with the path of the tape, it follows a helical (spiral) path, which is called Helical scan recording. As illustrated in Figure 5.1, each stripe represents information for one field of a video frame. A single video frame is made up of two fields that are interlaced.

Audio is recorded on a separate straight-line track at the top of the videotape, although with some recording systems (notably for 3/4 inch tape and for 3/2 inch tape with high-fidelity audio), sound is recorded helically between the video tracks.

- At the bottom of the tape is a control track containing the pulses used to regulate speed. Tracking is fine adjustment of the tape so that the tracks are properly aligned as the tape moves across the playback head. This is how your VCR works.



5.2 Broadcast Video Standards

Most countries around the world use following broadcast standards. These are the main standards: NTSC, PAL, SECAM, ATSC and DTV. However, each standard is not compatible with the other.

5.2.1 National Television System Committee (NTSC)

Most countries using the NTSC standard, as well as those using other analogue television standards, are switching to newer DTV standards, of which at least four different ones are in use

Notes around the world. North America, parts of Central America, and South Korea are adopting the ATSC standards, while other countries are adopting or have adopted other standards.

The NTSC was the first widely adopted broadcast colour system. After nearly 70 years of use, the vast majority of over-the-air NTSC transmissions in the US were replaced with digital ATSC on 12 June 2009 and 31 August 2011 in Canada and most other NTSC markets. Despite the shift to digital broadcasting, standard definition television in these countries continues to follow the NTSC standard in terms of frame rate and number of lines of resolution. In the US a small number of short-range local and TV relay stations continue to broadcast NTSC, as the FCC allows. The NTSC baseband video signals are also still often used in video playback (typically of recordings from existing libraries using existing equipment) and in CCTV and surveillance video systems.

Technical Details

| | |
|-----------------------------|--------------|
| SYSTEM | NTSC M |
| Lines/Field | 525/60 |
| Horizontal Frequency | 15.734 kHz |
| Vertical Frequency | 60 Hz |
| Colour Subcarrier Frequency | 3.579545 MHz |
| Video Bandwidth | 4.2 MHz |
| Sound Carrier | 4.5 MHz |



The first NTSC standard was developed in 1941 and had no provision for colour television. In 1953, a second modified version of the NTSC standard was adopted, which allowed colour television broadcasting compatible with the existing stock of black-and-white receivers.

5.2.2 Phase Alternating Line (PAL)

The PAL, stand for Phase Alternating Line, is an analogue television colour encoding system used in broadcast television systems in many countries. Other common analogue television systems are NTSC and SECAM. This page primarily discusses the PAL colour encoding system.

In the 1950s, the Western European countries commenced planning to introduce colour television, and were faced with the problem that the NTSC standard demonstrated several weaknesses, including colour tone shifting under poor transmission conditions. To overcome NTSC's shortcomings, alternative standards were devised, resulting in the development of the PAL and SECAM standards. The goal was to provide a colour TV standard for the European picture frequency of 50 fields per second (50 hertz), and finding a way to eliminate the problems with NTSC.

The PAL was developed by Walter Bruch at Telefunken in Germany. The format was unveiled in 1963, with the first broadcasts beginning in the United Kingdom in 1964 and Germany in 1967, though the one BBC channel initially using the broadcast standard only began to broadcast in colour from 1967.

| SYSTEM | PAL B,G,H | PAL I | PAL D | PAL N | PAL M |
|----------------------|------------|------------|------------|------------|------------|
| Line/Field | 625/50 | 625/50 | 625/50 | 625/50 | 525/60 |
| Horizontal Frequency | 15.625 kHz | 15.625 kHz | 15.625 kHz | 15.625 kHz | 15.750 kHz |
| Vertical Frequency | 50 Hz | 50 Hz | 50 Hz | 50 Hz | 60 Hz |
| Colour Sub Carrier | | | | | |

| | | | | | | Notes |
|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-------|
| Frequency | 4.433618 MHz | 4.433618 MHz | 4.433618 MHz | 3.582056 MHz | 3.575611 MHz | |
| Video Bandwidth | 5.0 MHz | 5.5 MHz | 6.0 MHz | 4.2 MHz | 4.2 MHz | |
| Sound Carrier | 5.5 MHz | 6.0 MHz | 6.5 MHz | 4.5 MHz | 4.5 MHz | |

PAL Versus NTSC

The NTSC receivers have a tint control to perform colour correction manually. If this is not adjusted correctly, the colours may be faulty. The PAL standard automatically cancels hue errors by phase reversal, so a tint control is unnecessary. Chrominance phase errors in the PAL system are cancelled out using a 1H delay line resulting in lower saturation, which is much less noticeable to the eye than NTSC hue errors.

However, the alternation of colour information—Hanover bars—can lead to picture grain on pictures with extreme phase errors even in PAL systems, if decoder circuits are misaligned or use the simplified decoders of early designs (typically to overcome royalty restrictions). In most cases such extreme phase shifts do not occur. This effect will usually be observed when the transmission path is poor, typically in built up areas or where the terrain is unfavourable. The effect is more noticeable on UHF than VHF signals as VHF signals tend to be more robust.

In the early 1970s, some Japanese set manufacturers developed decoding systems to avoid paying royalties to Telefunken. The Telefunken license covered any decoding method that relied on the alternating subcarrier phase to reduce phase errors. This included very basic PAL decoders that relied on the human eye to average out the odd/even line phase errors. One solution was to use a 1H delay line to allow decoding of only the odd or even lines. For example, the chrominance on odd lines would be switched directly through to the decoder and also be stored in the delay line. Then, on even lines, the stored odd line would be decoded again. This method effectively converted PAL to NTSC. Such systems suffered hue errors and other problems inherent in NTSC and required the addition of a manual hue control.

The PAL and NTSC have slightly divergent colour spaces, but the colour decoder differences here are ignored.

5.2.3 Systeme Electronique Pour Couleur Avec Memoire (SECAM)

The SECAM (Sequential Color Memory) is an analogue colour television system first used in France. A team led by Henri de France working at *Compagnie Française de télévision* (later bought by Thomson, now Technicolor) invented SECAM. It is, historically, the first European colour television standard.

Just as with the other colour standards adopted for broadcast usage over the world, SECAM is a standard which permits existing monochrome television receivers predating its introduction to continue to be operated as monochrome televisions. Because of this compatibility requirement, colour standards added a second signal to the basic monochrome signal, which carries the colour information. The colour information is called chrominance or C for short, while the black and white information is called the luminance or Y for short. Monochrome television receivers only display the luminance, while colour receivers process both signals.

However, PAL and SECAM are just standards for the colour sub carrier, used in conjunction with older standards for the base monochrome signals. The names for these monochrome standards are letters, such as M, B/G, D/K and L.

These signals are much more important to compatibility than the colour sub carriers are. They differ by AM or FM sound modulation, signal polarization, relative frequencies within the channel, bandwidth, etc. For example, a PAL D/K TV set will be able to receive a SECAM D/K signal (although in black and white), while it will not be able to decode the sound of a PAL B/G signal. So even before SECAM came to Eastern European countries, most viewers (other than those in East Germany and Yugoslavia) could not have received Western programs. This, along

Notes with language issues, meant that in most countries monochrome-only reception did not pose a significant problem for the authorities.

| SYSTEM | SECAM B,G,H | SECAM D,K,K1,L |
|----------------------|-------------|----------------|
| Line/Field | 625/50 | 625/50 |
| Horizontal Frequency | 15.625 kHz | 15.625 kHz |
| Vertical Frequency | 50 Hz | 50 Hz |
| Video Bandwidth | 5.0 MHz | 6.0 MHz |
| Sound Carrier | 5.5 MHz | 6.5 MHz |

PAL versus SECAM

The SECAM is an earlier attempt at compatible colour television which also tries to resolve the NTSC hue problem. It does so by applying a different method to colour transmission, namely alternate transmission of the U and V vectors and frequency modulation, while PAL attempts to improve on the NTSC method.

The SECAM transmissions are more robust over longer distances than NTSC or PAL. However, owing to their FM nature, the colour signal remains present, although at reduced amplitude, even in monochrome portions of the image, thus being subject to stronger cross colour. Like PAL, a SECAM receiver needs a delay line.

5.2.4 Advanced Television Systems Committee (ATSC)

The ATSC standards are a set of standards developed by the Advanced Television Systems Committee for DTV transmission over terrestrial, cable and satellite networks.

The ATSC standards were developed in the early 1990s by the Grand Alliance, a consortium of electronics and telecommunications companies that assembled to develop a specification for what is now known as HDTV. The ATSC formats also include standard-definition formats, although initially only HDTV services were launched in the digital format.

The high definition television standards defined by the ATSC produce wide screen 16 : 9 images up to 1920×1080 pixels in size – more than six times the display resolution of the earlier standard. However, many different image sizes are also supported. The reduced bandwidth requirements of lower-resolution images allow up to six standard-definition “subchannels” to be broadcast on a single 6 MHz TV channel.

The ATSC standards are marked A/x (x is the standard number) and can be downloaded freely from the ATSC’s website at ATSC.org. The ATSC Standard A/53, which implemented the system developed by the Grand Alliance, was published in 1995; the standard was adopted by the Federal Communications Commission in the US in 1996. It was revised in 2009. The ATSC Standard A/72 was approved in 2008 and introduces H.264/AVC video coding to the ATSC system.

The ATSC also boasts 5.1-channel surround sound using the Dolby Digital AC-3 format. Numerous auxiliary data casting services can also be provided.

Many aspects of ATSC are patented, including elements of the MPEG video coding, the AC-3 audio coding, and the 8VSB modulation. The cost of patent licensing, estimated at up to 50 US\$ per DTV receiver, has prompted complaints by manufacturers.

As with other systems, ATSC depends on numerous interwoven standards, e.g., the EIA-708 standard for digital closed captioning, leading to variations in implementation.

5.2.5 Digital Television (DTV)

The DTV is a reality in the US and many countries around the world. Actually FCC set May, 2006 as the deadline for all terrestrial TV broadcasting to be done 100% in digital format. Some countries

do not have DTV broadcasting yet but have already decided which standard to follow. Just like analogue TV has its "standards war" (NTSC, PAL, SECAM, etc.) so does have the DTV.

Notes

There are following three DTV transition standards in the world:

1. ATSC adopted by the USA, Canada, Mexico and South Korea;
2. ISDB-T adopted by Japan;
3. DVB-T (Digital Video Broadcast Terrestrial), adopted by the other countries that have already decided which DTV standard they will follow, like the countries located in Europe, Asia, Africa and Oceania.

All three DTV transmitting system uses the MPEG-2 algorithm to encode the image, the same algorithm used by DVD. The differences between them are the video format before the encoding, the video format after encoding and the way audio is encoded. The ATSC system uses a technique called 8-VSB while the other two systems use a technique called COFDM, which is less sensitive to noise.

Apparently the fact of ATSC being the standard most sensitive to noise, does not bother the US market, where few people still watch terrestrial TV (i.e., using antennas). Which makes us think if the ATSC standard was the best choice for Mexico. On the other hand, Mexico is a part of NAFTA (North American Free Trade Association), which makes the country one of the main product manufacturers and exporters to the US. Thus, we believe that the adoption of the same standard as the US was more commercial wise than technical.

Rise of Digital Compression

Since 1972, International Telecommunication Union's radio telecommunications sector (ITU-R) has been working on creating a global recommendation for analogue HDTV. These recommendations however did not fit in the broadcasting bands which could reach home users. The standardization of MPEG-1 in 1993 also led to the acceptance of recommendations ITU-R BT.709. In anticipation of these standards the Digital Video Broadcasting (DVB) organisation was formed, an alliance of broadcasters, consumer electronics manufacturers and regulatory bodies. The DVB develops and agrees on specifications which are formally standardised by ETSI.

The DVB created first the standard for DVB-S digital satellite TV, DVB-C digital cable TV and DVB-T digital terrestrial TV. These broadcasting systems can be used for both SDTV and HDTV. In the US, the Grand Alliance proposed ATSC as the new standard for SDTV and HDTV. Both ATSC and DVB were based on the MPEG-2 standard. The DVB-S2 standard is based on the newer and more efficient H.264/MPEG-4 AVC compression standards. Common for all DVB standards is the use of highly efficient modulation techniques for further reducing bandwidth, and foremost for reducing receiver-hardware and antenna requirements.

In 1983, the International Telecommunication Union's radio telecommunications sector (ITU-R) set up a working party (IWP11/6) with the aim of setting a single international HDTV standard. One of the thornier issues concerned a suitable frame/field refresh rate, the world already having split into two camps, 25/50 Hz and 30/60 Hz, related by reasons of picture stability to the frequency of their main electrical supplies.

The IWP11/6 working party considered many views and through the 1980s served to encourage development in a number of video digital processing areas, not least conversion between the two main frame/field rates using motion vectors, which led to further developments in other areas. While a comprehensive HDTV standard was not in the end established, agreement on the aspect ratio was achieved.

Initially the existing 5 : 3 aspect ratio had been the main candidate but, due to the influence of widescreen cinema, the aspect ratio 16:9 (1.78) eventually emerged as being a reasonable compromise between 5 : 3 (1.67) and the common 1.85 widescreen cinema format. (Bob Morris

Notes

explained that the 16 : 9 ratio was chosen as being the geometric mean of 4 : 3, Academy ratio, and 2.4 : 1, the widest cinema format in common use, in order to minimize wasted screen space when displaying content with a variety of aspect ratios.)

An aspect ratio of 16 : 9 was duly agreed at the first meeting of the IWP11/6 working party at the BBC's Research and Development establishment in Kingswood Warren. The resulting ITU-R Recommendation ITU-R BT.709-2 ("Rec. 709") includes the 16 : 9 aspect ratio, a specified colorimetry, and the scan modes 1080i (1,080 actively interlaced lines of resolution) and 1080p (1,080 progressively scanned lines). The British Freeview HD trials used MBAFF, which contains both progressive and interlaced content in the same encoding.

5.3 Analogue Video

The original video recording method that stores continuous waves of red, green and blue intensities. In analogue video, the number of rows is fixed. There are no real columns and the maximum detail is determined by the frequency response of the analogue system.

Analogue video may be carried in separate channels, as in two channel S-Video (YC) and multi-channel component video formats.

Analogue video is used in both consumer and professional television production applications. However, digital video signal formats with higher quality have been adopted, including serial digital interface (SDI), Firewire (IEEE1394), Digital Visual Interface (DVI) and High-definition Multimedia Interface (HDMI).

5.3.1 Analogue Video Formats

Composite video signals are analogue signals that combine luminance and chrominance (colour) information in a single analogue signal that can be transmitted over a single wire or stored in a single track on an analogue magnetic tape. The NTSC video signals used by commercial television sets in the US and Japan are an example of composite signals. Composite video is particularly prone to errors in reproducing exact colours due to the overlap of the colour and luminance signals. Video professionals jokingly refer to "Never The Same Colour" (NTSC).

The S-Video signals separate the luminance and chrominance information into two separate analogue signals that can be transmitted over two separate wires or stored in two separate tracks on an analogue tape. The S-Video is generally superior to composite video in reproducing colours correctly. The S-VHS and Hi8 video tape standards use S-Video. Ordinary VHS video tape uses composite NTSC signals. Thus, in general, using an S-VHS or Hi8 video camera with S-Video output to provide the analogue video signal to the S-Video input of a PC video capture card will provide better video quality.

A third type of video signal is component video. In component video, the luminance (Y) and two colour difference signals (U and V or I and Q) are separated into three separate analogue signals that can be transmitted over three separate wires or stored in three separate tracks on an analogue tape, or digitized separately. Component video is used in professional video production and provides the best quality and the most accurate reproduction of colours. The professional Betacam SP video cameras use component video. The current generation of widely used PC video capture cards do not provide component video inputs.

5.4 Digital Video

Digital video is audio/visual in a binary format. Information is presented as a sequence of digital data, rather than in a continuous signal as analogue information is.

Information in the natural world, received through the five senses, is analogue. That means it is infinitely variable. Digital A/V information, on the other hand, consists of discrete units of data that

are placed so close together that the human senses perceive them as a continuous flow. Analogue data, such as video recorded on tape, is transmitted as electronic signals of varying frequency or amplitude that are added to carrier waves of a given frequency. To make that information usable on a computer or a modern media player, analogue-to-digital conversion translates an analogue signal to a series of zeroes and ones, which represent, respectively, "negative" and "positive," "off" and "on," or "low" and "high." The opposite action, digital-to-analogue conversion, recreates the analogue signal for playback.

Notes

Digital video offers a number of advantages over analogue video, including:

1. Ease of sharing and storage.
2. No degradation of data quality when copied.
3. Easy and inexpensive copying.
4. The capacity for multicasting.

Digital video technology can also incorporate analytical software for intelligent video, which enables capabilities such as video search, object tracking and intrusion detection.

5.5 Digital Video Standards – ATSC, DVB, ISDB

5.5.1 Advanced Television Systems Committee (ATSC)

The ATSC coexists with the more widely used DVB standards, and ISDB being implemented in Japan. The system includes the capability to carry PAL- and SECAM-format video (576 displayable lines, 50 fields per second) along with NTSC (480 displayable lines, 60 fields per second) and film (24 frames per second). Broadcasters, who use ATSC and must retain an analogue signal, have to broadcast on two separate channels, as the ATSC system requires use of an entire 6 MHz channel. The system has been criticized as being complicated and expensive to implement and use. Many aspects of ATSC are patented, including the AC-3 audio coding, and the VSB modulation. The standards ATSC depends on are often ambiguous, one example would be the EIA-708 standard for closed captioning.

5.5.2 Digital Video Broadcasting (DVB)

Digital Video Broadcasting (DVB) is a suite of internationally accepted open standards for DTV. The DVB standards are maintained by the DVB Project, an international industry consortium with more than 270 members, and they are published by a Joint Technical Committee (JTC) of European Telecommunications Standards Institute (ETSI), European Committee for Electrotechnical Standardization (CENELEC) and European Broadcasting Union (EBU). The interaction of the DVB sub-standards is described in the DVB Cookbook. Many aspects of DVB are patented, including elements of the MPEG video coding and audio coding.

Services using DVB standards are available on every continent with more than 600 million DVB receivers deployed. The DVB worldwide section offers country-by-country news stories and an overview of where DVB technology has been deployed.

History

From the very earliest days of television, right up until the 1990s, all television broadcasts were made using analogue television and it had not been thought feasible to introduce a digital system due to the complexity of the processing required. However, with the advance of digital processing techniques and the advances made in integrated circuit technology, the possibility of using digital techniques for television broadcasting became a real possibility.

As a result, over the course of 1991, various organisations discussed how to move forwards with the idea and how to form a pan-European platform that would enable considerable economies of scale to be achieved.

Notes

The resulting organization was named the Electronics Launching Group (ELG), and it developed a memorandum of understanding that was signed in 1993. At the same time it renamed itself the DVB Project, and the development of the technologies and standards started to move forwards with a swifter pace.

The first of the DVB standards to be agreed was the DVB-S standard for satellite transmission which was agreed in 1994. With the standard agreed, services were commenced in early 1995 and the first operator was the pay TV operator Canal Plus in France.

The DVB system used for terrestrial transmissions, DVB-T was agreed later, in 1997. The first countries to deploy the system were Sweden, launching their system in 1998, and the UK launching their system a year later.

5.5.3 Integrated Services Digital Broadcasting (ISDB)

Integrated Services Digital Broadcasting (ISDB) is a Japanese standard for DTV and digital radio used by the country's radio and television stations. The ISDB replaced the previously used MUSE "Hi-vision" analogue HDTV system. A derivative of ISDB, ISDB-T International, was developed by the Brazilian government and is being widely adopted in South America.

The core standards of ISDB are ISDB-S (satellite television), ISDB-T (terrestrial), ISDB-C (cable) and 2.6 GHz band mobile broadcasting which are based on MPEG-2 video and audio coding as well as the transport stream described by the MPEG-2 standard, and are capable of high-definition television (HDTV). The ISDB-T and ISDB-Tsb are for mobile reception in TV bands. The 1seg is the name of an ISDB-T service for reception on cell phones, laptop computers and vehicles.

Japan started digital broadcasting using the DVB-S standard by PerfecTV in October 1996, and DirecTV in December 1997, with communication satellites. Still, DVB-S did not satisfy the requirements of Japanese broadcasters, such as NHK, key commercial broadcasting stations like Nippon Television, TBS, Fuji Television, TV Asahi, TV Tokyo and WOWOW (Movie-only Pay-TV broadcasting). Consequently, ARIB developed the ISDB-S standards. The requirements were HDTV capability, interactive services, network access and effective frequency utilization, and other technical requirements. The DVB-S standard allows the transmission of a bit stream of roughly 34 M bit/s with a satellite transponder, which means the transponder can send one HDTV channel. Unfortunately, the NHK broadcasting satellite had only four vacant transponders, which led ARIB and NHK to develop ISDB-S: The new standard could transmit at 51 M bit/s with a single transponder, which means that ISDB-S is 1.5 times more efficient than DVB-S and that one transponder can transmit two HDTV channels, along with other independent audio and data. Digital satellite broadcasting (BS digital) was started by NHK and followed commercial broadcasting stations on 1 December 2000. Today, SKY PerfecTV!, successor of Skyport TV, and Sky D, CS burn, Platone, EP, DirecTV, J Sky B, and PerfecTV!, adopted the ISDB-S system for use on the 110 degree (east longitude) wide-band communication satellite.

5.5.4 List of Countries used these Standards

DVB

Australia

Standard: DVB-T

Frequencies: UHF and VHF,

Compression: HD and SD in MPEG2

Channel bandwidth: 7 MHz

Carrier type: 8 k

Modulation: 64 QAM

| <i>India</i> | Notes |
|---|--------------|
| Standard: DVB-T | |
| Frequencies: (currently being tested) | |
| Compression: (currently being tested) | |
| Channel bandwidth: (currently being tested) | |
| Carrier type: (currently being tested) | |
| Modulation: (currently being tested) | |
| ATSC | |
| <i>Canada/North America</i> | |
| Standard: ATSC | |
| Compression: MPEG-2 | |
| Channel bandwidth: 6 MHz | |
| Modulation: 8 VSB, 256 QAM | |
| <i>Mexico</i> | |
| Standard: ATSC | |
| Compression: MPEG-2 | |
| Channel bandwidth: 6 MHz | |
| Modulation: 8 VSB, 256 QAM | |
| ISDB | |
| <i>Japan</i> | |
| Standard: ISDB-S, ISDB-T | |
| Frequencies: OFDM | |
| Compression: MPEG-2 (video) AAC (Audio) | |
| Channel bandwidth: 6 MHz | |
| Modulation: 64 QAM-OFDM, 16 QAM-OFDM, QPSK-OFDM, DQPSK-OFDM | |
| <i>Brazil</i> | |
| Standard: SBTVD-T (Brazilian version of ISDB) | |
| Frequencies: OFDM | |
| Compression: MPEG-4 AVC H.264 (video) HEAAC (Audio) | |
| Channel bandwidth: 6 MHz | |
| Modulation: 64 QAM-OFDM, 16 QAM-OFDM, QPSK-OFDM, DQPSK-OFDM | |

5.6 Video Recording and Shooting Videos

Video recording is the process of converting an analogue video signal—such as that produced by a video camera or DVD player to digital video.

- Notes**
- Although the concept of “live” may have exciting connotations, recording a production has many advantages.
1. The length of a program or segment can be shortened or lengthened during editing,
 2. Mistakes on the part of the talent or crew can be corrected, either by restarting the show, or to some degree during post-production,
 3. Program segments can be reorganized and rearranged for optimum pacing and dramatic effect,
 4. Program content can be embellished through the use of a wide array of editing and visual effect techniques,
 5. Production costs can be saved by scheduling production talent, crew and production facilities for optimum efficiency, and
 6. Once recorded, programs can be time-shifted or played back to meet the needs of time zones and the programming preferences of local station.

5.6.1 Videotape Recording Process

Although videotape has been phased out at most TV stations in favour of recoding on hard disks or solid-state devices, it is widely in archival storage.

Videotape resembles audiotape in its makeup. It consists of a strip of plastic backing coated with a permanent layer of microscopic metal particles embedded in a resin base. These particles are capable of holding a magnetic charge.

Video recording revolutionized TV production.

Two inch wide videotape (pictured at the left) was the first practical video recording medium and one that was used for several decades. Since it used four video heads to scan a complete video picture on 2 inch wide tape, this system was referred to as the 2 inch quad system.

At the other end of the size spectrum was the Hi8 camcorder (right) that used videotape that is only 8 mm wide.

To record very high frequencies associated with video, not only must the tape be moving, but also the heads, themselves, must spin over the surface of the tape otherwise you did not get high quality video.

5.6.2 Disk-based Recording

DVD

In 1997, the DVD was introduced. (The initials stand for both *digital versatile disk* and *digital videodisk*.)

Although DVDs resemble audio CDs, they are capable of holding much more information—up to 17 GB of data.

To achieve capacities up to this level some innovations were added to the standard audio CD approach.

First, it is possible to record at two disk surface levels on the same side of the disk. For even greater a storage capacity both sides of the disk can be used.

Red light lasers were originally used, but the recording-playback density of data advanced in the early 2000s with the introduction of lasers using a shorter wavelength blue light. Hence, the name, Blu-ray.

The chart below compares standard audio CDs with several versions of DVDs:

Notes

| Recording | Technique | Audio CD | DVD |
|------------------|-------------------------|----------|--------|
| Single-sided, | single-layer | 0.74 GB | 4.7 GB |
| Single-sided, | double-layer | — | 8.5 GB |
| Double-sided, | single-layer | — | 9.4 GB |
| Double-sided, | double-layer | — | 17 GB |
| HD-DVD, | single-layer (obsolete) | — | 15 GB |
| HD-DVD, | double-layer (obsolete) | — | 20 GB |
| HD single layer, | Blu-ray | — | 25 GB |
| HD double layer, | Blu-ray | — | 50 GB |

Recording technology has been demonstrated that raises the Blu-ray data capacity to 200 GB for a double-sided platter. In 2008, several decisions were made by the industry that meant HD-DVD format would be replaced by Blu-ray.

Data compression is used in almost all audio and video digital formats. Data compression is a little like freeze-dried instant coffee; elements are removed that can be later restored without appreciably affecting the final result.

In the same way that instant coffee is almost as good as the real thing, compressed video is almost as good as the original video signal.

Even though an engineer with a sharp eye (or ear) can tell the difference (just as coffee connoisseurs can tell the difference between instant and freshly brewed coffee), by “dehydrating” video and audio signals they take up much less digital space.

Since the spiral tracks on the DVD disk surface are microscopic in size, it means that DVD equipment requires a high level of mechanical precision.

The move from videotape to DVDs was also accelerated when DVDs became cheaper to manufacture than VHS tapes.

The DVDs also allow for random-access, while VHS tapes were totally linear in nature. This means that with a DVD you can almost instantly jump to any point in a recording. No lengthy fast-forward or rewind process is involved.

The high data capacity of DVDs also means that a production can include a number of “extras.” Depending on the length of the original production, these extra options may include out-takes, audio in multiple languages, and commentary from the stars or production personnel.

The narration from the director can be of particular value to people in production because it can add significant insight into music selection, production problems, acting issues and why particular scenes were deleted.

5.6.3 High-definition DVDs

In 2006 we began to see “home theatres” centered around 5.1 sound from HDTV videodisks (and even 7.1 sound, with an option for two more speakers).

With images that rival or exceed those in theatres, many people—at least those who can afford home theatres—now find little reason leave their homes to see a movie.

At the end of 2007, there were two major competing and incompatible standards for DVDs in the high-definition. There was the HD-DVD format led by Toshiba consortium and Blu-ray backed by a Sony-led consortium.

Notes

By early 2008, after several major motion picture studios backed away from HD-DVD, Toshiba conceded that Blu-ray had won the HD format competition. The public had also become aware of the picture quality advantage of Blu-ray.

5.6.4 Disk-based Camcorders

In 1995, two companies introduced the first disk-based camcorders, primarily designed for ENG work.

After going through a few generations of improvement, a disk-based camcorder was introduced in 2002 with a three hour capacity and the ability to simultaneously record on DVCAM videotape.

Once video and audio segments are recorded with the professional versions of disk-based camcorders, the segments can be played back almost instantly and in any order.

5.6.5 Solid State Memory

Any camcorders—amateur, prosumer and professional—now record on solid state-memory cards, sometimes called flash memory. The memory module shown in front of the credit card on the left can hold up to 90 minutes of consumer-grade video.

This approach provides faster camera-to-computer transfer speeds. Plus, since there are no moving parts in the camcorder, maintenance costs are reduced to a fraction of what they were with videotape or even videodisc.

Consumer-grade camcorders were the first to use solid-state recording or flash memory. In 2003, after quality and recording capacity had advanced sufficiently, this type of recording also moved to professional camcorders. As we noted earlier, there are currently many types of solid-state or flash memory.

Camera memory cards can be slipped into a computer and quickly accessed by an editing program. A common transfer approach for cameras with hard disks is with camera-to-computer cable—often a Firewire connection.



Task

Select any video and compress it using video converter software.

5.6.7 File Servers and File-based Systems

While, we are talking about digital recording approaches we might as well venture into the editing domain for a moment and talk about file servers (also called video servers and media servers).

Instead of videotape, file servers store audio and video information on high-capacity computer disks. Most broadcast and production facilities are now “tapeless,” meaning that file servers are used almost exclusively. These are referred to as file-based systems.

A file server can be thought of as a kind of high-capacity depository of audio and video segments that can be accessed from workstations (computer editing stations) throughout a production facility.

A production facility may have numerous workstations that all tie into a single, high-capacity server. The concept in newsrooms, where it is most used, is referred to as file-based architecture. In its structure, it is similar to a local area network (LAN) used in many institutions to tie desktop computers into the company’s main computer.

5.6.8 Guidelines for Shooting Quality Videos

Notes

1. Avoid zooming in and out too much

Many digital camcorders come with a super duper 1000X zoom in and out feature. This is a good thing, but the problem is, many people get carried away. Countless videos which keep zooming in and out during the shoot, they generally succeed in giving me a bad headache. Use the zoom in and out feature sparingly. Even if you must use it, do it slowly. A slow, well-controlled zoom is much more professional looking than a quick zoom. Another tip is to restrict the usage of the zoom in between scenes.

2. Steady does it?

The professionals always say "Keep it Steady". There is no doubt that when we are shooting videos, our hands tend to vibrate a little. If the vibration is too much, it will badly affect the quality of the video footage. There are two ways to overcome this.

One way is to do it like the professionals, get a good tripod stand. These can be obtained rather cheaply. Another way is to brace yourself against something like a wall, or perhaps stoop down on your knee while filming.

3. The end or the beginning?

Another good video shooting trick is to use the end of the story at the start of the video. Again, experts do this all the time. If you are filming a wedding video, you can start off with an interview of the happily married couple on the wedding day before you cut off into scenes of how they met, how they grew up, etc.

4. Keep them short and simple

Never, ever, shoot long, drawn out video clips of more than two minutes. It bores the audience to death! Using many short clips of 5–10 seconds duration is much more effective. It also brings variety to the audience. Imagine, if a television commercial lasted two minutes focusing on the same video scene, would not that be boring?

5. Lighting, lighting, lighting

Of all the factors listed here, nothing spoils a video shoot as much as poor lighting. Sure, you can use video editing software to brighten up the scenes, but they can only do so much.

Many innovative videos marred by poor lighting. One important tip is to shoot video with the light source behind you, shining on the subject. An example is an outdoor shot where the sun is shining. Make sure the sun shines on your subject and not on your camera lens! Another tip is to use the camera's backlight feature if there is one. It allows you to compensate for overly bright light.

6. Conserve the battery

We have seen or heard so many people forgetting about the battery. Please buy extra batteries preferably two extra batteries. Nothing is worse than shooting a video outdoors and having the battery die on you. Also, always bring the AC adapter too—so that you can charge your current battery whenever time permits.



The videotape recording process was first demonstrated in 1953, and the first machines went into service in 1956.

Self Assessment

Choose the correct answer:

1. Audio is recorded on a separate straight-line track at the top of the videotape.

(a) True
(b) False

Notes

5.7 Video Editing

Video editing is the process of manipulating and rearranging video shots to create a new work. Editing is usually considered to be one part of the post production process. Other post-production tasks include titling, colour correction, sound mixing, etc.

Many people use the term editing to describe all their post-production work, especially in non-professional situations. Whether or not you choose to be picky about terminology is up to you. We use the word editing to mean any of the following:

1. Rearranging, adding and/or removing sections of video clips and/or audio clips.
 2. Applying colour correction, filters and other enhancements.
 3. Creating transitions between clips.

5.7.1 Objectives of Video Editing

Notes

There are many reasons to edit a video and your editing approach will depend on the desired outcome. Before you begin you must clearly define your editing goals, which could include any of the following:

1. Remove unwanted footage

This is the simplest and most common task in editing. Many videos can be dramatically improved by simply getting rid of the flawed or unwanted bits.

2. Choose the best footage

It is common to shoot far more footage than you actually need and choose only the best material for the final edit. Often, you will shoot several versions (takes) of a shot and choose the best one when editing.

3. Create a flow

Most videos serve a purpose such as telling a story or providing information. Editing is a crucial step in making sure the video flows in a way which achieves this goal.

4. Add effects, graphics, music, etc

This is often the “wow” part of editing. You can improve most videos (and have a lot of fun) by adding extra elements.

5. Alter the style, pace or mood of the video

A good editor will be able to create subtle mood prompts in a video. Techniques such as mood music and visual effects can influence how the audience will react.

6. Give the video a particular “angle”

Video can be tailored to support a particular viewpoint, impart a message or serve an agenda.



Bringing plenty of flashlights and be aware of your perimeter, so that unwanted things are noticed before they appeared in the video.



Import a video clip in video editing software and write some message on it.

5.8 Optimizing Video Files for CD-ROM

The CD-ROMs provide an excellent distribution medium for computer-based video, because they are inexpensive to mass produce, and they can store great quantities of information. The CD-ROM players offer slow data transfer rates, but adequate video transfer can be achieved by taking care to properly prepare your digital video files. Without great care, these digital files may display poorly in low-bandwidth/high-compression environments:

1. Limit the amount of synchronization required between the video and audio. With Microsoft’s AVI file, the audio and video data are already interleaved, so this is not a necessity, but with QuickTime files, you should “flatten” your movie. Flattening means that you interleave the audio and video segments together.
2. Use regularly spaced key frames, 10–15 frames apart, and temporal compression can correct for seek time delays. Seek time is how long it takes the CD-ROM player to locate specific data on the CD-ROM disc. Even fast 56x drives must spin up, causing some delay (and occasionally substantial noise).

- Notes**
3. The size of the video window and the frame rate you specify dramatically affect performance. In QuickTime, 20 frames per second played in a 160×120 -pixel window is equivalent to playing 10 frames per second in a 320×240 window. The more data that has to be decompressed and transferred from the CD-ROM to the screen, the slower the playback.
 4. Although interleaving CD-quality audio into your video production will theoretically yield the highest-quality sound, the volume of data required may be too great to transfer from the CD-ROM in real-time. Try a lower sampling rate and sample size to reduce the quantity of audio data.
 5. The software compression algorithm you specify will make a dramatic difference in performance. The Sorenson algorithm or codec, available within both AVI and QuickTime, is optimized for CD-ROM playback. But take care: it can take many hours of computation to compress just a few minutes of digital video.
 6. Defragment your files before burning the master.
 7. If you are working with QuickTime, consider using a specialized application such as Media Cleaner Pro to automatically optimize your digital video file for playback from CD-ROM.

5.9 Digital Display Standards

Digital display standards are often a combination of aspect ratio, display resolution, color depth, and refresh rate.

5.9.1 Monochrome Display Adapter (MDA)

Introduced in 1981, MDA was a pure text display showing 80 character lines with 25 vertical lines on the screen. Typically, the display was green text on a black background. Individual characters were 9 pixels wide by 14 pixels high (7×11 for the character, the rest for spacing). If you multiply that out you get a resolution of 720×350 but since the individual pixels were not capable of being addressed there were no graphics.

5.9.2 Hercules Graphics Card

Noting the 720×350 resolution of the MDA display, a company called Hercules Computer Technology, in 1982, developed an MDA-compatible video card that could display MDA text as well as graphics by having routines to individually address each pixel in the display. Because the screen height had to be a multiple of four, the full resolution of the Hercules Graphics Card was 720×348 .

The Hercules card addressed two graphic pages, one at B0000h and the other at B8000h. When the second page was disabled, there was no conflict with other adapters and the Hercules card could run in a dual-monitor mode with CGA or other graphics cards on the same computer. Hercules even made a CGA-compatible card called the Hercules Color Card and later the Hercules Graphics Card Plus (June 1986) followed by the Hercules InColor Card (April 1987) which had capabilities similar to EGA cards.

5.9.3 Colour Graphics Adapter (CGA)

The CGA card came with 16 KB of video memory and supported several different modes:

1. Text mode which included 80×25 text (like the MDA system) in 16 colours. The resolution, however was lower as each character was made up of 8×8 pixels instead of the MDA's

- Notes**
- 9×14 pixels. A 40×25 text mode was also supported in 16 colours. In both, the foreground and background colours could be changed for each character.
2. Monochrome graphics mode which displayed graphics at 640×200 pixels. This was lower than the Hercules card but seemed to serve the purpose for an initial release and this was quickly replaced with the EGA standard.
 3. Colour graphics mode which came in two flavors: a 320×200 pixel mode with four colours and a lesser-used resolution of 160×200 in 16 colours. The four-colour mode only had two official palettes to choose from:
 1. Magenta, cyan, white and background colour (black by default).
 2. Red, green, brown/yellow and background colour (black by default).

5.9.4 Enhanced Graphics Adapter (EGA)

The Enhanced Graphics Adapter was introduced by IBM in 1984 as the primary display for the new PC-AT Intel 286-based computer. The EGA increased resolution to 640×350 pixels in 16 colors. The card itself contained 16 KB of ROM to extend the system BIOS to add graphics functions. The card started with 64 KB of video memory but later cards and clone cards came with 256KB of video memory to allow full implementation of all EGA modes which included:

1. High-resolution mode with 640×350 pixel resolution. On any given screen display a total of 16 colours could be displayed; however, these could be selected from a palette of 64 colors.
2. CGA mode included full 16-color versions of the CGA 640×200 and 320×200 graphics modes. The original CGA modes were present in the card but EGA is not 100% hardware-compatible with CGA.
3. MDA could be supported to some degree. By setting switches on the card an MDA monitor could be driven by an EGA card however only the 640×350 display could be supported.

5.9.5 Video Graphics Array (VGA)

With VGA you see a change in the terminology from adapter to array. This was a result of the fact that VGA graphics started to come on the motherboard as a single chip and not as plug-in adapter boards that took up an expansion slot in the computer. While since replaced with other standards for general use, VGA's 640×480 remains a sort of lowest common denominator for all graphics cards. Indeed, even the Windows splash screen logo comes in at 640×480 because it shows before the graphics drivers for higher resolution are loaded into the system.

The VGA supports both graphics and text modes of operation and can be used to emulate most (but not all) of the EGA, CGA and MDA modes of operation). The most common VGA graphics modes include:

1. 640×480 in 16 colours. This is a planar mode with four bit planes. When speaking about VGA, this is the mode most often thought of and is often what is meant when some say "VGA."
2. 640×350 in 16 colours.
3. 320×200 in 16 colours.
4. 320×200 in 256 colours (Mode 13h). This is a packed-pixel mode.

Notes**5.9.6 Super VGA (SVGA)**

Super VGA was first defined in 1989 by the Video Electronics Standards Association (VESA); an association dedicated to providing open standards instead of the closed standards from a single company (IBM). While initially defined as 800×600 with 16 colours, SVGA evolved to 1024×768 with 256 colours and even higher resolutions and colours as time went on.

As a result SVGA is more of an umbrella than a fixed standard. Indeed, most any graphics system released between the early 1990s and early 2000s (a decade!) has generally been called SVGA. And, it was up to the user to determine from the specifications if the graphics system supported their needs.

5.9.7 Extended Graphics Array (XGA)

The IBM's XGA was introduced in 1990 and is generally considered to be a 1024×768 pixel display. It would be wrong, however, to consider XGA a successor to SVGA as the two were initially released about the same time. Indeed, the SVGA "definition" has expanded as seen above and one might consider XGA to have been folded under the SVGA umbrella.

Initially, XGA was an enhancement to VGA and added two modes to VGA, such as:

1. 800×600 pixels at 16-bit pixel for 65,536 colours.
2. 1024×768 pixels at 8-bit pixel for 256 colours.



Jackson uses Online Video to Educate Financial Advisors on Investment Choices

While many financial services firms are just beginning to integrate multimedia into their communication strategy to improve audience engagement, some have fully embraced this medium and are already looking for ways to build upon years of success.

"We have been using multimedia to educate advisors and wholesalers on our products for years," said Luis Gomez, Vice President of Marketing Strategy at Jackson National Life Distributors, an industry leader in variable, fixed and fixed index annuities, also offering life insurance and institutional products. "If we relied solely on e-mail or mailings to deliver those messages it just would not be as effective. We are always looking for innovative ways to differentiate ourselves. Expanding the use of video was the next step in the evolution of our marketing program."

After discovering Flash-based presentations and video e-mail were more effective than text-based materials in educating advisors and wholesalers about complex products, Gomez sought to develop a library of online videos to provide an even richer experience. "We found that text-based communications led to a lot of confusion as they left room for interpretation and were not very dynamic. Video not only helps in simplifying products which are often complex, but it also communicates body language and tone so advisors and wholesalers can really understand how to deliver the message."

Online Video as the Centerpiece to Jackson's Investment Platform Lineup

The process of building the video library starts with Gomez asking fund partners to create video overviews for selecting variable annuity options. Once completed, the content is returned to Jackson's compliance group for review. After feedback is exchanged and the videos are

Contd...

approved, Thomson Reuters uploads the files into a completely customized on-demand video webcast player. Featuring both Jackson's and the fund's branding, the player includes links to other fund videos in the series as well as additional resources. Viewers can access the videos in high-resolution 800 k Windows Media or Flash streams twenty-four hours a day, seven days a week using any modern Web browser and operating system.

Notes*Measuring the Success of Online Video*

Gomez will consider both qualitative and quantitative metrics in gauging the success of the program. "The response we get from advisors and wholesalers is important and their feedback was one of the reasons we have expanded the use of video," said Gomez. "In addition, we will review the analytics Thomson Reuters provides for each of the webcasts—such as visits and viewing time—to help us monitor how well the content is resonating with our audiences."

Questions:

1. Explain the features of Adobe Flash.
2. What are the points kept in mind while sharing online video?

Self Assessment**Fill in the blanks:**

11. Video editing is the process of and rearranging video shots.
12. are a combination of aspect ratio, display resolution, colour depth and refresh rate.
13. The CGA card came with of video memory.
14. The Enhanced Graphic Adapter (EGA) was introduced by in 1984.
15. The IBMs XGA is generally considered to be a pixel display.

5.10 Summary

- Video is the technology of electronically capturing, recording, processing, storing, transmitting, and reconstructing a sequence of still images representing scenes in motion.
- The main standards for broadcast video standards are NTSC, PAL, SECAM, ATSC and DTV.
- Analogue videos have fixed number of rows.
- Digital Video Broadcasting is a suite of internationally accepted open standards for digital television.
- All videotape formats used video heads that travelled across the surface of the tape and left magnetic traces in the tape's coating.
- The CD-ROM players offer slow data transfer rates, but adequate video transfer can be achieved by taking care to properly prepare your digital video files.
- Digital display standards have evolved from early monochrome to today's high resolution colour.

5.11 Keywords

Advanced Television Systems Committee (ATSC) standards: They are a set of standards for digital television transmission over terrestrial, cable and satellite networks.

- Notes**
- Analogue video:** It is used in both consumer and professional television production applications.
- Enhanced Graphics Adapter (EGA):** It was introduced by IBM in 1984 as the primary display for the new PC-AT Intel 286-based computer.
- Integrated Services Digital Broadcasting (ISDB):** It is a Japanese standard for DTV and digital radio used by the country's radio and television stations.
- Phase Alternating Line (PAL):** It is an analogue television colour encoding system used in broadcast television systems in many countries.
- Video:** It is the technology that captures moving images electronically.
- Video editing:** It is the process of manipulating and rearranging video shots to create a new work.



Lab Exercise

1. Record a video clip using hypermedia tools.

2. Select any video file and compress using video compression tools.

5.12 Review Questions

1. Explain the National Television System Committee video standard.
2. What do you mean by phase alternating line standard?
3. Describe the features of Advanced Television Systems Committee standard.
4. Explain three digital television transition standards.
5. Differentiate between analogue video and digital video.
6. Describe Digital Video Standards.
7. What is the process of video taperecording?
8. What are the points we should kept in mind while shooting a video?
9. Explain the objectives of video editing.
10. Differentiate between PAL versus SECAM.
11. What do you mean by monochrome display adapter?
12. Distinguish between video graphics array and super video graphics array.

Answers to Self Assessment

- | | | | | |
|------------------|-------------------------------|-----------|--------|---------|
| 1. (a) | 2. (b) | 3. (c) | 4. (a) | 5. (b) |
| 6. (b) | 7. (c) | 8. (a) | 9. (a) | 10. (b) |
| 11. Manipulating | 12. Digital display standards | 13. 16 KB | | |
| 14. IBM | 15. 1024 × 768 | | | |

5.13 Further Reading



Books

Multimedia Video, by Gian Luca Foresti, Petri Mähönen, and Carlo S. Regazzoni.



Online link

[s&dq=Images&hl=en&ei=f__ETvrhMI7jrAfE0fTCCw&sa=X&oi=book_result&ct=result&resnum=2&ved=0CDkQ6AEwAQ](https://www.google.com/search?q=Images&hl=en&ei=f__ETvrhMI7jrAfE0fTCCw&sa=X&oi=book_result&ct=result&resnum=2&ved=0CDkQ6AEwAQ)

Unit 6: Hardware

Notes

CONTENTS

Objectives

Introduction

6.1 Macintosh versus Windows

6.2 Connections

6.2.1 Integrated Drive Electronics (IDEs)

6.2.2 Small Computer System Interface (SCSI)

6.2.3 Enhanced Integrated Drive Electronics (EIDEs)

6.2.4 Analogue Telephone Adapter (ATA)

6.2.5 Universal Serial Bus (USB)

6.2.6 FireWire

6.3 Storage Devices

6.3.1 Random Access Memory (RAM)

6.3.2 Read-only Memory (ROM)

6.3.3 Floppy and Hard Disks

6.3.4 Zip, Jaz, SyQuest and Optical Storage Devices

6.3.5 Digital Versatile Disc (DVD)

6.3.6 CD-ROM

6.3.7 CD-ROM Players

6.3.8 CD Recorders

6.3.9 Videodisc Players

6.4 Input Devices

6.4.1 Classification of Input Devices

6.5 Output Devices

6.5.1 Audio Devices

6.5.2 Amplifiers and Speakers

6.5.3 Monitors

6.5.4 Video Device

6.5.5 Projectors

6.5.6 Printers

6.6 Summary

6.7 Keywords

6.8 Review Questions

6.9 Further Reading

Notes

Objectives

After studying this unit, you will be able to:

- Understand Macintosh versus Windows
- Explain different types of connections
- Describe storage devices
- Understand different types of input devices
- Explain output devices

Introduction

To begin your quest with a multimedia project you must have a decent computer. A decent computer means you should have adequate hardware. Hardware interprets your commands into computer activity. As of now, if you are asked to develop a multimedia project, you would ask for a fast computer with lot of speed and storage.

There are many more things that you need to know like which component makes a computer fast, what is the device for storage, etc. The components are thus divided into five categories viz. system devices, memory and storage devices, input devices, output devices and communication devices.

6.1 Macintosh versus Windows

This controversy often sparks heated arguments to say the least. Moreover, there have also been instances of fights, vandalism and worse over which is the best. Windows users claim that Mac users are arrogant, citing that old “computer for the rest of us” advertising while Mac users claim the same about Windows users. Who really cares?

The truth of the matter is that both are about the same. All they are different graphical user interfaces (GUIs); slightly different ways of opening applications. Once the application is open, the only differences might be whether you use a single button mouse or a multi-button mouse, and even that difference vanishes with third party hardware.

First of all, we will look at some pros and cons for each, then we will dispel some myths perpetuated about both platforms. We will also see how this plays into which might be better suited for Web design.

Remember, also, that both Microsoft and Apple share a good deal of technology. Both Windows and MacOS use hundreds of patents shared between the two. Also remember that Microsoft makes a lot of software for the Mac including Microsoft Office which was created by a separate department for the Mac.

Typography: Mac’s support of typography is a result of years and year’s involvement with the pre-press industry. Type-styles rendered with a Mac just plain transfer better when submitted to a service bureau. You get what you saw.

Video Subsystem: Windows open architecture and Peripheral Component Interconnect (PCI) bus allows a wide non-saturated video subsystem. Video cards are made which exceed 6 Gigaflops of geometric rendering. Mac, though PCI, has a severely bottle-necked video subsystem so if you are into advanced 3D rendering, Windows is the clear winner here.

Postscript Support: Mac natively supports both postscript and PDF formats making them the clear winning here. Again, if you are into pre-press, Mac makes a lot of sense.

Raw Speed: Windows PCs have a serious edge here. Where time is money, processor speed can be very important. Regardless of how hard Mac advertising attempts to claim that the slower clock speed Macs are really just as fast as a PC. If you have the “need for speed” in gaming, software development, 3D rendering and other applications, Windows is the clear winner here.

Notes

Colour Matching: Apple is the only OS and hardware which supports Colorsync, the industry standard for “what you see is what you get” colour matching. If you want your advertising copy of an egg to come out of the press with the same yellow you saw on the screen, Mac is for you.

Web Design: Now this will be a hot one. In our opinion the clear choice here is Windows. We said this for two reasons:

- First, 95% of the people surfing the Web use Windows on PCs. If you want to be able to design in an atmosphere where you see pretty much what that 95% sees, then Windows just plain makes sense.
- Secondly, though many technologies are available for the Mac, Windows technology is not and much of the Web uses this technology. If you want to take advantage of .NET technology or ASP, it is just way easier to implement from a Windows platform.

Ease to Use: It given Mac the edge here, though the difference is pretty small with the release of Windows XP. Windows binary Plug-in-Play is no longer “Plug-n-Pray” and though technologically superior to Mac does not get the job done as nicely. By using nearly draconian measures and monopolistic threats, Apple has been able to maintain tight control over makers of third party hardware. What this means to you is an easier to use system, but with much less choice in add-ons.

Software Availability: Though many might argue that anything you might need is available for Mac, and though almost all generic task software is, industry specific software is not. For example, if you own say a lawn mower repair shop, you might want software written exclusively to run lawn mower repair shops. You just want to find it on the shelf or by mail order for the Mac, while you have several to choose from for Windows, maybe even for free or cheap as shareware downloads.

6.2 Connections

Establishing a connection between two multimedia devices is very easy now using a lot of connecting devices. There are many hardware devices which are generally used for making a connection between two or more devices such as cables. Here, we are discussing some interfaces and connecting devices.

6.2.1 Integrated Drive Electronics (IDEs)

Usually storage devices connect to the computer through an Integrated Drive Electronics (IDEs) interface. Essentially, an IDE interface is a standard way for a storage device to connect to a computer. The IDE is actually not the true technical name for the interface standard. The original name, AT Attachment (ATA), signified that the interface was initially developed for the IBM AT computer.

The IDE was created as a way to standardize the use of hard drives in computers. The basic concept behind IDE is that the hard drive and the controller should be combined. The controller is a small circuit board with chips that provide guidance as to exactly how the hard drive stores and accesses data. Most controllers also include some memory that acts as a buffer to enhance hard drive performance. Before IDE, controllers and hard drives were separate and often proprietary. In other words, a controller from one manufacturer might not work with a hard drive from another manufacturer. The distance between the controller and the hard drive could result in poor signal quality and affect performance. Obviously, this caused much frustration for computer users.

Notes

The IDE devices use a ribbon cable to connect to each other. Ribbon cables have all of the wires laid flat next to each other instead of bunched or wrapped together in a bundle. The IDE ribbon cables have either 40 or 80 wires. There is a connector at each end of the cable and another one about two-thirds of the distance from the motherboard connector. This cable cannot exceed 18 inches (46 cm) in total length (12 inches from first to second connector, and 6 inches from second to third) to maintain signal integrity. The three connectors are typically different colours and attach to specific items:

- The blue connector attaches to the motherboard.
- The black connector attaches to the primary (master) drive.
- The grey connector attaches to the secondary (slave) drive.

Enhanced IDE (EIDE) – an extension to the original ATA standard again developed by Western Digital – allowed the support of drives having a storage capacity larger than 504 MiBs (528 MB), up to 7.8 GiBs (8.4 GB). Although these new names originated in branding convention and not as an official standard, the terms IDE and EIDE often appear as if interchangeable with ATA. This may be attributed to the two technologies being introduced with the same consumable devices – these “new” ATA hard drives. With the introduction of Serial ATA around 2003, conventional ATA was retroactively renamed to Parallel ATA (P-ATA), referring to the method in which data travels over wires in this interface.

6.2.2 Small Computer System Interface (SCSI)

The Small Computer System Interface (SCSI) is a set of ANSI standard electronic interfaces that allow personal computers to communicate with peripheral hardware such as disk drives, tape drives, CD-ROM drives, printers, and scanners faster and more flexibly than previous interfaces. Developed at Apple Computer and still used in the Macintosh, the present set of SCISIs are parallel interfaces. The SCSI ports continue to be built into many personal computers today and are supported by all major operating systems.

In addition to faster data rates, SCSI is more flexible than earlier parallel data transfer interfaces. The latest SCSI standard, Ultra-2 SCSI for a 16-bit bus can transfer data at up to 80 megabytes per second (mbps). The SCSI allows up to 7 or 15 devices (depending on the bus width) to be connected to a single SCSI port in daisy-chain fashion. This allows one circuit board or card to accommodate all the peripherals, rather than having a separate card for each device, making it an ideal interface for use with portable and notebook computers. A single host adapter, in the form of a PC Card, can serve as a SCSI interface for a laptop, freeing up the parallel and serial ports for use with an external modem and printer while allowing other devices to be used in addition.

Although not all devices support all levels of SCSI, the evolving SCSI standards are generally backwards-compatible. That is, if you attach an older device to a newer computer with support for a later standard, the older device will work at the older and slower data rate.

The original SCSI, now known as SCSI-1, evolved into SCSI-2, known as “plain SCSI” as it became widely supported. The SCSI-3 consists of a set of primary commands and additional specialized command sets to meet the needs of specific device types. The collection of SCSI-3 command sets is used not only for the SCSI-3 parallel interface but for additional parallel and serial protocols, including Fibre Channel, Serial Bus Protocol (used with the IEEE 1394 Firewire physical protocol), and the Serial Storage Protocol (SSP).

A widely implemented SCSI standard is Ultra-2 (sometimes spelled “Ultra2”) which uses a 40 MHz clock rate to get maximum data transfer rates up to 80 Mbps. It provides a longer possible cabling distance (up to 12 metres) by using low voltage differential (LVD) signalling. Earlier forms of SCISIs

use a single wire that ends in a terminator with a ground. Ultra-2 SCSI sends the signal over two wires with the data represented as the difference in voltage between the two wires. This allows support for longer cables. A LVD reduces power requirements and manufacturing costs.

Notes

The latest SCSI standard is Ultra-3 (sometimes spelled "Ultra3") which increases the maximum burst rate from 80 Mbps to 160 Mbps by being able to operate at the full clock rate rather than the half-clock rate of Ultra-2. The standard is also sometimes referred to as Ultra160/m. New disk drives supporting Ultra160/m will offer much faster data transfer rates. Ultra160/m also includes cyclical redundancy checking (CRC) for ensuring the integrity of transferred data and domain validation for testing the SCSI network.

Currently existing SCSI standards are summarized in the Table 6.1.

Table 6.1 The SCSI Standards

| Technology Name | Maximum Cable Length (metres) | Maximum Speed (Mbps) | Maximum Number of Devices |
|---------------------------|-------------------------------|----------------------|---------------------------|
| SCSI-1 | 6 | 5 | 8 |
| SCSI-2 | 6 | 5-10 | 8 or 16 |
| Fast SCSI-2 | 3 | 10-20 | 8 |
| Wide SCSI-2 | 3 | 20 | 16 |
| Fast Wide SCSI-2 | 3 | 20 | 16 |
| Ultra SCSI-3, 8-bit | 1.5 | 20 | 8 |
| Ultra SCSI-3, 16-bit | 1.5 | 40 | 16 |
| Ultra-2 SCSI | 12 | 40 | 8 |
| Wide Ultra-2 SCSI | 12 | 80 | 16 |
| Ultra-3 (Ultra160/m) SCSI | 12 | 160 | 16 |

6.2.3 Enhanced Integrated Drive Electronics (EIDEs)

Enhanced (sometimes "Expanded") IDE is a standard electronic interface between your computer and its mass storage drives. The EIDE's enhancements to IDE make it possible to address a hard disk larger than 528 Mbytes. The EIDE also provides faster access to the hard drive, support for direct memory access (DMA), and support for additional drives, including CD-ROM and tape devices through the AT Attachment Packet Interface.

When updating your computer with a larger hard drive (or other drives), an EIDE "controller" can be added to your computer in one of its card slot.

To access larger than 528 M byte drives, EIDE (or the basic input/output system that comes with it) uses a 28-bit Logical Block Address (LBA) to specify the actual cylinder, head, and sector location of data on the disk. The 28 bits of the LBA provide enough information to specify unique sectors for a device up to 8.4 GB in size.

The IDE interface cable has two plugs and can be attached to two devices. The first device acts as the master, and the second device acts as a slave. This interface is busy if either device is processing a request, so activity on one device blocks access to the other. It will generally be necessary when adding a new disk to a system to set a switch or connector on the disk to indicate if it is to function as master or slave.

When they designed the EIDE standard, they needed compatibility with all the existing IDE devices. So they did not change the rules on the cable. The EIDE interface chip can support four devices, but it has two interface cables each connecting two devices. The EIDE chip looks and acts like two IDE chips. An old IDE disk can be connected to a new EIDE connector.

Notes

However, a new large EIDE disk cannot always be connected to an old PC. The original IBM programming interface limited the disk space to 528 megabytes (not a big problem when hard disks had 10 or 20 megs). However, an old IDE disk interface chip may not support data beyond the first 528 megs. You may need to load a new operating system (Windows 95, OS/2 or Windows NT) and the partitions containing the operating system files may have to reside completely within the first 528 megs of the disk.

Computers built in the last year should come with EIDE. The extensions overcome limits in the original IDE design:

- The IDE supports only disks. The EIDE supports a mixture of disks, tapes and CD-ROM drives.
- The IDE supports only two devices. The EIDE supports up to four devices on the same controller chip although it uses two cables.
- The EIDE allows disks up to 1 gigabyte. Larger disks may also work, but that is up to the vendor. The IBM, for example, does not officially support EIDE disks larger than one gig.

Since EIDE simulated two separate IDE interface chips, there is an optimization that many customers do not fully appreciate. Newer operating systems (OS/2, Windows NT and even Windows 95 to some extent) permit more than one I/O request to be running at a time. When a program wants to read something from a disk, the request is given to the disk interface and another program is allowed to run while the first program waits for data. However, the IDE interface allows only one of the two disks connected to the same cable to be active at a time, and any request to use the second disk will be blocked while data is being read from the first disk. An EIDE interface duplicates this IDE restriction, but since the EIDE chip looks like two IDE devices, a request can be made through the second interface while the first interface is busy.

If you run plain old DOS and Windows 3.x, it does not matter. Those systems will wait for any operation to complete before running any other program. However, if you are running a new system, and if you purchase a second IDE hard disk, then there is a performance advantage to putting the second drive on the second interface cable (managed by the second simulated IDE "device") rather than connecting it to the same flat disk interface to which the first disk is connected. On separate cables, the two disks can be active at the same time.

However, if you have two hard disks and an EIDE CD-ROM, then it is best to put the two disks on the same cable and isolate the CD-ROM on the second cable. A CD-ROM is much slower than a hard disk, and it will be busy longer. If it is on the same cable with a hard disk, it will block access to that disk when any request is made. Unless it is used very infrequently, the best performance will probably be provided by isolating the slow CD-ROM on its own cable.



The EIDE was adopted as a standard by ANSI in 1994 and also called as Advanced Technology Attachment-2.

6.2.4 Analogue Telephone Adapter (ATA)

An analogue telephony adapter, or analogue telephone adapter (ATA) is a device used to connect one or more standard analogue telephones to a digital telephone system (such as voice over IP) or a non-standard telephone system.

An ATA usually takes the form of a small box with a power adapter, one Ethernet port, one or more FXS telephone ports and may also have a FXO link. Users can plug one or more standard analogue telephone devices into the ATA and the analogue device(s) will operate, usually transparently, on a VoIP network.

The most common ATA is a box with at least one Foreign Exchange Station (which includes a telephone jack), used to connect a conventional telephone, and an Ethernet jack used to connect

the adapter to a LAN. Using such an ATA, it is possible to connect a conventional telephone to a remote VoIP server. The ATA communicates with the server using a protocol such as H.323, SIP, MGCP, SCCP or IAX, and encodes and decodes the voice signal using a voice codec such as G.711, G.729, GSM, iLBC or others. Since the ATA communicates directly with the VoIP server, it does not require a personal computer or any software such as a softphone. It uses approximately 3 to 5 watts of electricity, depending on model and brand.

Notes**Purpose**

An ATA is connected between an IP network (such as a broadband connection) and an existing telephone jack in order to provide service nearly indistinguishable from PSTN providers on all the other telephone jacks in the residence. The ATAs are used by many VoIP companies selling a telco-alternative VoIP service, where the device is used to replace a user's connection to a traditional telephone company. When sold in connection with a VoIP service, the ATA is often locked so it cannot be used with a competing service, and the user can only partly change its configuration. Some providers do sell devices that are not locked and can be used with any compatible provider. This type of service, which is fixed to one location, is generally offered by broadband Internet providers such as cable companies and telephone companies as a cheaper flat-rate traditional phone service.

6.2.5 Universal Serial Bus (USB)

The Universal Serial Bus (USB) is a standard for a wired connection between two electronic devices, including a mobile phone and a desktop computer. The connection is made by a cable that has a connector at either end. One end, the one that plugs into the computer, is the same across all USB cables while the one that plugs into the mobile device can be of various types such as miniUSB, microUSB or a proprietary connector.

The USB version 1.1 provides maximum speeds of up to 1.5 MB/s while the current version 2.0 is about 40 times faster. The versions are backwards compatible and the speed is limited by the slower device. Transferring data may require drivers to be installed on the desktop computer but some phones offer "mass storage" mode which means they appear as thumb drives to the computer and no special drivers are needed.

The USB is an industry standard developed in the mid-1990s that defines the cables, connectors and protocols used for connection, communication and power supply between computers and electronic devices.

The USB was designed to standardize the connection of computer peripherals, such as keyboards, pointing devices, digital cameras, printers, portable media players, disk drives and network adapters to personal computers, both to communicate and to supply electric power. It has become commonplace on other devices, such as smart phones, PDAs and video game consoles. The USB has effectively replaced a variety of earlier interfaces, such as serial and parallel ports, as well as separate power chargers for portable devices.

Upto 2008, about 2 billion USB devices were sold each year, and approximately 6 billion devices were sold in total.

In addition to their data transferring application, USB cables also carry an electric charge that can be used to power peripherals (such as USB mice or keyboards), and many mobile phones can be charged through their USB port.

USB 1.0

- *USB 1.0:* Released in January 1996.
- Specified data rates of 1.5 Mbit/s (Low-Bandwidth) and 12 Mbit/s (Full-Bandwidth). Does not allow for extension cables or pass-through monitors (due to timing and power limitations). Few such devices actually made it to market.

Notes

USB 1.1

- *USB 1.1*: Released in August 1998. Fixed problems identified in 1.0, mostly relating to hubs. Earliest revision to be widely adopted.

USB 2.0

The Hi-Speed USB Logo

- *USB 2.0*: Released in April 2000.

Added higher maximum bandwidth of 480 Mbit/s (60 MB/s) (now called “*Hi-Speed*”). Further modifications to the USB specification have been done via Engineering Change Notices (ECN). The most important of these ECNs are included into the USB 2.0 specification package available from USB.org:

- *Mini-A and Mini-B Connector ECN*: Released in October 2000.

Specifications for Mini-A and B plug and receptacle. Also receptacle that accepts both plugs for On-the-Go. These should not be confused with Micro-B plug and receptacle.

- *Errata as of December 2000*: Released in December 2000.

- *Pull-up/Pull-down Resistors ECN*: Released in May 2002.

- *Errata as of May 2002*: Released in May 2002.

- *Interface Associations ECN*: Released in May 2003.

New standard descriptor was added that allows multiple interfaces to be associated with a single device function.

- *Rounded Chamfer ECN*: Released in October 2003.

A recommended, compatible change to Mini-B plugs those results in long lasting connectors.

- *Unicode ECN*: Released in February 2005.

This ECN specifies that strings are encoded using UTF-16LE. The USB 2.0 did specify that Unicode is to be used but it did not specify the encoding.

- *Inter-Chip USB Supplement*: Released in March 2006.

- *On-the-Go Supplement 1.3*: Released in December 2006.

USB On-the-Go makes it possible for two USB devices to communicate with each other without requiring a separate USB host. In practice, one of the USB devices acts as a host for the other device.

- *Battery Charging Specification 1.1*: Released in March 2007 (Updated 15 April 2009).

Adds support for dedicated chargers (power supplies with USB connectors), host chargers (USB hosts that can act as chargers) and the No Dead Battery provision which allows devices to temporarily draw 100 mA current after they have been attached. If a USB device is connected to dedicated charger, maximum current drawn by the device may be as high as 1.8 A. (Note that this document is not distributed with USB 2.0 specification package only USB 3.0 and USB On-the-Go.)

- *Micro-USB Cables and Connectors Specification 1.01*: Released in April 2007.

- *Link Power Management Addendum ECN*: Released in July 2007.

This adds a new power state between enabled and suspended states. Device in this state is not required to reduce its power consumption. However, switching between enabled and

sleep states is much faster than switching between enabled and suspended states, which allows devices to sleep while idle.

Notes

USB 3.0

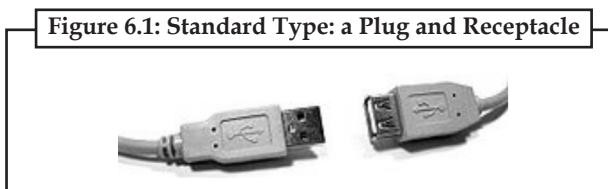
The SuperSpeed USB Logo

- *USB 3.0:* Released in November 2008.

Specified with a maximum transmission speed of up to 5 Gbit/s (640 MB/s), which is over 10 times faster than USB2.0 (480 Mbit/s), although this speed is typically only achieved using powerful professional grade or developmental equipment. The USB 3.0 reduces the time required for data transmission, reduces power consumption, and is backward compatible with USB 2.0. The USB 3.0 Promoter Group announced on 17 November 2008 that the specification of version 3.0 had been completed and had made the transition to the USB Implementers Forum (USB-IF), the managing body of USB specifications. This move effectively opened the specification to hardware developers for implementation in future products. A new feature is the “SuperSpeed” bus, which provides a fourth transfer mode at 5.0 Gbit/s. The raw throughput is 4 Gbit/s (using 8b/10b encoding), and the specification considers it reasonable to achieve around 3.2 Gbit/s (0.4 GB/s or 400 MB/s), increasing as hardware advances in the future take hold.

Connector Properties

The connectors specified by the USB committee were designed to support a number of USB's underlying goals, and to reflect lessons learned from the menagerie of connectors which have been used in the computer industry. The connector mounted on the host or device is called the receptacle, and the connector attached to the cable is called the plug. In the case of an extension cable, the connector on one end is a receptacle. The official USB specification documents periodically define the term male to represent the plug, and female to represent the receptacle (see Figure 6.1).



Durability

The standard connectors were designed to be robust. Many previous connector designs were fragile, specifying embedded component pins or other delicate parts which proved vulnerable to bending or breakage, even with the application of modest force. The electrical contacts in a USB connector are protected by an adjacent plastic tongue, and the entire connecting assembly is usually protected by an enclosing metal sheath.

Compatibility

The USB standard specifies relatively loose tolerances for compliant USB connectors to minimize physical incompatibilities in connectors from different vendors. To address a weakness present in some other connector standards, the USB specification also defines limits to the size of a connecting device in the area around its plug. This was done to prevent a device from blocking adjacent ports due to the size of the cable strain relief mechanism (usually moulding integral with the cable outer insulation) at the connector. Two-way communication is also possible. In USB 3.0, full-duplex communications are done when using SuperSpeed (USB 3.0) transfer. In previous USB versions (*i.e.*, 1.× or 2.0), all communication is half-duplex and directionally controlled by the host.

Notes



Task

Create a connection between two multimedia devices and exchange some data using data cable.

6.2.6 FireWire

FireWire is Apple Computer's version of a standard, IEEE 1394, High Performance Serial Bus, for connecting devices to your personal computer. FireWire provides a single plug-and-socket connection on which up to 63 devices can be attached with data transfer speeds up to 400 Mbps (megabits per second). The standard describes a serial bus or pathway between one or more peripheral devices and your computer's microprocessor. Many peripheral devices now come equipped to meet IEEE 1394. FireWire and other IEEE 1394 implementations provide:

- A simple common plug-in serial connector on the back of your computer and on many different types of peripheral devices.
- A thin serial cable rather than the thicker parallel cable you now use to your printer.
- A very high-speed rate of data transfer that will accommodate multimedia applications (100 and 200 megabits per second today; with much higher rates later).
- Hot-plug and plug and play capability without disrupting your computer.
- The ability to chain devices together in a number of different ways without terminators or complicated set-up requirements.

In time, IEEE 1394 implementations are expected to replace and consolidate today's serial and parallel interfaces, including Centronicsparallel, RS-232C and SCSI. The first products to be introduced with FireWire include digital cameras, digital video disks (DVDs), digital video tapes, digital camcorders, and music systems. Since IEEE 1394 is a peer-to-peer interface, one camcorder can dub to another without being plugged into a computer. With a computer equipped with the socket and bus capability, any device (e.g., a video camera) can be plugged in while the computer is running.

How it works?

There are two levels of interface in IEEE 1394, one for the backplane bus within the computer and another for the point-to-point interface between device and computer on the serial cable. A simple bridge connects the two environments. The backplane bus supports 12.5, 25 or 50 megabits per second data transfer. The cable interface supports 100, 200 or 400 megabits per second. Each of these interfaces can handle any of the possible data rates and change from one to another as needed.

The serial bus functions as though devices were in slots within the computer sharing a common memory space. A 64-bit device address allows a great deal of flexibility in configuring devices in chains and trees from a single socket.

The IEEE 1394 provides two types of data transfer: asynchronous and isochronous. Asynchronous is for traditional load-and-store applications where data transfer can be initiated and an application interrupted as a given length of data arrives in a buffer. Isochronous data transfer ensures that data flows at a pre-set rate so that an application can handle it in a timed way. For multimedia applications, this kind of data transfer reduces the need for buffering and helps ensure a continuous presentation for the viewer.

The 1394 standard requires that a device be within 4.5 metres of the bus socket. Up to 16 devices can be connected in a single chain, each with the 4.5 metre maximum (before signal attenuation begins to occur) so theoretically you could have a device as far away as 72 metres from the computer.

Another new approach to connecting devices, the USB, provides the same “hot plug” capability as the 1394 standard. It is a less expensive technology but data transfer is limited to 12 Mbps (million bits per second). The SCSI offers a high data transfer rate (up to 40 megabytes per second) but requires address pre-assignment and a device terminator on the last device in a chain. FireWire can work with the latest internal computer bus standard, Peripheral Component Interconnect (PCI), but higher data transfer rates may require special design considerations to minimize undesired buffering for transfer rate mismatches.

Notes

Task

Collect the information about the USB devices available in the market and also know that which version of USB is providing quicker speed.

Self Assessment

Choose the correct answer:

1. Video cards are made which exceed Gigaflops of geometric rendering.

| | |
|-------|-------|
| (a) 5 | (b) 6 |
| (c) 7 | (d) 8 |
2. The devices use a ribbon cable to connect to each other.

| | |
|----------|-------------------|
| (a) IDE | (b) ATA |
| (c) EIDE | (d) None of these |
3. The latest SCSI standard is Ultra-3.

| | |
|----------|-----------|
| (a) True | (b) False |
|----------|-----------|

6.3 Storage Devices

A data storage device is a device for recording (storing) information (data). Recording can be done using virtually any form of energy. A storage device may hold information, process information, or both. A device that only holds information is a recording medium. Devices that process information (data storage equipment) may both access a separate portable (removable) recording medium or a permanent component to store and retrieve information.

Electronic data storage is storage which requires electrical power to store and retrieve that data. Most storage devices that do not require visual optics to read data fall into this category. Electronic data may be stored in either an analogue or digital signal format. This type of data is considered to be electronically encoded data, whether or not it is electronically stored. Most electronic data storage media (including some forms of computer storage) are considered permanent (non-volatile) storage, that is, the data will remain stored when power is removed from the device. In contrast, electronically stored information is considered volatile memory.

By adding more memory and storage space to the computer, the computing needs and habits to keep pace, is filling the new capacity.

To estimate the memory requirements of a multimedia project—the space required on a floppy disk, hard disk or CD-ROM, not the random access sense of the project’s content and scope. Colour images, Sound bites, video clips and the programming code that glues it all together require memory; if there are many of these elements, you will need even more. If you are making multimedia, you will also need to allocate memory for storing and archiving working files used during production, original audio and video clips, edited pieces, and final mixed pieces, production paperwork and correspondence, and at least one backup of your project files, with a second backup stored at another location.

Notes

6.3.1 Random Access Memory (RAM)

The RAM is the main memory where the operating system is initially loaded and the application programs are loaded at a later stage. The RAM is volatile in nature and every program that is quit/exit is removed from the RAM. More the RAM capacity, higher will be the processing speed.

If there is a budget constraint, then it is certain to produce a multimedia project on a slower or limited-memory computer. On the other hand, it is profoundly frustrating to face memory (RAM) shortages time after time, when you are attempting to keep multiple applications and files open simultaneously. It is also frustrating to wait the extra seconds required to each editing step when working with multimedia material on a slow processor.

On the Macintosh, the minimum RAM configuration for serious multimedia production is about 32 MB; but even 64 MB and 256 MB systems are becoming common, because while digitizing audio or video, you can store more data much quickly in RAM. And when you are using some software, you can quickly chew up available RAM—for example, Photoshop (16 MB minimum, 20 MB recommended); After Effects (32 MB required), Director (8 MB minimum, 20 MB better); Page maker (24 MB recommended); Illustrator (16 MB recommended); Microsoft Office (12 MB recommended).

In spite of all the marketing hype about processor speed, this speed is ineffective if not accompanied by sufficient RAM. A fast processor without enough RAM may waste processor cycles while it swaps needed portions of program code into and out of memory.

In some cases, increasing available RAM may show more performance improvement on your system than upgrading the processor chip. On an MPC platform, multimedia authoring can also consume a great deal of memory. It may be needed to open many large graphics and audio files, as well as your authoring system, all at the same time to facilitate faster copying/pasting and then testing in your authoring software. Although 8 MB is the minimum under the MPC standard, much more is required as of now.

6.3.2 Read-only Memory (ROM)

Read-only memory is not volatile. Unlike RAM, when you turn off the power to a ROM chip, it will not forget, or lose its memory. The ROM is typically used in computers to hold the small BIOS program that initially boots up the computer, and it is used in printers to hold built-in fonts. Programmable ROMs (called PROM's) allow changes to be made that are not forgotten. A new and inexpensive technology, optical read-only memory (OROM), is provided in proprietary data cards using patented holographic storage. Typically, OROMs offer 128 MB of storage, have no moving parts, and use only about 200 milliwatts of power, making them ideal for handheld, battery-operated devices.

6.3.3 Floppy and Hard Disks

Adequate storage space for the production environment can be provided by large capacity hard disks; a server-mounted disk on a network; Zip, Jaz or SyQuest removable cartridges; optical media; CD-R (compact disc-recordable) discs; tape; floppy disks; banks of special memory devices or any combination of the above.

Removable media (floppy disks, compact or optical discs and cartridges) typically fit into a letter-sized mailer for overnight courier service. One or many disks may be required for storage and archiving each project, and it is necessary to plan for backups kept off-site.

Floppy disks and hard disks are mass-storage devices for binary data that can be easily read by a computer. Hard disks can contain much more information than floppy disks and can operate at far greater data transfer rates. In the scale of things, floppies are, however, no longer "mass-storage" devices.

A floppy disk is made of flexible Mylar plastic coated with a very thin layer of special magnetic material. A hard disk is actually a stack of hard metal platters coated with magnetically sensitive material, with a series of recording heads or sensors that however a hairbreadth above the fast-spinning surface, magnetizing or demagnetizing spots along formatted tracks using technology similar to that used by floppy disks and audio and video tape recording. Hard disks are the most common mass-storage device used on computers, and for making multimedia, it is necessary to have one or more large-capacity hard disk drives.

Notes

As multimedia has reached consumer desktops, makers of hard disks have been challenged to build smaller profile, larger-capacity, faster, and less-expensive hard disks.

In 1994, hard disk manufacturers sold nearly 70 million units; in 1995, more than 80 million units. And prices have dropped a full order of magnitude in a matter of months. As network and Internet servers increase the demand for centralized data storage requiring terabytes (1 trillion bytes), hard disks will be configured into fail-proof redundant array offering built-in protection against crashes.

6.3.4 Zip, Jaz, SyQuest and Optical Storage Devices

SyQuest's 44 MB removable cartridges have been the most widely used portable medium among multimedia developers and professionals, but Iomega's inexpensive Zip drives with their likewise inexpensive 100 MB cartridges have significantly penetrated SyQuest's market share for removable media. Iomega's Jaz cartridges provide a gigabyte of removable storage media and have fast enough transfer rates for audio and video development. Pinnacle Micro, Yamaha, Sony, Philips and others offer CD-R "burners" for making write-once CDs, and some double as quad-speed players. As blank CD-R discs become available for less than a dollar each, this write-once media competes as a distribution vehicle.

Magneto-optical (MO) drives use a high-power laser to heat tiny spots on the metal oxide coating of the disk. While the spot is hot, a magnet aligns the oxides to provide a 0 or 1 (on or off) orientation. Like SyQuests and other Winchester hard disks, this is rewritable technology, because the spots can be repeatedly heated and aligned. Moreover, this media is normally not affected by stray magnetism (it needs both heat and magnetism to make changes), so these disks are particularly suitable for archiving data.

The data transfer rate is, however, slow compared to Zip, Jaz and SyQuest technologies.

One of the most popular formats uses a 128 MB-capacity disk-about the size of a 3.5 inch floppy. Larger-format MO drives with 5.25 inch cartridges offering 650 MB to 1.3 GB of storage are also available.

6.3.5 Digital Versatile Disc (DVD)

With this (DVD) new medium capable not only of gigabyte storage capacity but also full motion video (MPEG2) and high-quality audio in surround sound, the bar has again risen for multimedia developers. Commercial multimedia projects will become more expensive to produce as consumer's performance expectations rise. There are two types of DVD: DVD—Video and DVD—ROM. These reflect marketing channels, not the technology.

The DVD can provide 720 pixels per horizontal line whereas current television (NTSC) provides 240-television pictures will be sharper and more detailed. With Dolby AC-3 Digital surround Sound as part of the specification, six discrete audio channels can be programmed for digital surround sound, and with a separate subwoofer channel, developers can program the low-frequency doom and gloom music popular with Hollywood. Users can randomly access any section of the disc and use the slow-motion and freeze-frame features during movies. Audio tracks can be programmed for as many as eight different languages, with graphic subtitles in 32 languages.

Notes



In December 1995, nine major electronics companies (Toshiba, Matsushita, Sony, Philips, Time Waver, Pioneer, JVC, Hitachi and Mitsubishi Electric) agreed to promote a new optical disc technology for distribution of multimedia and feature-length movies called DVD.

6.3.6 CD-ROM

A Compact Disc or CD is an optical disc used to store digital data, originally developed for storing digital audio. The CD, available on the market since late 1982, remains the standard playback medium for commercial audio recordings to the present day, though it has lost ground in recent years to MP3 players.

An audio CD consists of one or more stereo tracks stored using 16-bit PCM coding at a sampling rate of 44.1 kHz. Standard CDs have a diameter of 120 mm and can hold approximately 80 minutes of audio. There are also 80 mm discs, sometimes used for CD singles, which hold approximately 20 minutes of audio. The technology was later adapted for use as a data storage device, known as a CD-ROM, and to include record once and re-writable media (CD-R and CD-RW respectively). The CD-ROMs and CD-Rs remain widely used technologies in the computer industry as of 2007. The CD and its extensions have been extremely successful in 2004, the worldwide sales of CD audio, CD-ROM and CD-R reached about 30 billion discs. By 2007, 200 billion CDs had been sold worldwide.

6.3.7 CD-ROM Players

Compact disc read-only memory (CD-ROM) players have become an integral part of the multimedia development workstation and are important delivery vehicle for large, mass-produced projects. A wide variety of developer utilities, graphic backgrounds, stock photography and sounds, applications, games, reference texts, and educational software are available only on this medium.

The CD-ROM players have typically been very slow to access and transmit data (150 k per second, which is the speed required of consumer Red Book Audio CDs), but new developments have led to double, triple, quadruple, speed and even 24x drives designed specifically for computer (not Red Book Audio) use. These faster drives spool up like washing machines on the spin cycle and can be somewhat noisy, especially if the inserted CD is not evenly balanced.

6.3.8 CD Recorders

With a CD recorder, you can make your own CDs using special CD recordable (CD-R) blank optical discs to create a CD in most formats of CD-ROM and CD-Audio. The machines are made by Sony, Phillips, Ricoh, Kodak, JVC, Yamaha and Pinnacle. Software, such as Adaptec's Toast for Macintosh or Easy CD Creator for Windows, lets you organize files on your hard disk(s) into a "virtual" structure, then writes them to the CD in that order. The CD-R discs are made differently than normal CDs but can play in any CD-Audio or CD-ROM player. They are available in either a "63 minute" or "74 minute" capacity for the former, that means about 560 MB, and for the latter, about 650 MB. These write-once CDs make excellent high-capacity file archives and are used extensively by multimedia developers for premastering and testing CDROM projects and titles.

6.3.9 Videodisc Players

Videodisc players (commercial, not consumer quality) can be used in conjunction with the computer to deliver multimedia applications. You can control the videodisc player from your authoring software with X-Commands (XCMDS) on the Macintosh and with MCI commands in Windows.



The Digital Videodisc player employs a laser system. To prevent direct exposure to the laser beam, do not try to open the enclosure or defeat the safety interlocks.

6.4 Input Devices

Notes

Often, input devices are under direct control by a human user, who uses them to communicate commands or other information to be processed by the computer, which may then transmit feedback to the user through an output device. Input and output devices together make up the hardware interface between a computer and the user or external world. Typical examples of input devices include keyboards and mice. However, there are others which provide many more degrees of freedom. In general, any sensor which monitors, scans for and accepts information from the external world can be considered an input device, whether or not the information is under the direct control of a user.

6.4.1 Classification of Input Devices

Input devices can be classified according to:

- The modality of input (e.g., mechanical motion, audio, visual, sound, etc.)
- Whether the input is discrete (e.g., keypresses) or continuous (e.g., a mouse's position, though digitized into a discrete quantity, is high-resolution enough to be thought of as continuous).
- The number of degrees of freedom involved (e.g. many mice allow 2D positional input, but some devices allow 3D input, such as the Logitech Magellan Space Mouse) Pointing devices, which are input devices used to specify a position in space.
- Whether the input is direct or indirect. With direct input, the input space coincides with the display space, i.e. pointing is done in the space where visual feedback or the cursor appears. Touchscreens and light pens involve direct input. Examples involving indirect input include the mouse and trackball.
- Whether the positional information is absolute (e.g., on a touchscreen) or relative (e.g., with a mouse that can be lifted and repositioned).

Note that direct input is almost necessarily absolute, but indirect input may be either absolute or relative. For example, digitizing graphics tablets that do not have an embedded screen involve indirect input and sense absolute positions and are often run in an absolute input mode, but they may also be setup to simulate a relative input mode where the stylus or puck can be lifted and repositioned.

Keyboards

A keyboard is the most common method of interaction with a computer. Keyboards provide various tactile responses (from firm to mushy) and have various layouts depending upon your computer system and keyboard model. Keyboards are typically rated for at least 50 million cycles (the number of times a key can be pressed before it might suffer breakdown).

The most common keyboard for PCs is the 101 style (which provides 101 keys), although many styles are available with more or fewer special keys, LEDs, and others features, such as a plastic membrane cover for industrial or food-service applications or flexible "ergonomic" styles. Macintosh keyboards connect to the Apple Desktop Bus (ADB), which manages all forms of user input from digitizing tablets to mice.



Example of types of keyboards:

- Computer keyboard
- Keyster
- Chorded keyboard
- LPFK

Notes

Pointing Devices

A pointing device is any computer hardware component (specifically human interface device) that allows a user to input spatial (*i.e.*, continuous and multi-dimensional) data to a computer. CAD systems and GUIs allow the user to control and provide data to the computer using physical gestures—point, click and drag—typically by moving a hand-held mouse across the surface of the physical desktop and activating switches on the mouse.

While the most common pointing device by far is the mouse, many more devices have been developed. However, mouse is commonly used as a metaphor for devices that move the cursor. A mouse is the standard tool for interacting with a GUI. All Macintosh computers require a mouse; on PCs, mice are not required but recommended. Even though the Windows environment accepts keyboard entry in lieu of mouse point-and-click actions, your multimedia project should typically be designed with the mouse or touchscreen in mind. The buttons on the mouse provide additional user input, such as pointing and double-clicking to open a document, or the click-and-drag operation, in which the mouse button is pressed and held down to drag (move) an object, or to move to and select an item on a pull-down menu, or to access context-sensitive help.



Examples of common pointing devices:

- Mouse
- Trackball
- Touchpad
- Spaceball—6 degrees-of-freedom controller
- Touchscreen
- Graphics tablets (or digitizing tablet) that use a stylus
- Light pen
- Light gun
- Eye tracking devices
- Steering wheel—can be thought of as a 1D pointing device
- Yoke (aircraft)
- Jog dial—another 1D pointing device
- Isotonic joysticks—where the user can freely change the position of the stick, with more or less constant force joystick
- Analogue stick
- Isometric joysticks—where the user controls the stick by varying the amount of force they push with, and the position of the stick remains more or less constant
- Pointing stick
- Discrete pointing devices
 - directional pad—a very simple keyboard
 - dance pad—used to point at gross locations in space with feet

High-degree of Freedom Input Devices**Notes**

Some devices allow many continuous degrees of freedom to be input, and could sometimes be used as pointing devices, but could also be used in other ways that do not conceptually involve pointing at a location in space.

- Wired glove
- ShapeTape

Composite Devices

Input devices, such as buttons and joysticks, can be combined on a single physical device that could be thought of as a composite device. Many gaming devices have controllers like this.

- Game controller
- Gamepad (or joypad)
- Paddle (game controller)
- Wii Remote

Figure 6.2: Wii Remote with Attached Strap

**Imaging and Video Input Devices***Flat-bed Scanners*

A scanner may be the most useful piece of equipment used in the course of producing a multimedia project; there are flat-bed and handheld scanners. Most commonly available gray-scale and colour flat-bed scanners, that provides a resolution of 300 or 600 dots per inch (dpi). Professional graphics houses may use even higher resolution units. Handheld scanners can be useful for scanning small images and columns of text, but they may prove inadequate for the multimedia development.

Be aware that scanned images, particularly those at high resolution and in colour, demand an extremely large amount of storage space on the hard disk, no matter what instrument is used to do the scanning. Also remember that the final monitor display resolution for your multimedia project will probably be just 72 or 95 dpi—leave the very expensive ultra-high-resolution scanners for the desktop publishers. Most expensive flat-bed scanners offer at least 300 dpi resolution, and most scanners allow to set the scanning resolution.

Scanners help to make clear electronic images of existing artwork such as photos, ads, pen drawings and cartoons, and can save many hours when you are incorporating proprietary art into the application. Scanners also give a starting point for the creative diversions. The devices used for capturing image and video are:

- Webcam
- Image scanner

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- Fingerprint scanner
- Barcode reader
- 3D scanner
- Medical imaging sensor technology
 - Computed tomography
 - Magnetic resonance imaging
 - Positron emission tomography
 - Medical ultrasonography

Audio Input Devices

The devices used for capturing audio are:

- Microphone
- Speech recognition

Note that, MIDI allows musical instruments to be used as input devices as well.

Touchscreens

Touchscreens are monitors that usually have a textured coating across the glass face. This coating is sensitive to pressure and registers the location of the user's finger when it touches the screen. The Touch Mate System, which has no coating, actually measures the pitch, roll and yaw rotation of the monitor when pressed by a finger, and determines how much force was exerted and the location where the force was applied.

Other touchscreens use invisible beams of infrared light that crisscross the front of the monitor to calculate where a finger was pressed. Pressing twice on the screen in quick and dragging the finger, without lifting it, to another location simulates a mouse click-and-drag. A keyboard is sometimes simulated using an onscreen representation so users can input names, numbers, and other text by pressing "keys". Touchscreen recommended for day-to-day computer work, but are excellent for multimedia applications in a kiosk, at a trade show, or in a museum delivery system anything involving public input and simple tasks. When your project is designed to use a touchscreen, the monitor is the only input device required, so you can secure all other system hardware behind locked doors to prevent theft or tampering.

6.5 Output Devices

Presentation of the audio and visual components of the multimedia project requires hardware that may or may not be included with the computer itself-speakers, amplifiers, monitors, motion video devices and capable storage systems. The better the equipment, of course, better the presentation. There is no greater test of the benefits of good output hardware than to feed the audio output of your computer into an external amplifier system: suddenly the bass sounds become deeper and richer, and even music sampled at low quality may seem to be acceptable.

6.5.1 Audio Devices

All Macintoshes are equipped with an internal speaker and a dedicated sound chip, and they are capable of audio output without additional hardware and/or software. To take advantage of built-in stereo sound, external speakers are required. Digitizing sound on the Macintosh requires an external microphone and sound editing/recording software such as SoundEdit16 from Macromedia, Alchemy from Passport, or SoundDesigner from DigiDesign.

6.5.2 Amplifiers and Speakers

Notes

Often the speakers used during a project's development will not be adequate for its presentation. Speakers with built-in amplifiers or attached to an external amplifier are important when the project will be presented to a large audience or in a noisy setting.

6.5.3 Monitors

The monitor needed for development of multimedia projects depends on the type of multimedia application created, as well as what computer is being used. A wide variety of monitors is available for both Macintoshes and PCs. High-end, large-screen graphics monitors are available for both, and they are expensive. Serious multimedia developers will often attach more than one monitor to their computers, using add-on graphic board. This is because many authoring systems allow working with several open windows at a time, so we can dedicate one monitor to viewing the work we are creating or designing, and we can perform various editing tasks in windows on other monitors that do not block the view of your work. Editing windows that overlap a work view when developing with Macromedia's authoring environment, director, on one monitor. Developing in director is best with at least two monitors, one to view the work the other two view the "score". A third monitor is often added by director developers to display the "Cast".

6.5.4 Video Device

No other contemporary message medium has the visual impact of video. With a video digitizing board installed in a computer, we can display a television picture on your monitor. Some boards include a frame-grabber feature for capturing the image and turning it in to a colour bitmap, which can be saved as a PICT or TIFF file and then used as part of a graphic or a background in your project.

Display of video on any computer platform requires manipulation of an enormous amount of data. When used in conjunction with videodisc players, which give precise control over the images being viewed, video cards you place an image in to a window on the computer monitor; a second television screen dedicated to video is not required. And video cards typically come with excellent special effects software.

There are many video cards available today. Most of these support various video in a window sizes, identification of source video, setup of play sequences are segments, special effects, frame grabbing, digital movie making; and some have built-in television tuners so you can watch your favourite programs in a window while working on other things. In windows, video overlay boards are controlled through the Media Control Interface. On the Macintosh, they are often controlled by external commands and functions (XCMDs and XFCNs) linked to your authoring software.

Good video greatly enhances your project whereas poor video will ruin it. Whether you delivered your video from tape using VISCA controls, from videodisc, or as a QuickTime or AVI movie, it is important that your source material be of high quality.

6.5.5 Projectors

When it is necessary to show a material to more viewers than can huddle around a computer monitor, it will be necessary to project it on to large screen or even a white painted wall. Cathode-ray tube (CRT) projectors, liquid crystal display (LCD) panels attached to an overhead projector, stand-alone LCD projectors, and light-valve projectors are available to splash the work on to big-screen surfaces.

The CRT projectors have been around for quite a while they are the original "bigscreen" televisions. They use three separate projection tubes and lenses (red, green and blue), and three colour channels

Notes

of light must “converge” accurately on the screen. Setup, focusing, and aligning are important to getting a clear and crisp picture. The CRT projectors are compatible with the output of most computers as well as televisions.

The LCD panels are portable devices that fit in a briefcase. The panel is placed on the glass surface of a standard overhead projector available in most schools, conference rooms and meeting halls. While they overhead projectors do the projection work, the panel is connected to the computer and provides the image, in thousands of colours and, with active-matrix technology, at speeds that allow full-motion video and animation. Since LCD panels are small, they are popular for on-the-road presentations, often connected to a laptop computer and using a locally available overhead projector.

More complete LCD projection panels contain a projection lamp and lenses and do not recover a separate overheads projector. They typically produce an image brighter and sharper than the simple panel model, but they are somewhat large and cannot travel in a briefcase.

Light-valves complete with high-end CRT projectors and use a liquid crystal technology in which a low-intensity colour image modulates a high-intensity light beam. These units are expensive, but the image from a light-valve projector is very bright and colour saturated can be projected onto screen as wide as 10 metres.

6.5.6 Printers

With the advent of reasonably priced colour printers, hard-copy output has entered the multimedia scene. From storyboards to presentation to production of collateral marketing material, colour printers have become an important part of the multimedia development environment. Colour helps clarify concepts, improves understanding and retention of information, and organizes complex data. As multimedia designers already know intelligent use of colours is critical to the success of a project. Tektronix offers both solid ink and laser options, and either Phases 560 will print more than 10000 pages at a rate of 5 colour pages or 14 monochrome pages per minute before requiring new toner.

Epson provides lower-cost and lower-performance solutions for home and small business users; Hewlett Packard's Colour LaserJet line competes with both. Most printer manufacturers offer a colour model-just as all computers once used monochrome monitors but are now colour, all printers will become colour printers.



Customer Success Story – Fairfield Industries

Case Study

In keeping with their agenda to deliver the highest quality geophysical services to their customers, on time and within budget, Fairfield was one of the early adopters of high-performance, parallel computing. They built one of the industry's first production-grade, Linux clusters for seismic data processing, designing and building their cluster from scratch. Fairfield called out the specifications, computing platforms, and microprocessors needed to do the job. This approach gave the company a business-competitive edge over other seismic imaging vendors because it allowed Fairfield to fine-tune processing operations to achieve the highest I/O performance, and tailor algorithms and software applications specifically to the requirements of its oil and gas customers.

The early Fairfield Linux cluster relied on small computer system interface (SCSI)-based, RAID systems that were attached to workstations with NFS-supported storage. According to Richard Rowbatham, Systems Administrator at Fairfield, “The storage was the size of a

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washing machine and only had 500 Gigabytes of capacity. Approximately 15 to 16 five and a quarter inch disk drives were used in each RAID system to read and write data. These data were then manipulated with custom algorithms and passed on to oil and gas customers to help them pinpoint oil reserves with accuracy."

But as the technology evolved, the SCSI disks reached the end of their lifecycle and Fairfield had no vendor support. "We had to move away from that system and on to newer technologies to keep abreast of client backlog and to remain competitive," said Rowbatham.

The Challenge

In building a custom HPC production environment, Fairfield also designed and built a custom NFS-based storage system. As more powerful computing hardware and software applications were added to the infrastructure, older end-of-life storage was replaced with newer and faster storage technologies. But the switchover began to uncover cracks in the previously robust production system. Problems surfaced in overall stability, management, and serviceability. In addition, Fairfield experienced challenges obtaining vendor management support for the company's HPC infrastructure. With no single point of management and support, Fairfield's production system sputtered and struggled to keep pace with mounting seismic processing demands.

"Our applications were becoming increasingly more complex, so we had to make sure the storage technology was bullet-proof and capable of withstanding the processing demands that we knew would continue to grow. We had already designed our cluster to be 100% efficient, so reliability was becoming a critical issue. It was clear we needed enhanced reliability and management features in our data storage solution. The search was on," said Rowbatham.

The Solution

Fairfield Industries has replaced its older NFS-based storage with Panasas ActiveStor™ scale-out NAS systems running in conjunction with existing storage that has not reached its end-of-life cycle. Unlike the existing storage systems, Panasas ActiveStor scale-out NAS systems have taken charge of the heavy-duty, processing operations that demand long-term reliability and stability. Fairfield evaluated Panasas ActiveStor scale-out NAS systems during a month long evaluation period running it non-stop with benchmark data to test its reliability and performance. Although performance was not the driving factor, the company experienced improved I/O performance in addition to enhanced ease of use, manageability, and improved vendor service with a dedicated service contact.

In addition, the Panasas storage has replaced two racks of previous storage systems with a much smaller storage footprint. This will enable Fairfield to add more compute capacity when needed, without requiring more data center real estate or cooling requirements. "Before installing Panasas storage we had racks and racks of storage that we had to design a specific way to maintain an acceptable performance ratio. Now, we have replaced two racks of existing storage with a half of a rack of Panasas storage, and the performance is even better although it is more than we need at this time. We have been able to fit a lot more storage within a smaller space and will be able to accommodate all of the storage capacity needed as more customer jobs come online," said Rowbatham.

The Result

After a rigorous month-long evaluation program, Panasas ActiveStor was immediately deployed into Fairfield's production system. Not only did the Panasas ActiveStor deliver enhanced reliability and ease of management, the storage solution was also backed by a superior team of Panasas service experts who came in and brought the Panasas system online in less than one day. The Panasas team also provided a one-stop shop for keeping the

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| | |
|--------------|--|
| Notes | system up and running, freeing up Fairfield administrative time for more customer work, and reducing overall operational costs. |
| | Panasas ActiveStor includes the patented DirectFlow protocol, a direct access path between Fairfield’s Linux cluster nodes and their storage, eliminating delays inherent in traditional SAN and NAS architectures. The additional benefits of this increased efficiency allow Fairfield to take on and complete more customer projects in a shorter amount of time, improve IT productivity, and further reduce the overall cost of ownership in their IT infrastructure investments. |
| | The Panasas operating environment featuring PanFSTM parallel file system with its patented object-based architecture allows Fairfield to maximize application performance and eliminate storage system complexities. Also, the single global namespace and the parallel reconstruction capabilities of the solution contribute to superior ease of management. |

Self Assessment

Choose the correct answer:

6.6 Summary

Notes

- Both Windows and Mac OS use hundreds of patents shared between the two.
- There are many hardware devices which are generally used for making a connection between two or more devices such as cables.
- Users can plug one or more standard analogue telephone devices into the ATA.
- Most electronic data storage media are considered permanent (non-volatile) storage, that is, the data will remain stored when power is removed from the device.
- Input and output devices together make up the hardware interface between a computer and the user or external world.
- Electronic output devices can be mechanical, audio or visual.

6.7 Keywords

Analogue Telephone Adapter (ATA): It is a device used to connect one or more standard analogue telephones to a digital telephone system or a non-standard telephone system.

FireWire: It provides a single plug-and-socket connection on which up to 63 devices can be attached with data transfer speeds up to 400 Mbps.

Random Access Memory (RAM): It is the main memory where the operating system is initially loaded and the application programs are loaded at a later stage.

Small Computer System Interface (SCSI): It is a set of ANSI standard electronic interfaces that allow personal computers to communicate with peripheral hardware such as disk drives, tape drives, CD-ROM, etc.

Touchscreens: They are monitors that usually have a textured coating across the glass face.

Universal Serial Bus (USB): It is a standard for a wired connection between two electronic devices, including a mobile phone and a desktop computer.



1. Show, how FireWire connects two personal computers?

Lab Exercise

2. Connect five peripheral devices in parallel line.

6.8 Review Questions

1. Distinguish between Macintosh and Windows.
2. Define integrated drive electronics interface.
3. What are the features of small computer system interface?
4. Explain the purpose of analogue telephone adapter.
5. Describe the different versions of USB.
6. What do you mean by storage device? Explain any three of them.
7. Distinguish between random access memory and read-only memory.
8. Explain the different types of pointing devices.
9. What is flat-bed scanner?
10. What do you understand by video and audio output device?

Notes

Answers to Self Assessment

- | | | | | |
|--------|--------|--------|--------|---------|
| 1. (b) | 2. (a) | 3. (a) | 4. (c) | 5. (d) |
| 6. (b) | 7. (a) | 8. (b) | 9. (a) | 10. (b) |

6.9 Further Reading



Books

"Multimedia: Making it Work", by Tay Vaughan, TMH, 1999.



Online link

<http://piotech.wsd.wednet.edu/techtwounits/01presentations/task1/02hardware/hardware.html>

Unit 7: Multimedia Software Tools

Notes

CONTENTS

- Objectives
- Introduction
- 7.1 Text Editing and Word Processing Tools
- 7.2 OCR Software
 - 7.2.1 Types of OCR Software
 - 7.2.2 OCR Software in Present Scenario
 - 7.2.3 Advantages of OCR
- 7.3 Painting and Drawing Tools
- 7.4 Summary
- 7.5 Keywords
- 7.6 Review Questions
- 7.7 Further Reading

Objectives

After studying this unit, you will be able to:

- Discuss the text editing and word processing tools
- Explain the OCR software
- Discuss the painting and drawing tools

Introduction

The basic tools set for building multimedia project contains one or more authoring systems and various editing applications for text, images, sound, and motion video. A few additional applications are also useful for capturing images from the screen, translating file formats and tools for the making multimedia production easier.

7.1 Text Editing and Word Processing Tools

A text editor is a type of program used for editing plain text files. Text editors are often provided with operating systems or software development packages, and can be used to change configuration files and programming language source code.

Some text editors are small and simple, while others offer a broad and complex range of functionality. For example, Unix and Unix-like operating systems have the vi editor (or a variant), but many also include the Emacs editor. Microsoft Windows systems come with the very simple Notepad, though many people—especially programmers—prefer to use one of many other Windows text editors with more features. Under Apple Macintosh's classic Mac OS there was the native SimpleText, which was replaced under Mac OS X byTextEdit. Some editors, such as WordStar, have dual operating modes allowing them to be either a text editor or a word processor.

Notes Text editors geared for professional computer users place no limit on the size of the file being opened. In particular, they start quickly even when editing large files, and are capable of editing files that are too large to fit the computer's main memory. Simpler text editors often just read files into an array in RAM. On larger files this is a slow process, and very large files often do not fit.

The ability to read and write very large files is needed by many professional computer users. For example, system administrators may need to read long log files. Programmers may need to change large source code files, or examine unusually large texts, such as an entire dictionary placed in a single file.



If a file is copied into a word processing program from a text editor, caution must be taken to save the file as a ".txt" file so that it will be read correctly. Failure to do so may result in special characters being inserted where they were not needed and can leave your document unreadable.

Features of Text Editors:

- **String searching algorithm:** Search string with a replacement string. Different methods are employed, Global(ly) Search And Replace, Conditional Search and Replace, Unconditional Search and Replace.
- **Cut, copy, and paste:** Most text editors provide methods to duplicate and move text within the file, or between files.
- **Text formatting:** Text editors often provide basic formatting features like line wrap, auto-indentation, bullet list formatting, comment formatting, and so on.
- **Undo and redo:** As with word processors, text editors will provide a way to undo and redo the last edit. Often—especially with older text editors—there is only one level of edit history remembered and successively issuing the undo command will only “toggle” the last change. Modern or more complex editors usually provide a multiple level history such that issuing the undo command repeatedly will revert the document to successively older edits. A separate redo command will cycle the edits “forward” toward the most recent changes. The number of changes remembered depends upon the editor and is often configurable by the user.
- **Data transformation:** Reading or merging the contents of another text file into the file currently being edited. Some text editors provide a way to insert the output of a command issued to the operating system’s shell.
- **Ability to handle UTF-8 encoded text.**
- **Filtering:** Some advanced text editors allow the editor to send all or sections of the file being edited to another utility and read the result back into the file in place of the lines being “filtered”. This, for example, is useful for sorting a series of lines alphabetically or numerically, doing mathematical computations, and so on.
- **Syntax highlighting:** Contextually highlights software code and other text that appears in an organized or predictable format.

Specialized Editors

Some editors include special features and extra functions, for instance:

- Source code editors are text editors with additional functionality to facilitate the production of source code. These often feature user-programmable syntax highlighting, and coding tools or keyboard macros similar to an HTML editor.
- Folding editors includes so-called “orthodox editors” that are derivatives of Xedit. The specialized version of folding is usually called outlining.

- IDEs (integrated development environments) are designed to manage and streamline larger programming projects. They are usually only used for programming as they contain many features unnecessary for simple text editing.
- World Wide Web programmers are offered a variety of text editors dedicated to the task of Web development. These create the plain text files that deliver Web pages. HTML editors include: Dreamweaver, E Text Editor, Microsoft FrontPage, HotDog, Homesite, Nvu, Tidy, and GoLive. Many offer the option of viewing a work in progress on a built-in Web browser. XML editors share many traits.
- Mathematicians, physicists, and computer scientists often produce articles and books using TeX or LaTeX in plain text files. Such documents are often produced by a standard text editor, but some people use specialized TeX editors.
- Outliners. Also called tree-based editors, because they combine a hierarchical outline tree with a text editor. Folding can generally be considered a generalized form of outlining.
- Simultaneous editing is a technique in End-user development research to edit all items in a multiple selection. It allows the user to manipulate all the selected items at once through direct manipulation. The Lapis text editor and the multi edit plugin for gedit are examples of this technique. The Lapis editor can also create an automatic multiple selection based on an example item.
- Distraction-free editors provide a minimalistic interface with the purpose of isolating the writer from the rest of the applications and operating system, thus being able to focus on the writing alone.

Notes

A word processor is usually the first software tool computer users rely upon for creating text. The word processor is often bundled with an office suite.

Word processors such as Microsoft Word and WordPerfect are powerful applications that include spellcheckers, table formatters, thesauruses and prebuilt templates for letters, resumes, purchase orders and other common documents.

Using a computer to create, edit, and print documents. Of all computer applications, word processing is the most common. To perform word processing, you need a computer, a special program called a word processor, and a printer. A word processor enables you to create a document, store it electronically on a disk, display it on a screen, modify it by entering commands and characters from the keyboard, and print it on a printer.

The great advantage of word processing over using a typewriter is that you can make changes without retyping the entire document. If you make a typing mistake, you simply back up the cursor and correct your mistake. If you want to delete a paragraph, you simply remove it, without leaving a trace. It is equally easy to insert a word, sentence, or paragraph in the middle of a document. Word processors also make it easy to move sections of text from one place to another within a document, or between documents. When you have made all the changes you want, you can send the file to a printer to get a hardcopy.

Word processors vary considerably, but all word processors support the following basic features:

- Insert text:** Allows you to insert text anywhere in the document.
- Delete text:** Allows you to erase characters, words, lines, or pages as easily as you can cross them out on paper.
- Cut and paste:** Allows you to remove (cut) a section of text from one place in a document and insert (paste) it somewhere else.

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- **Copy:** Allows you to duplicate a section of text.
- **Page size and margins:** Allows you to define various page sizes and margins, and the word processor will automatically readjust the text so that it fits.
- **Search and replace:** Allows you to direct the word processor to search for a particular word or phrase. You can also direct the word processor to replace one group of characters with another everywhere that the first group appears.
- **Word wrap:** The word processor automatically moves to the next line when you have filled one line with text, and it will readjust text if you change the margins.
- **Print:** Allows you to send a document to a printer to get hardcopy.

Word processors that support only these features (and maybe a few others) are called *text editors*. Most word processors, however, support additional features that enable you to manipulate and format documents in more sophisticated ways. These more advanced word processors are sometimes called *full-featured word processors*. Full-featured word processors usually support the following features:

- **File management:** Many word processors contain file management capabilities that allow you to create, delete, move, and search for files.
- **Font specifications:** Allow you to change fonts within a document. For example, you can specify bold, italics, and underlining. Most word processors also let you change the font size and even the typeface.
- **Footnotes and cross-references:** Automate the numbering and placement of footnotes and enables you to easily cross-reference other sections of the document.
- **Graphics:** Allow you to embed illustrations and graphs into a document. Some word processors let you create the illustrations within the word processor; others let you insert an illustration produced by a different program.
- **Headers, footers, and page numbering:** Allow you to specify customized headers and footers that the word processor will put at the top and bottom of every page. The word processor automatically keeps track of page numbers so that the correct number appears on each page.
- **Layout:** Allows you to specify different margins within a single document and to specify various methods for indenting paragraphs.
- **Macros:** A macro is a character or word that represents a series of keystrokes. The keystrokes can represent text or commands. The ability to define macros allows you to save yourself a lot of time by replacing common combinations of keystrokes.
- **Merges:** Allows you to merge text from one file into another file. This is particularly useful for generating many files that have the same format but different data. Generating mailing labels is the classic example of using merges.
- **Spell checker:** A utility that allows you to check the spelling of words. It will highlight any words that it does not recognize.
- **Tables of contents and indexes:** Allow you to automatically create a table of contents and index based on special codes that you insert in the document.
- **Thesaurus:** A built-in thesaurus that allows you to search for synonyms without leaving the word processor.

- **Windows:** Allows you to edit two or more documents at the same time. Each document appears in a separate window. This is particularly valuable when working on a large project that consists of several different files.
- **WYSIWYG (what you see is what you get):** With WYSIWYG, a document appears on the display screen exactly as it will look when printed.

Notes

The line dividing word processors from desktop publishing systems is constantly shifting. In general, though, desktop publishing applications support finer control over layout, and more support for full-colour documents.



Did u know?

Electric Pencil, released in December 1976, was the first word processor software for microcomputers.



Task

Collect information about latest text editors and word processors.

7.2 OCR Software

It stands for “Optical Character Recognition”. This technology is what allows you to scan that paper you lost on your hard drive, but fortunately printed out, back into your computer. When a page of text is scanned into a computer without OCR software, all the computer sees is a bunch graphical bits, or an image. In other words, it has no idea that there is text on the page, much less what the text says. However, an OCR program can convert the characters on the page into a text document that can be read by a word processing program. More advanced OCR programs can even keep the formatting of the document in the conversion.

Often there will be multimedia content and other text to incorporate into a multimedia project, but no electronic text file. With optical character recognition (OCR) software, a flat-bed scanner, and a computer, it is possible to save many hours of rekeying printed words, and get the job done faster and more accurately than a roomful of typists.

The OCR software turns bitmapped characters into electronically recognizable ASCII text. A scanner is typically used to create the bitmap. Then the software breaks the bitmap into chunks according to whether it contains text or graphics, by examining the texture and density of areas of the bitmap and by detecting edges. The text areas of the image are then converted to ASCII character using probability and expert system algorithms.

7.2.1 Types of OCR Software

There are the following types of OCR software available:

Desktop and Server OCR Software

OCR software and ICR (Intelligent Character Recognition) software technologies are analytical artificial intelligence systems that consider sequences of characters rather than whole words or phrases. Based on the analysis of sequential lines and curves, OCR and ICR make ‘best guesses’ at characters using database look-up tables to closely associate or match the strings of characters that form words.

WebOCR and OnlineOCR

With IT technology development, the platform for people to use software has been changed from single PC platform to multi-platforms such as PC +Web-based+ Cloud Computing + Mobile devices. After 30 years development, OCR software started to adapt to new application requirements. WebOCR also known as OnlineOCR or Web-based OCR service has been a new

Notes trend to meet larger volume and larger group of users after 30 years development of the desktop OCR. Internet and broadband technologies have made WebOCR and OnlineOCR practically available to both individual users and enterprise customers. Since 2000, some major OCR vendors began offering WebOCR and Online software, a number of new entrants companies to seize the opportunity to develop innovative Web-based OCR service, some of which are free of charge services.

Application-Oriented OCR

Since OCR technology has been more and more widely applied to paper-intensive industry, it is facing more complex images environment in the real world. For example, complicated backgrounds, degraded-images, heavy-noise, paper skew, picture distortion, low-resolution, disturbed by grid and lines, text image consisting of special fonts, symbols, glossary words and etc. All the factors affect OCR products' stability in recognition accuracy.

In recent years, the major OCR technology providers began to develop dedicated OCR systems, each for a special type of images. They combine various optimization methods related the special image, such as business rules, standard expression, glossary dictionary and rich information contained in colour image, to improve the recognition accuracy.

Such strategy to customize OCR technology is called "Application-Oriented OCR" or "Customized OCR", widely used in the fields of Business-card OCR, Invoice OCR, Screenshot OCR, ID card OCR, Driver-license OCR or Auto plant OCR, and so on.

7.2.2 OCR Software in Present Scenario

One study based on recognition of 19th and early 20th century newspaper pages concluded that character-by-character OCR accuracy for commercial OCR software varied from 71% to 98%; total accuracy can only be achieved by human review. Other areas – including recognition of hand printing, cursive handwriting, and printed text in other scripts (especially those East Asian language characters which have many strokes for a single character) – are still the subject of active research.

Accuracy rates can be measured in several ways, and how they are measured can greatly affect the reported accuracy rate. For example, if word context (basically a lexicon of words) is not used to correct software finding non-existent words, a character error rate of 1% (99% accuracy) may result in an error rate of 5% (95% accuracy) or worse if the measurement is based on whether each whole word was recognized with no incorrect letters.

On-line character recognition is sometimes confused with Optical Character Recognition (Handwriting recognition). The OCR is an instance of off-line character recognition, where the system recognizes the fixed *static shape* of the character, while on-line character recognition instead recognizes the *dynamic motion* during handwriting. For example, on-line recognition, such as that used for gestures in the Penpoint OS or the Tablet PC can tell whether a horizontal mark was drawn right-to-left, or left-to-right. On-line character recognition is also referred to by other terms such as dynamic character recognition, real-time character recognition, and Intelligent Character Recognition or ICR.

On-line systems for recognizing hand-printed text on the fly have become well known as commercial products in recent years. Among these are the input devices for personal digital assistants such as those running Palm OS. The Apple Newton pioneered this product. The algorithms used in these devices take advantage of the fact that the order, speed, and direction of individual lines segments at input are known. Also, the user can be retrained to use only specific letter shapes. These methods cannot be used in software that scans paper documents, so accurate recognition of hand-printed documents is still largely an open problem. Accuracy rates of 80% to 90% on neat, clean hand-printed characters can be achieved, but that accuracy rate still translates to dozens of errors per page, making the technology useful only in very limited applications.

Recognition of cursive text is an active area of research, with recognition rates even lower than that of hand-printed text. Higher rates of recognition of general cursive script will likely not be possible without the use of contextual or grammatical information. For example, recognizing entire words from a dictionary is easier than trying to parse individual characters from script. Reading the Amount line of a cheque (which is always a written-out number) is an example where using a smaller dictionary can increase recognition rates greatly. Knowledge of the grammar of the language being scanned can also help determine if a word is likely to be a verb or a noun, for example, allowing greater accuracy. The shapes of individual cursive characters themselves simply do not contain enough information to accurately (greater than 98%) recognise all handwritten cursive script.

Notes

It is necessary to understand that OCR technology is a basic technology also used in advanced scanning applications. Due to this, an advanced scanning solution can be unique and patented and not easily copied despite being based on this basic OCR technology.

For more complex recognition problems, intelligent character recognition systems are generally used, as artificial neural networks can be made indifferent to both affine and non-linear transformations.

A technique which is having considerable success in recognizing difficult words and character groups within documents generally amenable to computer OCR is to submit them automatically to humans in their CAPTCHA system.



In 1955, the first commercial OCR system was installed at the Reader's Digest. Reader's Digest is a general interest family magazine, published ten times annually.

7.2.3 Advantages of OCR

The advantages of OCR are numerous, but namely it increases the efficiency and effectiveness of office work. The ability to instantly search through content is immensely useful, especially in an office setting that has to deal with high volume scanning or high document inflow. You can now use the copy and paste tools on the document as well, instead of rewriting everything to correct it. The OCR is quick and accurate, ensuring the document's content remains intact while saving time as well. When combined with other technologies such as scanning and file compression, the advantages of OCR truly shine. Workflow is increased since employees no longer have to waste time on manual labour and can work quicker and more efficiently.

Self Assessment

Choose the correct answer:

1. A text editor cannot change configuration files and programming language source code.
 - (a) True
 - (b) False
2. With the help of word processor you can make changes without retying the entire document.
 - (a) True
 - (b) False
3. Which one is not a word processor?
 - (a) Microsoft Word
 - (b) WordPerfect
 - (c) Adobe Photoshop
 - (d) None of these
4. WYSIWYG stands for
 - (a) what you shown is what you gain

Notes

- (b) where you see and what you get
 - (c) what you see is what you get
 - (d) none of these

5. OCR software turns bitmapped characters into electronically recognizable text.

 - (a) ASCII
 - (b) binary
 - (c) decimal
 - (d) None of these.

6. ICR stands for

 - (a) Initial Character Recognition
 - (b) Intelligent Character Recognition
 - (c) Internet Character Recognition
 - (d) None of these

7. The accuracy for commercial OCR software varied from

 - (a) 81% to 98%
 - (b) 91% to 100%
 - (c) 71% to 98%
 - (d) None of these

7.3 Painting and Drawing Tools

Painting and drawing tools, as well as 3D modellers, are perhaps the most important items in the toolkit because, of all the multimedia elements, the graphical impact of the project will likely have the greatest influence on the end user. If the artwork is amateurish, or flat and uninteresting, both the creator and the users will be disappointed.

Painting software such as Photoshop, Fireworks, and Painter, is dedicated to producing crafted bitmap images. Drawing software, such as CorelDraw, FreeHand, Illustrator, Designer, and Canvas, is dedicated to producing vector-based line art easily printed to paper at high resolution.

Some software applications combine drawing and painting capabilities, but many authoring systems can import only bitmapped images. Typically, bitmapped images provide the greatest choice and power to the artist for rendering fine details and effects, and today bitmaps are used in multimedia more often than drawn objects. Some vector based packages such as Macromedia's Flash are aimed at reducing file download times on the Web, and may contain both bitmaps and drawn art. The anti-aliased character shown in the bitmap of Color Plate 5 is an example of the fine touches that improve the look of an image.

Look for these features in a drawing or painting packages:

- An intuitive graphical user interface with pull-down menus, status bars, palette control, and dialog boxes for quick, logical selection.
 - Scalable dimensions, so you can resize, stretch, and distort both large and small bitmaps.
 - Paint tools to create geometric shapes, from squares to circles and from curves to complex polygons.
 - Ability to pour a colour, pattern, or gradient into any area.
 - Ability to paint with patterns and clip art.
 - Customizable pen and brush shapes and sizes.
 - Eyedropper tool that samples colours.

- Auto trace tool that turns bitmap shapes into vector-based outlines.
- Support for scalable text fonts and drop shadows.
- Multiple undo capabilities, to let you try again.
- Painting features such as smoothing coarse-edged objects into the background with anti-aliasing, airbrushing in variable sizes, shapes, densities, and patterns; washing colours in gradients; blending; and masking.
- Support for third-party special effect plug-ins.
- Object and layering capabilities that allow you to treat separate elements independently.
- Zooming, for magnified pixel editing.
- All common colour depths: 1-, 4-, 8-, and 16-, 134-, or 313-bit colour, and grayscale.
- Good colour management and dithering capability among colour depths using various colour models such as RGB, HSB, and CMYK.
- Good palette management when in 8-bit mode.
- Good file importing and exporting capability for image formats such as PIC, GIF, TGA, TIF, WMF, JPG, PCX, EPS, PTN, and BMP.

Notes

Graphic impact of your multimedia presentation is very important in influencing the students. It is the graphics that would create the first impression of your multimedia project. These tools are, therefore, very useful in giving you the desired capability in terms of drawing and painting. Painting and drawing tools generally come with a graphical user interface with pull down menus for quick selection. You can create almost all kinds of possible shapes and resize them. These tools have the capability to colour with paint and clip arts. One can use brushes of different sizes and shapes according to the need. One can use layers to give different treatment to each element. Most of these tools come with built-in plug-ins for performing different tasks. Once you are done with the drawing, it can be imported or exported in many image formats like .gif, .tif, .jpg, .bmp, etc. We will give a brief description of good drawing software known as CorelDraw.

With CorelDraw, you can create illustrations from scratch. It has wide-ranging features to handle text and to create drawing with precision. It can be used to improve clip art, pictures and photos. It is an ideal tool for any design project like technical drawings, advertisements, logos, etc. It can be used in creating full-colour illustrations for multifarious drawings and graphics for any designing project. It has lot of clip arts and high-quality drawings, which can be inserted into your multimedia project. One can also generate drawing for an animation sequence by using CorelDraw.



Caution

To avoid exporting unwanted objects, create an invisible border around your arrangement of objects to add an artificial boundary, when you are exporting an image.



Task

Give some examples of image format converters.



Case Study

History of Text Editors

If you still think that Microsoft Notepad or EMacs were the first Text Editors ever known to the mankind then you are so incorrect. There had been Text Editors even before them, some were Free and others were either licensed under some License or were proprietary.

Contd...

Notes

History of Text Editors starts from early 70's era. With very basic functionality, those editors did not have many features to format your text. Time has really changed now. Editors like XEmacs and Notepad++ are one of the favourite text editors due to their exhaustive features, customizations and support for extensibility.

Below are the list of 9 oldest Text Editors (sans Emacs and Notepad) and brief history about them.

Ed

Ed is one of the oldest and standard Text editors of UNIX operating system. Ed is the first Text Editor to have implementation of regular expressions. Without any visual feedback, its error messages were in the form of a question mark ("?"). With coming of so many advance editors, nobody uses Ed these days but sometimes it is very useful when there is no support available for any other Text Editors or you are writing some simple shell script.

JOE

JOE is an acronym for Joe's Own Editor. It is a terminal based text editor for UNIX. It was the first text editor which incorporated built-in help system which had a reminder on the screen of how to use it. In many Linux distributions of that era, JOE was the default editor which is the reason why it was so popular then. The editor is still available with advanced features. You can download it from its source forge project page.

SlickEdit

SlickEdit was the first advanced editor that supported features like syntax highlighting, refactoring code and keyboard shortcuts customizations. It is a cross-browser platform which is still available with much more advanced features. Latest version of SlickEdit was released in March 2009.

CRISP Editor

CRISP is yet another cross platform text editor popular among programmers. Early features of CRISP also had syntax highlighting, keyboard bindings and code navigation and refactoring features. CRISP can also handle huge multi-gigabytes of files. The editor is still very much available for download with improvements.

Epsilon

Epsilon was the popular text editor among programmers. It was a shadow of Emacs with its default key bindings and layout too. Epsilon is supported on MSDOS, Windows, Linux, FreeBSD and OS/2 and has support for Unicode too.

VEDIT

VEDIT is a text editor for MS Windows and MS DOS. It was one of the first Visual Text editor which could also handle files of huge size. Since it is written in Assembly Language VEDIT is extremely fast Text editor when compared to other editors. It also supported editing of remote files via FTP and was able to detect DOS, Unix and Mac files before editing them. VEDIT is also commercial software.

Sam Editor

Sam was the first editor that supported multiple files editing. Initially it was designed for UNIX terminals and was later ported to other systems too. Sam is the favorite text editor of many distinguished people like Bjarne Stroustrup, Brian Kernighan and Ken Thompson (Ed editor).

NEdit

NEdit stands for Nirvana Editor. It was another popular visual text editors as well as source code editor used by programmers. Its interface quite resembles to Mac and Windows editors. It was one of the first editors that supported automatic indentation on the basis of code language that you are editing.

Mined

Mined stands for MINIX-Editor. Mined is a terminal based editor that is available for Unix, Linux, Windows and MSDOS. It was one of the first text editors to support Unicode inside a terminal. It also had implementation of smart quotes and had extensive support for Unicode.

Questions:

1. What was the main cause for developing the text editors?
2. Differentiate between Ed and CRISP editors.

Notes**Self Assessment****Fill in the blanks:**

8. is a design software.
9. An example of painting software is
10. jpg is an format.

7.4 Summary

- Text editors geared for professional computer users place no limit on the size of the file being opened.
- Text editors often provide basic formatting features like line wrap, auto-indentation, bullet list formatting, comment formatting, and so on.
- Source code editors are text editors with additional functionality to facilitate the production of source code.
- A word processor is usually the first software tool computer users rely upon for creating text.
- The OCR software turns bitmapped characters into electronically recognizable ASCII text.
- Painting software, such as Photoshop, Fireworks, and Painter, is dedicated to producing crafted bitmap images.
- Drawing software—CorelDraw, FreeHand, Illustrator, Designer, and Canvas—is dedicated to producing vector-based line art easily printed to paper at high resolution.

7.5 Keywords

Macros: A macro is a character or word that represents a series of keystrokes. The keystrokes can represent text or commands.

OCR software: Optical Character Recognition (OCR) program can convert the characters on the page into a text document that can be read by a word processing program.

Notes **Spell checker:** A utility that allows you to check the spelling of words. It will highlight any words that it does not recognize.

Text editor: A text editor is a type of program used for editing plain text files.

Word processor: A word processor enables you to create a document, store it electronically on a disk, display it on a screen, modify it by entering commands and characters from the keyboard, and print it on a printer.



1. How do we scan with the OCR software?

Lab Exercise

2. Explain the main image formats use in multimedia system.

7.6 Review Questions

1. What is the text editor? What are its features?
2. What is the difference between source code editor and folding editor?
3. What is the word processor? Write its features.
4. What are the difference between text editing and word processing tools?
5. What is the OCR software? Why we use it?
6. How many types of OCR software are available in the market?
7. What is on-line character recognition?
8. What is the status of OCR software in present scenario?
9. What are the features of painting and drawing tools in multimedia system?
10. Write about some painting and drawing tools use in present scenario.

Answers to Self Assessment

- | | | | |
|--------------|--------|-----------|--------------|
| 1. (b) | 2. (a) | 3. (c) | 4. (c) |
| 5. (a) | 6. (b) | 7. (c) | 8. Coreldraw |
| 9. Photoshop | | 10. Image | |

7.7 Further Reading



Introduction to Multimedia Systems, by Gaurav Bhatnagar, Shikha Mehta.



Online link <http://www.slideshare.net/guestb7a19c/basic-software-tools-for-multimedia>

Unit 8: Fundamental of Animations

Notes

CONTENTS

- Objectives
- Introduction
- 8.1 Principles of Animation
- 8.2 Animation Fundamentals
 - 8.2.1 Model Sheet
 - 8.2.2 Frame
 - 8.2.3 Cycle
 - 8.2.4 Storyboards
 - 8.2.5 Keyframes
 - 8.2.6 Backgrounds
- 8.3 Animation Techniques
 - 8.3.1 Blitting
 - 8.3.2 Page Flipping and Back Buffering
 - 8.3.3 Palette Cycling
- 8.4 Animation File Formats
 - 8.4.1 Adobe Flash
 - 8.4.2 Graphics Interchange Format (GIF)
 - 8.4.3 Autodesk Maya
- 8.5 Summary
- 8.6 Keywords
- 8.7 Review Questions
- 8.8 Further Readings

Objectives

After studying this unit, you will be able to:

- Describe principles of animation
- Explain animation fundamentals
- Understand animation techniques
- Describe animation file formats

Introduction

Animation is the rapid display of a sequence of images of 2D or 3D artwork or model positions in order to create an illusion of movement. The effect is an optical illusion of motion due to the phenomenon of persistence of vision, and can be created and demonstrated in several ways. The most common method of presenting animation is as a motion picture or video program, although there are other methods.

| | |
|--------------|--|
| Notes | The animation industry in India is large and growing. Indian studios work on animation projects for both, the Indian market as well as for international markets in the US and Europe. |
|--------------|--|

8.1 Principles of Animation

It all started after the 1930s when Walt Disney noticed that the level of animation was inadequate for some new story lines. Classes for his animators were set up under the instruction of Don Graham. Before those classes, the animations were made with little or no reference to nature. Out of these classes grew a new way of drawing moving human figures and animals, where the analysis of real action became important to the development of animation. After a while, each technique was named and they became known as the fundamental principles of animation that are listed below:

1. Timing
2. Ease In and Out (or Slow In and Out)
3. Arcs
4. Anticipation
5. Exaggeration
6. Squash and Stretch
7. Secondary Action
8. Follow Through and Overlapping Action
9. Straight Ahead Action and Pose-to-Pose Action
10. Staging
11. Appeal
12. Personality

Simply memorizing these principles is not the point. No one will care whether or not you know this list. It is whether or not you truly understand and can utilize these ideas that matter. If you do, it will show automatically in your work.

1. Timing

Timing is the essence of animation. The speed at which something moves gives a sense of what the object is, the weight of an object, and why it is moving. Something like an eye blink can be fast or slow. If it is fast, a character will seem alert and awake and if it is slow, the character may seem tired and lethargic.

J. Lesseter's example. Head that turns left and right.

- Head turns back and forth really slow: it may seem as if the character is stretching his neck (lots of in between frames).
- A bit faster it can be seen as saying "no" (a few in between frames).
- Really fast, and the character is reacting to getting hit by a baseball bat (almost none in between frames).

2. Ease In and Out (or Slow In and Out)

Ease in and out has to do with gradually causing an object to accelerate, or come to rest, from a pose. An object or limb may slow down as it approaches a pose (Ease In) or gradually start to move from rest (Ease Out).

For example, a bouncing ball tends to have a lot of ease in and out when at the top of its bounce. As it goes up, gravity affects it and slows down (Ease In), then it starts its downward motion more and more rapidly (Ease Out), until it hits the ground.

Notes

Note that this does not mean slow movement. This really means keep the in between frames close to each extreme.

3. Arcs

In the real world, almost all action moves in an arc. When creating animation one should try to have motion follow curved paths rather than linear ones. It is very seldom that a character or part of a character moves in a straight line. Even gross body movements when you walk somewhere tend not be perfectly straight. When a hand/arm reaches out to reach something, it tends to move in an arc.

Simple example – Kicking a ball.

4. Anticipation

Action in animation usually occurs in three sections – the setup for the motion, the actual action, and then follow-through of the action. The first part is known as anticipation. In some cases anticipation is needed physically. For example, before you can throw a ball you must first swing your arm backwards. The backwards motion is the anticipation and the throw itself is the motion. Anticipation is used to lead the viewers eye to prepare them for the action that follows. Longer period of anticipation is needed for faster actions. For example, a character zips off screen leaving a puff of smoke. Usually just before the zip, there is a pose where the character raises a leg and bends both arms as if he's about to run. That is the anticipation pose for the off screen run. Generally, for good clear animation, the viewer should know what is about happen (anticipation), what is happening (the actual action itself) and what happened (related to follow through).

5. Exaggeration

Exaggeration is used to accent an action. It should be used in a careful and balanced manner, not arbitrarily. Figure out what the desired goal of an action or sequence is and what sections need to be exaggerated. The result will be that the animation will seem more realistic and entertaining. One can exaggerate motions, for example, an arm may move just a bit too far briefly in an extreme swing. Generally when animating to dialogue, one listens to the track and picks out areas that sound like they have more stress or importance, and then tends to exaggerate poses and motions that fall at those times.

The key is to take something and make it more extreme in order to give it more life, but not so much that it destroys believability. Example: exaggerating the lamp proportions to give a sense of dad and son.

6. Squash and Stretch

Squash and stretch is a way of deforming an object such that it shows how rigid the object is. For example, if a rubber ball bounces and hits the ground it will tend to flatten when it hits. This is the squash principle. As it starts to bounce up it will stretch in the direction it is going. Squash and stretch was also initially done to prevent strobing due to lack of motion blur. An important note about squash and stretch is that no matter how an object deforms, it should still appear to retain its volume. The most obvious usage in character animation is muscles. When a muscle is contracted it will squash and when extended, it stretches. Rigid objects can still squash and stretch in a way. Think of the lamps above. The lamp itself is a rigid metal object but before it jumps it anticipates the action by crouching down and bending. That bending is basically squash and stretch.

Notes

7. Secondary Action

Secondary action creates interest and realism in animation. It should be staged such that it can be noticed but still not overpower the main action. A good example of this is a character at a table acting and delivering their main acting. A side piece of acting business might be the character thumbing their fingers on the table. This is not the main action say, perhaps it occurs as the other hand is more largely gesturing and your focus is on the face. But it is something that the character is doing/acting that adds a more realistic and natural feel to the animation. As mentioned, it must be staged so that the main action is not overpowered. It is the kind of thing that is usually more subtle or can be felt more than noticed immediately.

8. Follow Through and Overlapping Action

Follow through is the same as anticipation, only at the end of an action. It is usually animated as something goes past its resting point and then coming back to where it would normally be. For example, in throwing a ball, you put your hand back, that is anticipation, it is the preparation for throwing action itself. Then you throw the arm comes forward for the main action. Follow through is then the arm continuing past the normal stopping point, overshooting it and then coming back. The arm has continued or “followed through” on the action it was doing before returning back to rest.

Overlapping action is an action that occurs because of another action. For example, if a dog is running and suddenly comes to a stop, its ears will probably still keep moving for a bit. Another example, if an alien is walking and it has an antenna on it, the antenna will probably sway as a result of the main body motion. This is overlapping action. It is caused because of the main motion and overlaps on top of the main motion.

9. Straight Ahead Action and Pose-to-Pose Action

There are two basic methods for creating animation. Straight ahead animation is one where the animator draws or sets up objects one frame at a time in order. For example, the animator draws the first frame of the animation, and then draws the second, and so on until the sequence is complete. In this way, there is one drawing or image per frame that the animator has setup. This approach tends to yield a more creative and fresh look but can be difficult to time correctly and tweak.

The other approach is Pose-to-Pose animation. Pose-to-Pose is created by drawing or setting up key poses and then drawing or creating in between images. This is the basic computer “keyframe” approach to animation. It is excellent for tweaking timing and planning out the animation ahead of time. You figure out the key poses, and then the motion in between is generated from that. This is very useful when specific timing or action must occur at specific points. You always know exactly what will happen. The basic difference is with Pose-to-Pose you plan out, and know exactly what will happen ahead of time, whereas with straight ahead, you are not quite sure how things will turn out until you are done. With computers, some people tend to create a hybrid of the two, planning out the overall poses, and then straight ahead animating the stuff in between.

10. Staging

Staging is presenting an action or item so that it is easily understood. An action is staged so that it is understood; a personality is staged so that it is recognizable; an expression so that it can be seen; a mood so that it will affect the audience.

In general, it is important that action is presented one item at a time. If too much is going on, the audience will be unsure what to look at and the action will be “upstaged”. With characters, it is important to really think about whether or not each pose for an action adequately and correctly reads to the audience. You should also make sure no two parts of a character contradict each other (unless it is intended). For example, if you are staging a sad pose you may have the character hunched over with his arms hanging at his sides and a high camera angle... but if you give him this big grin on his face it would not fit with the rest of the pose.

Staging multiple characters is also an important issue. Generally, you want to always make sure that where the audience is looking within the shot. Background characters must be animated such that they are still “alive”, but not so much that they steal the viewer’s attention from the main action. Staging like this is also related to a lot of directing and editing principles.

Notes

11. Appeal

Appeal means anything that a person likes to see. This can be quality of charm, design, simplicity, communication or magnetism. Appeal can be gained by correctly utilizing other principles such as exaggeration in design, avoiding symmetry, using overlapping action and others. One should strive to avoid weak or awkward design, shapes and motion.

It is important to note that appeal does not necessarily mean good versus evil. For example, in Disney’s animated classic “Peter Pan”, Captain Hook is an evil character, but most people would agree that his character and design has appeal. The same goes for Hopper in “A Bug’s Life”. Even though he’s mean and nasty, his design and characterization/personality still has a lot of appeal.

12. Personality

This word is not actually a true principle of animation, but refers to the correct application of the other principles. Personality determines the success of an animation. The idea is that the animated creature really becomes alive and enters the true character of the role. One character would not perform an action the same way in two different emotional states. No two characters would act the same. It is also important to make the personality of a character distinct, but at the same time be familiar to the audience.

Personality has a lot to do with what is going on in the mind of the character, as well as the traits and mannerisms of the character. It is helpful to have some background in acting, and certainly taking acting or improve class as an animator is a good idea.



The Twelve Basic Principles of Animation is a set of principles of animation introduced by the Disney animators Ollie Johnston and Frank Thomas in their 1981 book: *The Illusion of Life: Disney Animation*.

8.2 Animation Fundamentals

Many of us grew up watching cartoon characters every Saturday and Sunday mornings, but we never really appreciated the work that went into making them. In this section, you will be looking at animation fundamentals and techniques that have been around for many years. These gave birth to talking rabbits, wacky ducks, and a mouse named Mickey.

Animation is the art of creating the illusion of movement from inanimate objects. Before we had full-motion moving pictures, there was animation. Flipbooks were small books with pages where small caricatures were drawn. As you flipped the books from front to back, the drawings looked as though they were animated. Some flipbooks came empty, and you could add your own drawings. Flipbooks gave the illusion that the cartoon character in the pages was actually moving before our eyes. This illusion is the cornerstone of animation.

8.2.1 Model Sheet

If you are going to create a character to animate, it usually helps to have a model sheet, which is a series of poses of the character to refer to when you are animating. The sheet could include poses of the character standing still, bouncing a ball, smiling, jumping and running.

The idea is to draw the emotions and actions that would be expected from the character. If your animations are going to be much simpler than an animated person or animal, however, a model sheet might not be necessary.

Notes**8.2.2 Frame**

A frame is a snapshot in time. If you were to take your favourite animated movie and pause the playback for a split second, you would see one frame of animation. Imagine a bird in flight. If you could stop this bird while it was flying along its course, you might see the wings folded slightly. Maybe its eyelids are opening or closing, and maybe the beak is slightly open. If you paused the playback a second later, the next frame would look different.

8.2.3 Cycle

Animation moves in cycles, and a cycle is a series of frames that make up an action. For example, the cycle of walking can be made up of about eight frames. This cycle begins with the character picking up his right foot with his right shoulder raised slightly. The cycle continues until frame 4, where the right foot is back on the ground. Then the same process happens with the left foot. Finally, frame 8 ends with the left foot being put back on the ground. Cycles can be repeated, if necessary, thus reducing the need for creating the animated frames from scratch.

When frame 8 of the walking cycle is finished, for example, just start over with frame 1. The character can walk on forever, if you want. A complex animation, such as those seen in cartoons, is made up of many individual cycles.

For example, the character moves to a specific spot (cycle 1). The character stands and acts as though he or she is thinking about something (cycle 2). The character suddenly does an about face (cycle 3). Finally, the character walks back the way he or she came (cycle 4).

8.2.4 Storyboards

Now comes the question "How do we decide what we need and how it is organized?" This is where the storyboard comes in. Storyboards are a series of small panels showing major scenes of action in the animation. Through the use of a storyboard, lead animators could create sample drawings of the scenes as they imagined them and write in the dialogue just below the storyboard panes. Today developers of multimedia applications use similar processes to organize the action before they begin actual development.

8.2.5 Keyframes

Lead animators would then take these storyboard scenes and create individual frames of the animation at specific pivot points in the action. These points are called keyframes. Keyframes are drawn where parts of the character's body reach their full range of motion. For example, an arm can bend only so far back before it breaks. If the character has reached that point in the animation, then that frame of animation should be a keyframe. The same goes for head movements and anybody appendages. These drawings create the templates from which other animators can create the finished frames of the cartoon.

8.2.6 Backgrounds

So, you have created an animation. It looks fantastic, but it is just bouncing around on a blank screen. Now you need to create a background, which is the environment you want to add to your scene that helps set the mood for the animation. Backgrounds were painted in earlier animated cartoons, but more and more of them have moved to using computer-generated backgrounds.



Storyboards were brought into the mainstream of animation with the Walt Disney studios.

8.3 Animation Techniques

Notes

8.3.1 Blitting

Blitting is the process of taking rectangles from off-screen drawing surfaces and copying them onto primary or secondary drawing surfaces. Blitting is much like taking pieces of a jigsaw puzzle and assembling the finished product on a table.

8.3.2 Page Flipping and Back Buffering

Page flipping is the process of cycling through the drawing surfaces, or pages. In back buffering, you populate these surfaces with new frames of information. With these two techniques, you can create true animation by creating a frame, displaying the frame, creating the secondary surface, and then displaying it.

Before the flip occurs, users see a single vehicle going east. What they are seeing at that point is the primary surface. While this is going on, the secondary surface is being redrawn with an additional vehicle, a little bit larger, going west. When the flip occurs, the users' view is changed to the secondary surface. In essence, the secondary surface in the previous frame is now the primary surface, and vice versa. Users now see both the vehicles. Since the car going east will have travelled off the screen in the next frame, you remove it from the secondary surface. The secondary surface is now redrawn to get ready for the next flip.

8.3.3 Palette Cycling

Palette cycling can best be visualized by imagining a painter's palette. Painters use a palette of colours to create their paintings. Just imagine what would happen if they changed a few of the colours on their palettes to new colours, and that change resulted in the colours in their painting automatically changing, too. You would have the same painting, but with a few colours changed. If you continued to do that, some of the images in the painting would look animated, simply because you had changed their colours over and over. This effect is called palette animation, and this technique can be used to create psychedelic effects such as those popular in the 1970s. You can also use it to create fading effects on objects and text to give the impression that they are appearing or disappearing.



Task

Give the use of page flipping and back buffering with the suitable example.

Self Assessment

Choose the correct answer:

1. is the essence of animation.

| | |
|------------------|------------------|
| (a) Timing | (b) Arcs |
| (c) Anticipation | (d) Exaggeration |
2. Action in animation usually occurs in sections.

| | |
|----------|-------------------|
| (a) four | (b) three |
| (c) two | (d) None of these |
3. Rigid objects can still squash and stretch in a way.

| | |
|----------|-----------|
| (a) True | (b) False |
|----------|-----------|

8.4 Animation File Formats

8.4.1 Adobe Flash

Adobe Flash is a multimedia platform used to add animation, video and interactivity to Web pages. Flash is frequently used for advertisements, games and flash animations for broadcast. More recently, it has been positioned as a tool for “Rich Internet Applications” (“RIAs”).

Flash manipulates vector and raster graphics to provide animation of text, drawings and still images. It supports bidirectional streaming of audio and video, and it can capture user input via mouse, keyboard, microphone and camera. Flash contains an object-oriented language called ActionScript and supports automation via the Javascript Flash language (JSFL).

Flash content may be displayed on various computer systems and devices, using Adobe Flash Player, which is available free of charge for common Web browsers, some mobile phones and a few other electronic devices (using Flash Lite).

File Format

Flash files are in the SWF format, traditionally called “ShockWave Flash” movies, “Flash movies,” or “Flash applications”, usually have a “.swf” file extension, and may be used in the form of a Web page plug-in, strictly “played” in a standalone Flash Player, or incorporated into a self-executing projector movie (with the .exe extension in Microsoft Windows). Flash Video files have an “.flv” file extension and are either used from within .swf files or played through a flv-aware player, such as VLC, or QuickTime and Windows Media Player with external codecs added.

The use of vector graphics combined with program code allows Flash files to be smaller – and thus for streams to use less bandwidth – than the corresponding bitmaps or video clips. For content in a single format (such as just text, video or audio), other alternatives may provide better performance and consume less CPU power than the corresponding Flash movie, for example when using transparency or making large screen updates such as photographic or text fades.

In addition to a vector-rendering engine, the Flash Player includes a virtual machine called the ActionScript Virtual Machine (AVM) for scripting interactivity at run-time, support for video, MP3-based audio and bitmap graphics. As of Flash Player 8, it offers two video codecs: ON2 Technologies VP6 and Sorenson Spark, and run-time support for JPEG, Progressive JPEG, PNG and GIF. In the next version, Flash is slated to use a just-in-time compiler for the ActionScript engine.

Flash Player is a browser plugin, and cannot run within a usual e-mail client, such as Outlook. Instead, a link must open a browser window. A Gmail labs feature allows playback of YouTube videos linked in e-mails.

8.4.2 Graphics Interchange Format (GIF)

The Graphics Interchange Format (GIF) is a bitmap image format that was introduced by CompuServe in 1987 and has since come into widespread usage on the World Wide Web due to its wide support and portability.

The format supports up to 8 bits per pixel thus allowing a single image to reference a palette of up to 256 distinct colours. The colours are chosen from the 24-bit RGB colour space. It also supports animations and allows a separate palette of 256 colours for each frame. The colour limitation makes the GIF format unsuitable for reproducing colour photographs and other images with continuous colour, but it is well-suited for simpler images such as graphics or logos with solid areas of colour.

The GIF images are compressed using the Lempel Ziv Welch (LZW) lossless data compression technique to reduce the file size without degrading the visual quality. This compression technique was patented in 1985. Controversy over the licensing agreement between the patent holder, Unisys and CompuServe in 1994 spurred the development of the Portable Network Graphics (PNG) standard; since then all the relevant patents have expired.

File Format**Notes**

Conceptually, a GIF file describes a fixed-sized graphical area (the “logical screen”) populated with zero or more “images”. Many GIF files have a single image that fills the entire logical screen. Others divide the logical screen into separate sub-images. The images may also function as animation frames in an animated GIF file, but again these need not fill the entire logical screen.

The GIF has “.gif” file extension and these files start with a fixed-length header (“GIF87a” or “GIF89a”) giving the version, followed by a fixed-length Logical Screen Descriptor giving the size and other characteristics of the logical screen. The screen descriptor may also specify the presence and size of a Global Colour Table, which follows next if present.

Thereafter, the file is divided into segments, each introduced by a 1-byte sentinel:

- An image (introduced by $0 \times 2C$, a comma ',')
- An extension block (introduced by 0×21 , an exclamation point '!')
- The trailer (a single byte of value $0 \times 3B$, a semi-colon ';'), which should be the last byte of the file.

An image starts with a fixed-length Image Descriptor, which may specify the presence and size of a Local Colour Table (which follows next if present). The image data follow: one byte giving the bit width of the unencoded symbols (which must be at least 2 bits wide, even for bi-colour images), followed by a linked list of sub-blocks containing the LZW-encoded data.

Extension blocks (blocks that “extend” the 87a definition via a mechanism already defined in the 87a spec) consist of the sentinel, an additional byte specifying the type of extension, and a linked list of sub-blocks with the extension data. Extension blocks that modify an image (like the Graphic Control Extension that specifies the optional animation delay time and optional transparent background colour) must immediately precede the segment with the image they refer to.

The linked lists used by the image data and the extension blocks consist of series of sub-blocks, each sub-block beginning with a byte giving the number of subsequent data bytes in the sub-block (1-255), the series terminated by the empty sub-block (a 0 byte).

This structure allows the file to be parsed even if not all parts are understood. A GIF marked 87a may contain extension blocks. The intent is that a decoder can read and display the file without the features covered in extensions it does not understand.

8.4.3 Autodesk Maya

Autodesk Maya commonly shortened to Maya, is 3D computer graphics software that runs on Microsoft Windows, Mac OS and Linux, originally developed by Alias Systems Corporation (formerly Alias Wavefront) and currently owned and developed by Autodesk, Inc. It is used to create interactive 3D applications, including video games, animated film, TV series or visual effects. The product is named after the Sanskrit word Maya, the Hindu concept of illusion.

Maya is an application used to generate 3D assets for use in film, television, game development and architecture. The software was initially released for the IRIX operating system. However, this support was discontinued in August 2006 after the release of version 6.5. Maya was available in both “Complete” and “Unlimited” editions until August 2008, when it was turned into a single suite.

Users define a virtual workspace (scene) to implement and edit media of a particular project. Scenes can be saved in a variety of formats, the default being .mb (Maya Binary). Maya exposes node graph architecture. Scene elements are node-based, each node having its own attributes and customization. As a result, the visual representation of a scene is based entirely on a network of interconnecting nodes, depending on each other information. For the convenience of viewing

Notes

these networks, there is a dependency and a directed acyclic graph. Autodesk Maya usually has “.ma” file extension.



Task

Create a 3D image using Maya software.



Case Study

The Success Story of an Indian Animation Company

Case Study

It has been an eventful five years for 32-year-old Rajiv Chilakalapudi ever since he began to nurture his Hyderabad-based animation company, Green Gold Animation Pvt. Ltd.

The company that started with just four people in 2001 is now 70-strong. But Chilakalapudi says ‘the employee strength will rise to 1,000 in the next three years’. As managing director of Green Gold Animation, he speaks at major business forums in India – like the ones organised by FICCI, NASSCOM, etc. – as an expert in the field.

The products from his company – Vikram aur Betal and Krishna are aired on Cartoon Network and Doordarshan. More programmes are on the way, he assures.

In a candid chat with rediff.com, Rajiv speaks about how he made his passion a success.

Cartoons, a Passion Even as a Child

Like all kids, I too was really fascinated by cartoons as a child. I remember getting up very early in the morning on Saturdays and Sundays to watch the Disney cartoons on Doordarshan. I used to wonder why there were only Mickey Mouse and Donald Duck and no Indian characters.

Though I was not an artist, I had lots of ideas then and there. I went on to do engineering as there were no courses on animation back then.

After my graduation from Osmania University in 1995, I went to the USA to do Masters in Computer Science. I worked as a software engineer in the US for three years. All through my studies, and also later on, my desire was to be in the animation industry.

Three years into my job as a software engineer, I began looking at the animation industry with more interest. I found that there were not many animation companies in India, and saw a large potential in the market.

Learning Animation

I saved as much money as I could in those three years and went to an animation school in San Francisco.

I then knew animation was what I wanted to do in my life. What I was doing till then was just mundane work where there was no creativity. I did not enjoy what I was doing. I decided to come back to India. It was intuition that gave me the courage to chuck my well paying job and come back to India to start my own animation company.

My parents were shocked. My father flew down to the United States to dissuade me. He asked me, “Are you crazy? Why do you want to do this?” I managed to convince him how passionate I was about my plans. Then he wanted to see my business plan. When I showed him my plan, he felt it was a good one, that there was future in it and that it was worth taking the risk.

I came back not only because India is a huge market but also because I love my country. I am very patriotic and I believe that India will be a superpower soon.

Contd...

Animation Company in Hyderabad

I did not waste time after I reached Hyderabad. I looked for a place immediately. We started with four people. We could not find any animators then. So, we recruited technical people.

I not only invested whatever I had saved but my father's and brother's money too. Altogether my initial investment was about ₹ 75 lakh (₹ 7.5 million). We needed ₹ 50 lakh (₹ 5 million) for the machinery itself. When we started out, the machinery was very expensive. Even the software was worth ₹ 8 lakh (₹ 800,000), but all that has come down now.

Green Gold Animation Pvt. Ltd.

The year was 2001. We named our company Green Gold Animation Pvt. Ltd. I wanted a colourful name. Green is nature and nature is associated with creativity. And, gold is Goddess Lakshmi.

What we did first was create a presentation for a US-based corporate though it was actually not our forte. But initially we decided to do all the jobs that came our way.

Although we did a lot of animation for advertisers, nobody was interested in any animation products, I found. So, we decided to create our own product.

Created an Alien Named Bongo

Although it was a big risk, we created Bongo. It is an animation-cum-live action television series more on the lines of the alien in the film, *Koi Mil Gaya*. Bongo is a friendly alien who helps people. We spoke to many TV channels but nobody was interested; everyone wanted only *saas-bahu* serials.

We then approached Doordarshan. Luckily for us, they were looking for children's programmes then. Our programme was first aired on Doordarshan by the end of 2004. Although there were gaps in between, it still is shown on Doordarshan every Saturday afternoon.

It was a great day for us when Bongo was first aired on Doordarshan. We were all eagerly waiting; the titles came and then the power went off. It was an anti-climax. The response also was amazing. It was at number three among all the kids' programmes.

Deal with Cartoon Network

Then we approached Cartoon Network with the idea of *Vikram aur Betal*. They were not sure about the commercial success of the idea. So they asked us to develop the product and show it to them. The risk was ours.

As we believed in our quality, we made the entire show and delivered it to Cartoon Network. They loved the programme and bought it. That was again, 2004. *Vikram aur Betal* was a turning point for us. It gave us a huge mileage.

Here Comes Krishna!

After *Vikram aur Betal*, we spoke to Cartoon Network about the tales of Lord Krishna. They accepted that too. The first part of *Krishna*—about his birth—was shown on Janmashtami day this year. It is a 75-minute programme which will be aired on Cartoon Network every three months. It is more like a feature film.

The Struggle

We struggled immensely in the initial years. For five years, there was nothing but work for us. When we create original content, it is very difficult to sell it. If we cannot sell a product, what will happen to the company? It was a very big risk we were taking.

As the market was at a nascent stage then, we thought we would suffer now so that the returns would come later. Our patience paid off as today we are a brand name in the animation industry.

From India, we are the number one animation supplier to Cartoon Network.

Notes

Contd...

| | |
|--------------|---|
| Notes | <p>Now, we have 70 people working with us. Our revenue is around ₹ 2 crore (₹ 20 million) this year. We expect to double our revenues every year. Now the sky is the limit. I have faith that one day we will make a world renowned movie and will make India proud of us.</p> <p>Indian content is as yet unexplored and in the future you will see Indian stories being watched all over the world. People are tired of seeing the same old Jack and Jill stories. Indian characters are unique and they will rule the world soon.</p> <p>The first successful animation film was <i>The Jungle Book</i> and it was based in India and all the characters are Indian and have Indian names. Our first animation feature film of 100 minutes will be on <i>Lord Ganesh</i> and it will be released on the next Ganesh Chaturthi in 2007.</p> <p>We want to start animation schools all over India as there is severe manpower shortage and a lot of poaching takes place now, which is not healthy for the industry. We may require 1,000 people in the next three years. Our ambition is to be the number one in the world like Walt Disney. In the next 10 years, we want to be a global player.</p> |
| | <p>Questions:</p> <ol style="list-style-type: none">1. Prepare a list of animation institutes in India.2. What are the risk factors Green Gold Animation Pvt. Ltd. faced? |

Self Assessment

Choose the correct answer:

4. A is a snapshot in time.

(a) arc (b) cycle
(c) frame (d) None of these

5. The JSFL stands for

(a) Javascript Flash Language (b) Javascript Flash Locomotive
(c) Javascript Flap Language (d) None of these

6. Flash Player is a browser plugin, and can run within a usual e-mail client such as Outlook.

(a) True (b) False

7. The “.mb” stands for

(a) Mega byte (b) Maya Binary
(c) Maya Byte (d) None of these

8. The Graphics Interchange Format file supports up to bits per pixel.

(a) 4 (b) 16
(c) 8 (d) None of these

8.5 Summary

- Animation is a simulation of movement created by displaying a series of pictures, or frames.
 - Keyframes are drawn where parts of the character's body reach their full range of motion.
 - The GIF images are compressed using the Lempel Ziv Welch lossless data compression technique to reduce the file size without degrading the visual quality.

- Squash and stretch was initially done to prevent strobing due to lack of motion blur.

Notes

8.6 Keywords

Model sheet: It is a series of poses of the character to refer to when you are animating.

Overlapping action: It is an action that occurs because of another action.

Page flipping: The process of cycling through the drawing surfaces or pages is known as page flipping.

Squash and stretch: It is a way of deforming an object such that it shows how rigid the object is.

Storyboards: They are a series of small panels showing major scenes of action in the animation.



1. Add a video to Web using Adobe flash.

Lab Exercise

2. Compress a GIF image using the Lempel Ziv Welch (LZW) technique.

8.7 Review Questions

1. Define animation.
2. What do you mean by squash and stretch?
3. Explain the importance of timing in animation.
4. Explain secondary action with suitable example.
5. Define follow through principle for animation.
6. What do you mean by Pose-to-Pose animation?
7. Explain the fundamentals of animation.
8. What are the different techniques available in animation?
9. Describe Adobe Flash.
10. Define Graphics Interchange Format.

Answers to Self Assessment

- | | | | |
|--------|--------|--------|--------|
| 1. (a) | 2. (b) | 3. (a) | 4. (c) |
| 5. (a) | 6. (b) | 7. (b) | 8. (c) |

8.8 Further Readings



Books

"Advanced Multimedia Programming", by Steve Rimmer MHI, 2000.

"Multimedia System Design", by K. Andleigh and K. Thakkar PHI, PTR, 2000.



Online link

<http://books.google.co.in/books?id=1odsKtv46ZQC&lpg=PA193&ots=muU4yj5Ab8&dq=Fundamental%20of%20Animations&pg=PA193#v=onepage&q&f=false>

Unit 9: Working with Animation

CONTENTS

- Objectives
- Introduction
 - 9.1 Video and Digital Movie Tools
 - 9.1.1 Video Editing Software
 - 9.1.2 DVD Authoring Software
 - 9.1.3 Video Processing Software
 - 9.1.4 Video Encoder Software
 - 9.1.5 Multimedia Player
 - 9.2 Multimedia Authoring Tools
 - 9.2.1 Multimedia Development Tools
 - 9.2.2 Features of Authoring Software
 - 9.2.3 Authoring Tools
 - 9.2.4 Types of Authoring Tools
 - 9.3 Components of an Authoring Tool
 - 9.4 Summary
 - 9.5 Keywords
 - 9.6 Review Questions
 - 9.7 Further Reading

Objectives

After studying this unit, you will be able to:

- Describe video and digital movie tools
- Explain various types of multimedia authoring tools
- Understand components of an authoring tool

Introduction

It is essentially animation that can be produced on a computer. This can vary from the crude paper style drawings of South Park to the 3D computer generated imagery of films such as Toy Story and Shrek.

In many ways, this is an extension of classic stop motion animation. Each image is created in the computer using a program. Some artists use what is known as a tablet in order to draw images that are used in the animation. It is argued this is a more natural feeling method than creating an image using a mouse, though there are people that use both options.

It works often depends on what you are trying to achieve. With a 3D character it often begins with a virtual skeleton that the animator then builds around. With 2D figures it is about using separate object and transparent layers. This may or may not involve the use of a virtual skeleton.

In order to create the illusion of movement, it usually requires around 12 frames per minute. A frame is a single picture and the contrast when viewing the pictures makes it seem smooth. Conventional hand drawn animation is usually around 15 frames although this more due to the constraints of having to physically draw the pictures.

Notes

A new development in recent years has been motion capture. This was used to memorable effect in the Lord of the Rings films to create the CGI character Gollum. The actor Andy Serkis wore a suit with coloured dots on it around his limbs and the animators creating the virtual skeleton and rendered the character from his movements.

When looking at digital animation a lot of people make the mistake of thinking that it makes the process easier. While some aspects may become simpler it often throws up new and interesting challenges, such as how to effectively animate blades of grass blowing in the wind or realistic looking fur. It also needs to be remembered that it is a medium for telling a story and the most successful animations remain the ones with the best stories and characters.

9.1 Video and Digital Movie Tools

Today, creating digital movies has become fairly simple and you can start with good quality digital cameras equipped with video recording capabilities. The ones created by Sony or Panasonic should do fine. Armed with a working device, even a novice can make good home movies to share with family and friends. And if it is really good, it could be bought by interested parties for other purposes. Creating digital video is now a popular hobby ever since YouTube and similar video blogging sites have garnered massive traffic in the Internet world.

You can make movies with a simple video camera. Simply catch the scenes, upload the file created on your computer, and play it. But if you want your digital videos to look less like the work of an amateur, you have got to start using digital video tools. Here are the programs that you are going to need:

9.1.1 Video Editing Software

If you want to add captions, background music and even delete unnecessary scenes from your video file, you are going to need some comprehensive video editing software. There are two types of video editing software: one is for the home user and the other is for the professional. Consumer video editing software has limited features compared with that of professionals.

With this tool, you can add effects to your film, put animated text in it, make the shot brighter or dimmer and even remove the shakes and out of frame shots that amateurs usually make. You can even add an entirely new story to your video with these tools. Examples of the more popular video editing software are Windows Movie Maker, Apples iMovie, and ArcSoft Inc's ShowBiz DVD.



Task

Develop a movie using digital movie tools to enhance the quality of a movie.

9.1.2 DVD Authoring Software

If you want to convert your movie into the more current DVD format, then you are going to need this tool. The DVD authoring software is a digital video tool that is designed to convert the default output file of your video camera into DVD format. With this software, you do not need to buy a new digital camera that automatically stores data into DVD. Your old Web camera can produce DVD movies with this software. You can also download other files off the Internet, no matter the format they use, and add it to your DVD movie. All of this can be done with a few clicks of a button.

Notes

9.1.3 Video Processing Software

There are times you need to convert certain formats of video, or even audio, into another format. For example, you may want to transform a .wmv file into mpeg or an .avi to .wmv. These are the most common digital video formats today. And video processing software is the one that you are going to need if you need to do jobs like these. An mpeg format cannot be used for media streaming. Therefore, you need to change its format to what is compatible. Some video processing software can even clean and master a video file so that the output format has quality that is comparable to the original.

9.1.4 Video Encoder Software

Depending upon the type of video editing software you use, you are going to need one or more video encoding and decoding software. The main job of these encoders and decoders is for video compression. Video encoder software does not standalone. More often than not, they are plug-ins that the video editing software needs to do a particular job. As such, it installs inside a compatible editor. The editor and the encoder are sold separately because usually, a different group of programmers have created one and the other. And so for you to use the software, you have got to acquire the necessary rights first.

9.1.5 Multimedia Player

You cannot possibly enjoy your video if you do not have multimedia player or viewer software. The main purpose of this software is to play back the movie you have created. They are multimedia players which mean they can play video files of all types and formats. It can also play the audio that comes with the video, including any other special effects you have in it. Some players can also process video files in batches for continuous play.

These are the different digital video tools that you need to make that perfect home video. And these are the same programs that professionals use. So, if you want to create videos that are as good as what expert movie makers create, start by getting these necessary tools today!

Self Assessment

Choose the correct answer:

9.2 Multimedia Authoring Tools

A multimedia production needs to be interactive. We will try to answer the question how multimedia production can be made interactive. Several tools are used for developing interactive multimedia. These are:

- authoring systems
- authoring languages

Notes

The term authoring results from the fact that the person creating the learning material on the computer is often called the author.

Authoring systems are generally menu-driven systems intended to be easy to use by the multimedia developer. They do not require the trainer to get involved with program code. Such systems endeavour to provide a complete, comprehensive authoring.

9.2.1 Multimedia Development Tools

A multimedia development environment is the glue that combines different media elements like images, sounds, text and animation into a coherent project that the user can explore. Although programs such as Photoshop and Infinite-D enable the user to create bit-mapped graphics or 3D illustrations, they do not allow adding buttons or data fields. This really limits the productions created by the user, and that is why he will nearly always want to have access to some kind of development environment such as HyperCard, Director, Authorware, etc.

The presentation tools available for multimedia development can be divided into three categories.

1. Slide Presentation Environments
2. Interactive Presentation Environments
3. Authoring Environments

Programs such as HyperCard, Director, etc. add another element to be multimedia developer's arsenal *i.e.*, scripting. Scripting really means programming, because you write "scripts" using a programming language that the development environment understands. The scripts or programs perform various functions such as importing a text file or sorting a list of words.

With scripting, it is possible to create very complex interactions between the user and the presentation. For example, by clicking, a single button, the user might inquire about a subject and then find all the information available on that subject in the presentation.

The authoring environments can be used to create slide presentation or simple interactive presentations but what sets them apart from the other classes of programs is the ability to write scripts and create complex interfaces.



The authoring software must be supported by add-on boards and peripheral devices to play multimedia otherwise it will not work accurately.



Task Using HyperCard develop a multimedia image.

9.2.2 Features of Authoring Software

Authoring software is the main production tool for multimedia. 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, capabilities, and learning capabilities of the user. Most of the authoring systems require some basic knowledge of heuristic thinking and algorithm design. Authoring actually is just a speed-up form of programming; although you need not know the intricacies of a programming language yet you do need to understand how programs work.

Notes The main features of authoring software are:

- Integrated multimedia elements
- Script language programs
- Icon based programs
- DLLs for extending features
- Supporting CD-ROM or laser disc sources
- Supporting video for windows
- Hypertext
- Cross-platform capability
- Runtime player for distribution

Integrating Multimedia Elements

It is essential for authoring software to support a wide area of format with different media elements. The final feature of authoring is to build interactivity.

- Authoring programs provide developers with a greater degree of control over each multimedia element than presentation programs.
- Authoring programs are geared towards education and training applications, as well as business presentations.

Script Language Programs

Authoring software offers the ability to write scripts for software to build features that are not supported by the software itself. Script language programs create multimedia presentations from a series of programming style commands linked together in a word processing typescript.

The scripting languages are closest in form to traditional programming. The scripting language specifies (by filename) multimedia elements, sequencing, hotspots, synchronization, etc. A powerful, object-oriented scripting language is presently available with many authoring systems. In such languages, the program editing of elements (still graphics, video, audio, etc.) tends to be minimal or non-existent. The scripting takes longer time in development (it takes longer to code an individual interaction), but generally allow more powerful interactivity. Since most scripting languages are interpreted, instead of compiled, the runtime speed gains over other authoring methods are minimal. However, it supports better and more complex media interactivity. The script language programs are powerful programs but can be difficult to learn. These programs are not readily transported to other hardware platforms.

Icon-based Programs

Although a multimedia project is a big task; makers of authoring software try to make it easy by using graphical icons as the control features of the authoring package program.

The main features of icon-based programs are:

- Icon-based programs are easier to learn than scripting programs;
- Editing individual elements in a presentation requires only clicking on its icon. Icon-based authoring programs are object oriented development programs where individual multimedia elements are represented by icons rather than script commands.

This tends to be the fastest (in development time) authoring style. Such programs are best suited for rapid prototyping and short-development time projects. Many of these tools are also optimized for developing Computer-based Training (CBT). The core of such programs is the Icon Palette,

containing the possible functions/interactions of a program, and the Flow Line, which shows the actual links between the icons. These programs tend to be the slowest at runtime, because each interaction carries with it all of its possible permutations. However, the higher end packages, such as Authorware or Icon Author are extremely powerful and suffer least from runtime speed problems.

Notes**Dynamic Linking Libraries for Extending Features**

Advanced authoring programs can call on special features included in the windows Dynamic Linking Libraries (DLLs). Many add-on boards and peripheral devices include specialized DLLs upon installation. They can be called on for special functions that may not be available in the authoring software program. Specialized programming languages such as C++ allow users to create their own DLLs for enhanced functions.

Supporting CD-ROM or Laser Disc Sources

Storing arrays of audio and video on hardware is often not practical to get the quality and speed as might be desired. Authoring software allows full control of CD-drives to integrate audio, video and computer files. Authoring programs support direct control of CD-ROM drives, video sources. This is provided through the MCI command language.

Multimedia presentations that depend on large amounts of sound or video clips require excessive amounts of hard disk space. The presentation system can be configured by having a CD-ROM drive as the sound source and a laserdisc or DVD player as a video source. Both the pieces of hardware are controlled by the authoring software in a seamless manner.

Supporting Video for Windows

Video stored on hard disk is sometimes the right media for your project. Authoring software has the capability to support most multimedia elements like video for windows.

The latest version of Authorware Professional from Macromedia permits the loading of video clips from video for windows and animation clips from Autodesk.

Hypertext

Words can be made into buttons that will take you to cross-reference in a program. Hypertext capabilities can be used to link graphics, some animation and of course other text.

Hypertext programming interfaces allows users to select individual Hot Words on a screen, which are then linked to additional pages and layers of text. The help system of windows is an example of hypertext. Hypertext systems are useful when presenting and referencing large amounts of textual information. Some hypertext authoring programs provide graphical links for animation, sound and video as well as text.

Cross-platform Capability

Authoring software can even package a multimedia project to play on other computer types with appropriate planning. This works successfully to broaden your potential audience. An important consideration with authoring programs is their capability to be altered for presentations on Macintosh or other hardware platforms. Some authoring programs are available on several platforms and provide tools for transforming and converting files and programs from one to the other.

Run-time Player for Distribution

Run-time software is often included in authoring software to explain the distribution of your final product by packaging playback software with your content. Advanced authoring programs

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| Notes | provide specialized packaging and run-time distribution for use with devices such as CD-ROMs. Care must be taken when using run-time players for advanced authoring systems that all specialized DLLs, run-time modules for other programs and non-system fonts used in the presentation are packaged together when the final product is distributed. |
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Did u know?

Early script languages are called batch languages or job control languages. Such early scripting languages were created to shorten the traditional edit-compile-link-run process.

9.2.3 Authoring Tools

Authoring can be described as creating highly interactive applications in which the information can flow in both the directions, *i.e.* from application to user and from user to application. Multimedia authoring tools has helped in creating higher-quality audio and video applications with very little expertise.

Authoring does not require a team of programmers, instructors, corporate communications and content specialists with no previous programming experience should be able to learn and use the authoring environment.

At last, authoring programs could be grouped into the following two distinct types:

1. Those that relied entirely on point and click and
2. Those that required simple scripting.

The advantage of using object-oriented programming has been inculcated in the authoring products like Everest Authoring System offers object instancing, while Media Verse and Oracle Media Objects allows to add new methods and events to existing objects.

Supplied templates in Authorware and Media Verse saves the time in implementing specific functionality. In order to create effective multimedia, one need tools that can handle a wide range of authoring tasks, including interactive title development, CBT, interactive catalogues/kiosks and Web authoring.

The CD-ROM's interactive title development task focuses on the flexibility and power of screen design tools and support for managing memory requirements and playback data rates. Also the ability to create cross-platform applications looked for.

Creation of CBT stresses wizards, templates and other tools designed to make it easier for non-programmers to generate applications. Other features included the ability to interface with a database either proprietary or via Open Database Connectivity (ODBC) for tracking student performance, and special tools designed for creating exercises.

As the ultimate goal of interactive catalogues/kiosks is to sell things, so the products that offer robust database-handling tools would be best suited for processing sales transactions.

The Web authoring task involves generating an application that can be played by a helper application from within a Web browser, or something as complex as a standalone application designed to stream data from the server over TCP/IP connections and onto the user's browser without making the user download the application.

The following subsections discuss a few important authoring tools:

Authorware

Macromedia's Authorware is a dependable industrial-strength environment that allows multiple people to contribute to an application. Artists can load a library with media, programmers can provide templates for complex interactions, and interface designers can put everything together. And one non-programming designer can even do the entire job alone.

Authorware-3 allows authoring of programs in identical environments on either the PC or the Macintosh and produce runtimes for either. Authorware's icons hold a wealth of programming information that never requires the user to think like a programmer.

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Some icons in Authorware can manipulate media on the screen. They can display and erase graphics, move or animate objects, play. The Audio Video Interleave (AVI) and Quick Time digital movies as well as WAV sound files, and access videodisk and videotape players.

The new framework icon automates hypermedia interactions and provides a default navigation structure. With a 10 page document in rich text format (RTF), it is easy to import it into the first "page" of framework using Authorware. Authorware can create a new display page for each hard page break in a RTF file. Eight buttons are used to move between pages, pop up a pick list of pages, search documents and exit the framework.

Authorware-3 has added text styles that you can apply to any text (labels, menu options, scrolling text boxes). Designing in Authorware is also allowed. Authorware elegantly provides full data integrity for its naming of icons and variables. Change a variable name and it changes everywhere it is used. Authorware can run timers, change the flow in response to a user, keep score and access laserdisc players via dialog box.

Although Authorware includes ODBC to enable connectivity to and from databases, it falls short of enabling proper database interactivity and reduces each fetched record to a single text string. Also, even though, Authorware ships with a full assortment of buttons, dialog boxes, sliders, gauges, scrolling text boxes and data entry boxes, it lacks such features as the critical list and combo boxes that are used in the other programs to create the order screens. Authorware rewards an open mind and a willingness to tackle its different approaches by giving non-programmers accessibility and allowing them to produce complex interactivity with a minimum of programmer like thinking. Authorware's built-in knowledge of interaction, testing and scoring makes it a mature and bullet proof environment for creating kiosks or CBTs.

Everest Authoring System

Everest Authoring System 1.5 is best suited for the developers of CBT applications who seek a powerful but easy-to-use windows-based authoring environment. As far as CBT environments go, Everest (a Windows 3.1 application that also plays back on Windows 95) features strong multimedia support, enough object orientation to improve the productivity over competing products and great technical support. Everest's nearly seamless multi-paradigmatic approach includes such features as visual programming with icons, direct manipulation of interface elements and procedural programming. Everest has successfully integrated these elements making applications development easier.

The Everest development environment opens with multiple views of an application. In Everest's application creation, the user starts off with a library and names an initial screen. Dragging a layout object icon from the toolset onto that screen provides the basis for the first screen. The layout object, visible as an icon on the Icon Script, also occupies the Attributes Window, in which the user can choose a background colour on bitmap, select a screen size, and specify up to 34 more properties.

Also interface and media object icons can be dragged onto the screen; like list and combo boxes, edit boxes, text displays, bitmap placeholders, sliders and gauges, buttons of all types, video and audio, OLE and animation.

These objects can be made to move around, visually resize them and their properties set by clicking on them in either the Visual Screen or the Icon Script. The placeholder objects can be left empty or their contents can be specified immediately.

Everest's object orientation, which supports object instancing but not sub classing, increases developer's productivity. For example, if suppose we dragged a button object, dropped it in

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the Visual Screen and sized it for use as a Back control button to return to previous screens. In the Attributes window, we name it, set the bitmap used for pressed and released, and assigned it an “event code”—in this case, 33—that it would generate when pressed and we did all this simply with drag-and-drop, point-and-click, and fill-in-the-blank. Then comes the fun part. In the Attributes Window, we set save as object to true. On the next screen, we dragged in another button off the Toolset. With one simple choice of a pull-down menu in the Attributes window, we made this new button an instance of the Back button that we saved as object, and the newly created button inherited all its properties. Once the screen design satisfies the user, Everest has provided an easy method of scripting navigation and control flow.

Overall, Everest offers a charming environment in which to create CBT applications. Additional modules from third-party vendors can infuse Everest with data handling facilities to access databases and utilize rich text format. The base product can access only its proprietary database, which can read to and write text files.

Icon Author

Icon Author, an authoring tool requires the use of an icon-based flowchart for building an application. It still maintains a strict separation between an application’s structure and the actual content and still ships with a number of ancillary programs that help to edit and manage content.

The role of Smart Object Editor has become central to the creation of Icon Author applications. Smart Object Editor assembles individual object such as imported pictures, sound files, video clips, animations, database links, text push buttons, tables and list boxes into coherent pages layouts. The appearance and behaviour of these objects can be controlled by changing the properties associated with each one.

Icon Author handles multimedia objects with aplomb. The sound, movie and animation files are not only easy to be imported but it also takes less effort to control them. For example, adding VCR start and stop buttons to a movie object requires just activating the control bar property in Smart Object Editor.

Creation of CBT application or authoring a CD/Kiosk presentation requires importing and manipulation of data. Icon Author has the ability to access databases via Microsoft ODBC drivers. Once the connection to a database is established externally (via the ODBC Administrator), the database object is simply inserted into a Smart Object Page.

ImageQ

The ImageQ is another multimedia authoring software package. Although, it is a Windows 3.1 application but it can also play back on Windows 95, create slide show presentations well and provides a way to distribute them easily. It lacks the intuitive programming language and strong interface necessary for truly productive multimedia applications development. The ImageQ presentations comprise a series of background images and associated control scripts that add user interface controls, overlay images and underlying programming to each slide. It uses a multiple-document interface to manage one or more presentations simultaneously.

The slide strip windows for each presentation contains either thumb nails or files information for each slide image and provide the means of navigating through the presentation at design time. Although the images in the slide strip are miniature versions of the background images, they do not show any of the users interface element that the user has added such as button and list boxes. The user must create these through code, which ImageQ will interpret only at runtime—a major deficiency that other authoring system (such as Icon Author and Director) avoids by offering design tools to arrange interface controls visually without code.

While ImageQ does not provide the robust slide design tools that competing products include, it does import a wide variety of graphics formats. Once the images have been imported into an ImageQ presentation, they can then kept in their native formats or saved as BMP or HKF files.

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Whenever images are imported into an ImageQ presentation, it involves only creation of thumbnails and slide references, the images themselves remain as separate files. The List of filenames and the control and transition settings are stored in a file with an IMQ extension, which serves as the main file for the presentation. ImageQ's programming language is awkward to work with, because it uses unconventional syntax and event handlers. For example, ImageQ uses lines like "add X to Y", put 150 into X for adding the two values in a single statement and assigning the value to 150 to X, respectively.

Though ImageQ lacks design and programming tools, it does well with distribution. It is easy to build portable presentations as standalone exe files that include the ImageQ runtime. The ImageQ is really a presentation package in an authoring system's clothing. Its real strength lies in ability to create traditional slide shows with prebuilt images and distribute them with no royalty. Yet the product's lack of interactive design tools and its clumsy programming languages ultimately make it a poor choice for robust multimedia applications development.

Macromedia Director

Macromedia Director 4.04 is better suited to multimedia presentations and kiosk applications than CBT or interactive catalogues that require more database work. This product offers a lot.

- (i) Central scoring component that provides precise timing control,
- (ii) Cross-platform compatibility,
- (iii) Strong yet intuitive animation features, and
- (iv) An extensive architecture to add functionality.

The application in Director's user interface is a movie, the playback screen is the stages, and the various elements in the movie are cast members. A Director movie consists of frames that comprise many separate, individual channels, each of which can hold a sprite or sound, custom palette, and the like. Each sprite is an instance of a cast member, such as a piece of text, a bit-mapped image, or a digital video clip. As all of the sprites can be accessed during each frame of the movie, so an ultimate time-based control can be achieved. Director has 48 separate sprite channels available in each frame. Sprites are only copies of the cast members so their look can be modified in a particular frame without affecting the original cast member. Each channel number represents a stage layer so the sprites can be moved between layers by simply stacking them up and down. Some special channels exist to refer to each frame; transition, palette, tempo, script and two sound channels. One of Director's strongest features is its cross-platform compatibility. The Windows and Macintosh versions of the products are binary compatible so the Director movies can be transferred between them by simply moving the file.

Director imports an impressively broad range of graphics formats. When a file is imported, it automatically becomes a cast member and receives a number. Version 4.04 has the ability to mix sound files sampled at different rates and sizes but it is not possible to mix AIF and WAV files with the audio in digital movie clips. An animation feature which is one of Director's strongest suits allows setting the sprites in motion differently.

Director lets the non-programmer arrange cast members frequently and put them in motion, but robust movies need some coding. (Director's language, Lingo, uses English like phrases for commands, but getting used to it takes some time). Director has been proved to be very useful for implementing linear presentations but weak for complex programming.

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| Notes | Though Director can create complex multimedia events such as CBT, a bit of programming experience is still required to pull them off. For time line-based interactive titles and demo CDs, however, Director is an exceptionally useful tool that exploits a logical metaphor to achieve spectacular results. |
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Multimedia authoring tools can be evaluated by performing certain tests, which include the creation of non-interactive multimedia, CBT applications, catalogue creation and even authoring for the World Wide Web.

9.2.4 Types of Authoring Tools

The various authoring tools can be classified in three categories based on the metaphor used for sequencing or organizing multimedia elements and events.

- Card or page based tools
- Icon base, event driven tools
- Time base and presentation tools

Now let us discuss each of them in detail.

1. **Card or Page Based Tools:** In these authoring systems, elements are organized as pages of a book or a stack of cards. These tools are best used when the bulk of your content consists of elements that can be viewed individually, like the pages of a book or cards in a card file. The authoring lets system you link these pages or cards into organized sequences. You can jump, on command, to any page you wish in the structured navigation pattern. It allows you to play sound elements and launch animations and digital video.
2. **Icon Based, Event Driven Tools:** In this authoring system, multimedia elements and interactions cues are organized as objects in a structural framework or process. Icon base, event-driven tools simplify the organization of your project and typically display flow diagrams of activities along branching paths. In complicate structures, this charting is particularly useful during development.
3. **Time Based Tools:** In these authoring systems, elements and events are organized along a time line, with resolutions as high or higher than 1/30 second. Time based tools are best to use when you have a message with a beginning and an end. Sequentially organized graphic frames are played back at a speed that you can set. Other elements are triggered back at a given time or location in the sequence of events. The more powerful time based tools let you program jumps to any location in a sequence, thereby adding navigation and interactive control.

9.3 Components of an Authoring Tool

Authoring can be described as creating highly interactive applications in which the information can flow in both the directions i.e., from application to user and from user to application. Multimedia authoring tools has helped in creating higher-quality audio and video applications with very little expertise.

Most authoring systems provide facilities for:

- Loading and saving media assets (graphics, sounds, videos, text, etc.)
- Creating or editing audio and graphic images
- Page or slide building (layering multimedia data to create a single page)

- Animation/transition effects
- Specifying the sequence of the application
- Adding interactive controls for navigation and actions at run-time
- Creation of CD-ROM or Web-based distributions

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Munich-based Convention “Digitale Cinematographie”

Attracts more Exhibitors and Visitors

Munich, Germany, 2008 – The digital film and production technology convention “Digitale Cinematographie” organized by Band Pro Munich, Ludwig Camera Rental and MKM Production was taking place for the 6th time in a row. Newest high definition trends, developments and experiences were accompanied by numerous screenings and workshops. A main focus during this unrivalled event throughout Europe was put on 3D stereoscopy. Trade visitors from film and media industry found a very interesting platform for lively discussions.

High definition is about to enter the domain of classic movie-, TV-and commercial production. High definition technology is more and more establishing as production and broadcast standard. Film professionals who will be successful in the future have to look into HD production. The “Digitale Cinematographie” had more exhibitors and visitors than ever before: 40 exhibitors and 1177 visitors reflect the growing interest in the industry. The so called High Definition Competence Centre, consisting of Band Pro Munich, Ludwig Camera Rental and MKMedia Production, had founded this unique industry platform out of their experience from sales, rental and production supervision. The 2000 qm exhibition space showcased a comprehensive overview on future developments in production and postproduction. Hands-on experience is the motor of success of the Digitale Cinematographie knows Gerhard Baier of Band Pro Munich. It is not the exhibition which is in the focus of the convention concept but the whole digital workflow chain. When rental and post production house owner Martin Ludwig had established this show together with Gerhard Baier and Martin Kreitl six years ago, he only thought of one thing: to demonstrate visitors how important it is to think about the result of the production first before starting the digital production process at all.” The Digitale Cinematographie wants to encounter trends by showing actual employments as for example this year’s RED One workflow session” explains Martin Ludwig. For Martin Kreitl the Digitale Cinematographie is even a pathfinder for cutting-edge trends throughout Europe. He is convinced that digital cinematography will offer new and astonishing possibilities for movie- and TV-audience, broadcast stations and cinema operators. He emphatically pointed out that the spread of HDTV and the digital movie theatres underlies no (longer) limitations on digital production technology. He is very positive about the fact that movie theatres could attract more audiences with live coverage from concerts and sports events or stereo 3D-projections.

Many visitors were from the Munich area, which traditionally plays an important role in the worldwide film production industry, as well as from other German film metropolis and neighbouring countries. Manufacturers use the Digitale Cinematographie mainly to present their newest gear and technology aside from the big industry conventions such as NAB and IBC. Especially the Munich-based manufacturers such as ARRI, P+S Technik and Chrosziel use their home field advantage. Also, many of the visitors – who are usually “main artisans” such as production companies and DoPs, etc. – expect to see the latest product generations

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such as a Sony F35, Sony PMW-EX3 or a RED One first time in Europe. The second day of the show was dedicated to hype stereo 3D-projection and -production. Many discussions with producers and experts on this hot topic comprised on the rules to be followed by shooting 3D and how 3D effects can be best made.

The core of the Digitale Cinematographie, however, is the numerous HD screenings from documentaries to Hollywood blockbusters. The German film award winner film "Kirschblüten-Hanami" by Doris Dörrie and best-director-award-movie at the Cannes film festival „Three Monkeys“ (Originaltitel "Üç Maymum") by Nuri Bilge Ceylan and the numerous 3D trailers were the highlights of the waste screening programme.

The workshops met many of the various demands: newest product generations, workflow-scenarios, comparisons of cine and HD objectives, editing software, film and video restoring software, colour grading software, use of studio recorders as well as specialized workshops on 3D-productions. Hands-on camera sets were made up by the famous German movie colleges HFF and BAF and were especially frequented by students. Sony – as main sponsor – was also very happy about the event: "The presentation of the whole digital workflow-spectrum as well as the possibility to get in touch with producers, camera operators, editors and other media professionals make this event even for a global player and broad line manufacturer very valuable," states Goran Hantschel, Divisional Director Professional Solutions Europe. A constantly increasing number of visitors since the beginning in 2002, more and more digital film productions as well the proceeding establishing of HD/HDTV as production and broadcast standard undermine the importance of the event. The organizers of the Digitale Cinematographie have already committed to keep on pushing this major industry event.

Questions:

1. Describe high definition technology.
2. How Munich area plays an important role in worldwide film production industry?

Self Assessment

Choose the correct answer:

4. is the main production tool for multimedia.

 - (a) Authoring software
 - (b) Multimedia development tool
 - (c) Video encoder software
 - (d) Video editing software

5. The scripting languages are closest in form to traditional programming.

 - (a) True
 - (b) False

6. The CBT stands for

 - (a) Collective-based Training
 - (b) Computer-based Transmission
 - (c) Computer-based Training
 - (d) None of these

7. systems are useful when presenting and referencing large amounts of textual information.

 - (a) Hypertext
 - (b) Authorware
 - (c) Icon-based
 - (d) None of these

9.4 Summary

- Authoring systems are menu-driven systems intended to be easy to use by the multimedia developer.
 - Authoring software is the main production tool for multimedia.
 - Many add-on boards and peripheral devices include specialized DLLs upon installation.
 - Authoring software allows full control of CD-drives to integrate audio, video and computer files.
 - The ImageQ presentations comprise a series of background images and associated control scripts that add user interface controls, overlay images and underlying programming to each slide.

9.5 Keywords

Authoring system: An authoring system is a program which has pre-programmed elements for the development of interactive multimedia software titles.

DVD authoring software: It is a digital video tool that is designed to convert the default output file of your video camera into DVD format.

Everest authoring system 1.5: It is best suited for the developers of CBT applications who seek a powerful but easy-to-use windows-based authoring environment.

Hypertext programming interfaces: It allows users to select individual Hot Words on a screen which are further linked to additional pages and layers of text.

Icon author: It is an authoring tool requires the use of an icon-based flowchart for building an application.

Script language programs: It create multimedia presentations from a series of programming style commands linked together in a word processing typescript.



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Lab Exercise

 1. Edit a video clip using Windows Movie maker.
 2. By using video processing tools, convert .wmv file into mpeg.

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9.6 Review Questions

1. Define digital animation.
2. Explain the features of video editing software.
3. How video encoder software works?
4. What are the features of authoring software?
5. Define script language programs and icon based programs.
6. Describe briefly authorware.
7. What do you mean by Everest authoring system?
8. What are the components of an authoring tool?
9. Explain the concept of Icon Author.
10. What are the different types of authoring tools?

Answers to Self Assessment

- | | | | | |
|--------|--------|--------|--------|---------|
| 1. (a) | 2. (b) | 3. (b) | 4. (a) | 5. (a) |
| 6. (c) | 7. (a) | 8. (c) | 9. (a) | 10. (d) |

9.7 Further Reading



Books

"*Multimedia: Computing, Communications Applications*", by Ralf Steinmetz and Klara Naharstedt Pearson, 2001



Online link

[http://msdn.microsoft.com/en-us/library/cc189069\(v=vs.95\).aspx](http://msdn.microsoft.com/en-us/library/cc189069(v=vs.95).aspx)

Unit 10: 3D Modelling and Animation Tools

Notes

CONTENTS

- Objectives
- Introduction
- 10.1 Advanced Animation Tools
 - 10.1.1 Modelling
 - 10.1.2 Types of 3D Art
- 10.2 Image Editing Tools
 - 10.2.1 Basics of Image Editing
 - 10.2.2 Automatic Image Enhancement
 - 10.2.3 Digital Data Compression
 - 10.2.4 Image Editor Features
- 10.3 Types of Image Editing Tools
- 10.4 Sound Editing Tools
 - 10.4.1 For use with Music
 - 10.4.2 For use with Speech
- 10.5 Types of Sound Editing Tools
 - 10.5.1 Audacity
 - 10.5.2 Power Sound Editor
 - 10.5.3 mp3directcut
 - 10.5.4 Music Editor Free
 - 10.5.5 Wavosaur
 - 10.5.6 Traverso DAW
 - 10.5.7 Ardour
 - 10.5.8 Rosegarden
 - 10.5.9 Hydrogen
 - 10.5.10 WavePad Sound Editor
 - 10.5.11 Sound Engine
 - 10.5.12 Expstudio Audio Editor
 - 10.5.13 DJ Audio Editor
 - 10.5.14 Eisenkraut
 - 10.5.15 Free Wave mp3 Editor
 - 10.5.16 Kangas Sound Editor
 - 10.5.17 Ecawave
 - 10.5.18 Audiobook Cutter
 - 10.5.19 Jokosher
 - 10.5.20 LMMS
 - 10.5.21 mp3Splt
 - 10.5.22 Qtractor

Notes

- 10.5.23 ReZound
- 10.5.24 Sweep
- 10.5.25 WaveSurfer
- 10.6 Summary
- 10.7 Keywords
- 10.8 Review Questions
- 10.9 Further Readings

Objectives

After studying this unit, you will be able to:

- Understand the concept of tools
- Discuss the image editing tools
- Explain the sound editing tools

Introduction

In 3D computer graphics, 3D modelling (also known as meshing) is the process of developing a mathematical representation of any three-dimensional surface of object (either inanimate or living) via specialized software. The product is called a 3D model. It can be displayed as a two-dimensional image through a process called 3D rendering or used in a computer simulation of physical phenomena. The model can also be physically created using 3D printing devices.

Models may be created automatically or manually. The manual modelling process of preparing geometric data for 3D computer graphics is similar to plastic arts such as sculpting.

Compatibility with popular graphics and 3D modelling software lets you model realistic or highly-stylized characters, weapons, vehicles, and props within the Source environment. A robust set of tools help you efficiently rig, animate, and define physics interactions for a wide range of characters and objects.

The 3D Canvas is a 3D modelling and animation tool developed by Amabilis. It is available in three different versions – 3D Canvas, 3D Canvas Plus, and 3D Canvas Pro. 3D Canvas is freeware, whereas the Plus and Pro upgrades cost. The upgraded versions allow for a larger number of import and export formats, as well as a number of additional functions. The software is designed to be user-friendly, and has an easy to use drag and drop interface.

10.1 Advanced Animation Tools

Skeletal Animation System: Articulate models with fluid and complex motion using Valve's proprietary skeletal animation system.

Facial Animation System: Valve's proprietary facial animation system seamlessly blends a wide range of facial expressions for natural, emotion-driven speech and movement. With more than 40 distinct facial "muscles", human characters convey the full array of human emotion and respond to the player with fluidity and intelligence.

Animation Blending: Seamlessly blend gestures to create continuous movement or add depth to any character situation.

Layered Animation Blending: Synthesize animations out of multiple pieces.

Notes

Face Poser. It easily crafts speech and emotions using the Face poser facial expression tool.

10.1.1 Modelling

Other issues that you can explore with storyboarding are what types of models you need for the scene and what they need to do. You will discover whether you need organic shapes or not and how to design your workflow.

As a minimum requirement, you need images from the front, side and perspective. Depending on whether you will need to illustrate other parts of the model, you will need images of the back, underside and top. It is also important to describe how the model will be used in a scene, such as doors opening, etc.

In the beginning, it can be difficult to know where to start. Over time, the process will become easier, but if you are constantly switching between various forms, the process will change and it may feel like you are starting over. Regardless of that, it is important to set up a workflow at the outset. Nothing is as frustrating as spending hours on a project, only to hit a wall and find that you have to start over.

In addition, 3D is often extremely time-consuming. It is necessary to budget this precious commodity, otherwise you can run out of time before a project is completed. Do not get caught up in small details that will have little impact on your finished scenes.

The 3D models are created by manipulating polygon meshes and moulding them into objects, characters and scenes. 3D art is used in everything from print ads, Web sites, television, movies, video games and beyond.

So, what does it take to be a 3D artist? Well, obviously, you must have an eye for art. Most people who begin learning 3D have some kind of background in drawing and sketching. It is not unheard of for 3D studios to hire artists who have no experience in 3D, based solely on the strength of a pencil drawing portfolio. Sculptors, who were previously limited to animatronics and claymation (clay animation), also tend to make an easier transition to 3D.

Even if you do not have formal art training that goes beyond the few classes, you took in high school or college you can still do great work in 3D.



Caution Before begin the modelling process, it should be create sketches or collect images that will help you build your model.

A 3D Artist must have the following qualities:

1. *Patience:* Many beginners unfairly compare themselves to established artists possessing years of experience. While it can be a great motivator and a valuable source of inspiration, 3D art is a diverse subject, requiring dedication and practice. Some say that 3D is like Go, the ancient game of strategy: it takes minutes to learn, but a lifetime to be master.
2. *Detail:* 3D artists tend to have a strong background in computers, compared to non-digital artists. Experience in computer programming is common in 3D circles, though not required. 3D artists need to have an eye for detail, be resourceful and self-sufficient.
3. *Hard work:* If you want something easy, pick up a pencil and paper and start drawing. 3D art is not nearly as immediate with results. One can spend, hours, days, and even weeks perfecting a 3D model before ever moving onto texturing, animation or final renders. 3D art is unique in that it can require a broad array of skills, from drawing to acting, to successfully bring together a finished piece. The payoff is that 3D artists are perhaps the most sought-after creative workers.

Notes

4. *Willingness to accept criticism:* Eventually you will feel motivated to submit your art for review by other artists. 3D artists can nitpick like no one else in the world, so be prepared to have even the slightest error pointed out to you in exacting detail—especially if you are attempting to create anything realistic. If you intend to work in a studio one day, your ability to accept criticism will be crucial to the overall success of the team.

10.1.2 Types of 3D Art

The 3D is a broad subject, and a typical finished composition will be composed of several – perhaps dozens – of hours of work in an array of skills. What follows is an overview of the subjects you will need to learn to be a well-rounded 3D artist.

Modelling: Modelling is the act of creating a 3D mesh, whether the end result is a bug-eyed alien or a teacup. How you get to that finished model depends largely on the methods that make the most sense to you.

Animation: Animation is the process of taking a 3D object and getting it to move. Animation comes in a few different flavours. There's keyframe animation, where the animator manipulates the objects on a frame-by-frame basis, similar to hand-drawn cartoons. Other methods of animation include placing objects on splines and setting them to follow the path of the curve, or importing motion capture data and applying it to a character rig. Another way to animate is to use your 3D application's built-in physics engines, such as when your scene requires that objects fall.

Texturing: Without some kind of texture art, everything will be variations of solid colours. The most common and accurate way to create a texture for a model is to "unwrap" the mesh (flatten it out) and paint over it in an application such as Photoshop. The final texture is then "wrapped" over the original mesh again. Depending on how a model is created, each section may have its own texture, i.e., a separate texture for hands, one for arms and one for the torso of a character, all made to blend together seamlessly.

Rendering: Rendering an image is typically the last step, and is perhaps the most important part. It is often overlooked by beginners, who are more focused on creating models and animating them. There are many aspects to creating a good final render of a scene, including attention to camera placement, lighting choices which may affect mood, shadows, reflections, transparency and the handling of special effects, such as fluids or grasses.

10.2 Image Editing Tools

Image editing encompasses the processes of altering images, whether they are digital photographs, traditional analogue photographs, or illustrations. Graphic software programs, which can be broadly grouped into vector graphics editors, raster graphics editors, and 3D modellers, are the primary tools with which a user may manipulate, enhance, and transform images. Many image editing programs are also used to render or create computer art from scratch.

10.2.1 Basics of Image Editing

Raster images are stored in a computer in the form of a grid of picture elements, or pixels. These pixels contain the image's colour and brightness information. Image editors can change the pixels to enhance the image in many ways. The pixels can be changed as a group, or individually, by the sophisticated algorithms within the image editors. The domain of this primarily refers to bitmap graphics editors, which are often used to alter photographs and other raster graphics. However, vector graphics software, such as Adobe Illustrator or Ink scape, are used to create and modify vector images, which are stored as descriptions of lines, Bézier splines, and text instead of pixels. It is easier to rasterize a vector image than to vectorize a raster image; how to go about vectorizing a raster image is the focus of much research in the field of computer vision. Vector images can be

modified more easily, because they contain descriptions of the shapes for easy rearrangement. They are also scalable, being rasterizable at any resolution.

Notes

10.2.2 Automatic Image Enhancement

Camera or computer image editing programs often offer basic automatic image enhancement features that correct colour hue and brightness imbalances as well as other image editing features, such as red eye removal, sharpness adjustments, zoom features and automatic cropping. These are called automatic because generally they happen without user interaction or are offered with one click of a button or mouse button or by selecting an option from a menu. Additionally, some automatic editing features offer a combination of editing actions with little or no user interaction.



Traditional analogue image editing is known as photo retouching, using tools such as an airbrush to modify photographs, or editing illustrations with any traditional art medium.

10.2.3 Digital Data Compression

Many image file formats use data compression to reduce file size and save storage space. Digital compression of images may take place in the camera, or can be done in the computer with the image editor. When images are stored in JPEG format, compression has already taken place. Both cameras and computer programs allow the user to set the level of compression.

Some compression algorithms, such as those used in PNG file format, are lossless, which means no information is lost when the file is saved. By contrast, the JPEG file format uses a lossy compression algorithm by which the greater the compression, the more information is lost, ultimately reducing image quality or detail that cannot be restored. The JPEG uses knowledge of the way the human brain and eyes perceive colour to make this loss of detail less noticeable.

10.2.4 Image Editor Features

Listed below are some of the most used capabilities of the better graphic manipulation programs. The list is by no means all inclusive. There are a myriad of choices associated with the application of most of these features.

Selection

One of the prerequisites for many of the applications mentioned below is a method of selecting part(s) of an image, thus applying a change selectively without affecting the entire picture. Most graphics programs have several means of accomplishing this, such as a marquee tool, lasso tool, magic wand tool, vector-based pen tools as well as more advanced facilities such as edge detection, masking, alpha compositing, and colour and channel-based extraction.

Layers

Another feature common to many graphics applications is that of Layers, which are analogous to sheets of transparent acetate (each containing separate elements that make up a combined picture), stacked on top of each other, each capable of being individually positioned, altered and blended with the layers below, without affecting any of the elements on the other layers. This is a fundamental workflow which has become the norm for the majority of programs on the market today, and enables maximum flexibility for the user while maintaining non-destructive editing principles and ease of use.

Image Size Alteration

Image editors can resize images in a process often called image scaling, making them larger, or smaller. High image resolution cameras can produce large images which are often reduced in size

Notes

for Internet use. Image editor programs use a mathematical process called resampling to calculate new pixel values whose spacing is larger or smaller than the original pixel values. Images for Internet use are kept small, say 640×480 pixels which would equal 0.3 megapixels.

Cropping an Image

Digital editors are used to crop images. Cropping creates a new image by selecting a desired rectangular portion from the image being cropped. The unwanted part of the image is discarded. Image cropping does not reduce the resolution of the area cropped. Best results are obtained when the original image has a high resolution. A primary reason for cropping is to improve the image composition in the new image.

Histogram

Image editors have provisions to create an image histogram of the image being edited. The histogram plots the number of pixels in the image (vertical axis) with a particular brightness value (horizontal axis). Algorithms in the digital editor allow the user to visually adjust the brightness value of each pixel and to dynamically display the results as adjustments are made. Improvements in picture brightness and contrast can thus be obtained.

Noise Reduction

Image editors may feature a number of algorithms which can add or remove noise in an image. The JPEG artifacts can be removed; dust and scratches can be removed and an image can be de-speckled. Noise reduction merely estimates the state of the scene without the noise and is not a substitute for obtaining a “cleaner” image. Excessive noise reduction leads to a loss of detail, and its application is hence subject to a trade-off between the undesirability of the noise itself and that of the reduction artifacts.

Noise tends to invade images when pictures are taken in low light settings. A new picture can be given an ‘antiquated’ effect by adding uniform monochrome noise.

Removal of Unwanted Elements

Most image editors can be used to remove unwanted branches, etc., using a “clone” tool. Removing these distracting elements draws focus to the subject, improving overall composition.

Figure 10.1: (a) Notice the Branch in the Original (b) The Eye is Drawn to the Centre of the Globe



Selective Colour Change

Some image editors have colour swapping abilities to selectively change the colour of specific items in an image, given that the selected items are within a specific colour range.

Notes

Figure 10.2: The Original Car is on the Right



Image Orientation

Image editors are capable of altering an image to be rotated in any direction and to any degree. Mirror images can be created and images can be horizontally flipped or vertically flopped. A small rotation of several degrees is often enough to level the horizon, correct verticality (of a building, for example), or both. Rotated images usually require cropping afterwards, in order to remove the resulting gaps at the image edges.

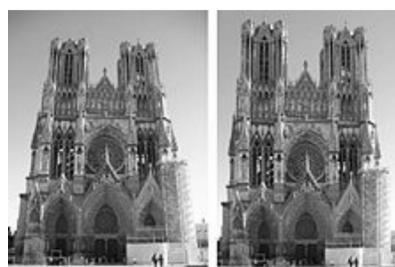
Figure 10.3: Image Orientation (from left to right): Original, -30° CCW Rotation, and Flipped



Perspective Control and Distortion

Some image editors allow the user to distort (or “transform”) the shape of an image. While this might also be useful for special effects, it is the preferred method of correcting the typical perspective distortion which results from photographs being taken at an oblique angle to a rectilinear subject. Care is needed while performing this task, as the image is reprocessed using interpolation of adjacent pixels, which may reduce overall image definition. The effect mimics the use of a perspective control lens, which achieves a similar correction in-camera without loss of definition.

Figure 10.4: Perspective Control: Original (left), Perspective Distortion Removed (right)



Lens Correction

Photo manipulation packages have functions to correct images for various lens distortions including pincushion, fisheye and barrel distortions. The corrections are in most cases subtle, but can improve the appearance of some photographs.

Notes**Enhancing Images**

In computer graphics, the process of improving the quality of a digitally stored image by manipulating the image with software. It is quite easy, for example, to make an image lighter or darker, or to increase or decrease contrast. Advanced photo enhancement software also supports many filters for altering images in various ways. Programs specialized for image enhancements are sometimes called image editors.

Sharpening and Softening Images

Graphics programs can be used to both sharpen and blur images in a number of ways, such as un-sharp masking or de-convolution. Portraits often appear more pleasing when selectively softened (particularly the skin and the background) to better make the subject stand out. This can be achieved with a camera by using a large aperture, or in the image editor by making a selection and then blurring it. Edge enhancement is an extremely common technique used to make images appear sharper, although purists frown on the result as appearing unnatural.

Selecting and Merging of Images

Many graphics applications are capable of merging one or more individual images into a single file. The orientation and placement of each image can be controlled.

Figure 10.5: Photomontage of 16 Photos which have been Digitally Manipulated in Photoshop to give the Impression that it is a Real Landscape



When selecting a raster image that is not rectangular, it requires separating the edges from the background, also known as silhouetting. This is the digital version of cutting out the image. Clipping paths may be used to add silhouetted images to vector graphics or page layout files that retain vector data. Alpha compositing allows for soft translucent edges when selecting images. There are a number of ways to silhouette an image with soft edges including selecting the image or its background by sampling similar colours, selecting the edges by raster tracing, or converting a clipping path to a raster selection. Once the image is selected, it may be copied and pasted into another section of the same file, or into a separate file. The selection may also be saved in what is known as an alpha channel.

A popular way to create a composite image is to use transparent layers. The background image is used as the bottom layer, and the image with parts to be added are placed in a layer above that. Using an image layer mask, all but the parts to be merged are hidden from the layer, giving the impression that these parts have been added to the background layer. Performing a merge in this manner preserves all of the pixel data on both layers to more easily enable future changes in the new merged image.

Slicing of Images

A more recent tool in digital image editing software is the image slicer. Parts of images for graphical user interfaces or Web pages are easily sliced, labelled and saved separately from whole images so the parts can be handled individually by the display medium. This is useful to allow dynamic swapping via interactivity or animating parts of an image in the final presentation.

Special Effects**Notes**

Image editors usually have a list of special effects that can create unusual results. Images may be skewed and distorted in various ways. Scores of special effects can be applied to an image which includes various forms of distortion, artistic effects, geometric transforms and texture effects, or combinations thereof.

Figure 10.6: An Example of Some Special Effects that can be Added to a Picture

**Change Colour Depth**

It is possible, using software, to change the colour depth of images. Common colour depths are 2, 4, 16, 256, 65,536 and 16.7 million colours. The JPEG and PNG image formats are capable of storing 16.7 million colours (equal to 256 luminance values per colour channel). In addition, gray scale images of 8 bits or less can be created, usually via conversion and down-sampling from a full-colour image.

Figure 10.7: An Example of Converting an Image from Colour to Gray Scale

**Contrast Change and Brightening**

Image editors have provisions to simultaneously change the contrast of images and brighten or darken the image. Underexposed images can often be improved by using this feature. Recent advances have allowed more intelligent exposure correction whereby only pixels below a particular luminosity threshold are brightened, thereby brightening underexposed shadows without affecting the rest of the image. The exact transformation that is applied to each colour channel can vary from editor to editor. GIMP applies the following formula:

```
if (brightness < 0.0) value = value * (1.0 + brightness);
```

```
else value = value + ((1 - value) * brightness);
```

```
value = (value - 0.5) * (tan ((contrast + 1) * PI/4)) + 0.5;
```

where, value is the input colour value in the 0..1 range and brightness and contrast are in the -1..1 range.

Notes**Figure 10.8: An Example of Contrast Correction. Left Side of the Image is Untouched****Gamma Correction**

In addition to the capability of changing the images' brightness and/or contrast, most current image editors provide an opportunity to manipulate the images' gamma value.

Colour Adjustments

The colour of images can be altered in a variety of ways. Colours can be faded in and out, and tones can be changed using curves or other tools. The colour balance can be improved, which is important if the picture was shot indoors with daylight film, or shot on a camera with the white balance incorrectly set. Special effects, like sepia and gray scale, can be added to an image. In addition, more complicated procedures such as the mixing of colour channels are possible using more advanced graphics editors.

Figure 10.9: An Example of Colour Adjustment Using Raster Graphics Editor

The red-eye effect, which occurs when flash photos are taken when the pupil is too widely open (so that light from the flash that passes into the eye through the pupil reflects off the fundus at the back of the eyeball), can also be eliminated at this stage.

Printing

Controlling the print size and quality of digital images requires an understanding of the pixels-per-inch (ppi) variable that is stored in the image file and sometimes used to control the size of the printed image. Within the Image Size dialog (as it is called in Photoshop), the image editor allows the user to manipulate both pixel dimensions and the size of the image on the printed document. These parameters work together to produce a printed image of the desired size and quality. Pixels per inch of the image, pixel per inch of the computer monitor, and dots per inch on the printed document are related, but in use are very different. The Image Size dialog can be used as an image calculator of sorts. For example, a 1600×1200 image with a ppi of 200 will produce a printed image of 8×6 inches. The same image with a ppi of 400 will produce a printed image of 4×3 inches. Change the ppi to 800, and the same image now prints out at 2×1.5 inches. All three printed images contain the same data (1600×1200 pixels) but the pixels are closer together

on the smaller prints, so the smaller images will potentially look sharp when the larger ones do not. The quality of the image will also depend on the capability of the printer.

Notes



Take care while performing perspective control and distortion task, as the image is reprocessed using interpolation of adjacent pixels, which may reduce overall image definition.

10.3 Types of Image Editing Tools

Some of the popular images editing tools are as follows:

Picasa (Windows/Mac/Linux, Free)

Picasa is the kind of application that geeks love because it is so simple and effective and non-geeks love because they usually do not have the time or inclination to get bogged down in the more technical aspects of digital photography. If your tech un-savvy mom or dad emailed you tomorrow and said she or he needed an easy-to-use program for organizing and editing photos, you'd likely send them to download Picasa. The built in editor is more than robust enough for most casual users and includes basic colour correction, cropping, and a variety of special effects—the majority of which manage to avoid being cheesy. Picasa is not a tool for deep and detailed editing, but it is extremely easy to use for the kind of quick crop and correct editing most digital camera owners need.



Native applications for Windows XP, Windows Vista, Windows 7 and Mac OS X (Intel only) are available through Google Labs. For Linux, Google has bundled Wine with the Windows version to create an installation package rather than write a native Linux version, but this version is severely out of date (the latest Windows version, however, can be run with Wine, see Linux section). There is also an iPhoto plugin or a standalone program for uploading photos available for Mac OS X 10.4 and later.



Picasa is an image organizer and image viewer, created by Idealab in 2002 and owned by Google since 2004.

GIMP (Windows/Mac/*nix, Free)

The GIMP (GNU Image Manipulation Program) is a free software raster graphics editor. It is primarily employed as an image retouching and editing tool and is freely available in versions tailored for most popular operating systems including Microsoft Windows, Apple Mac OS X, and Linux.

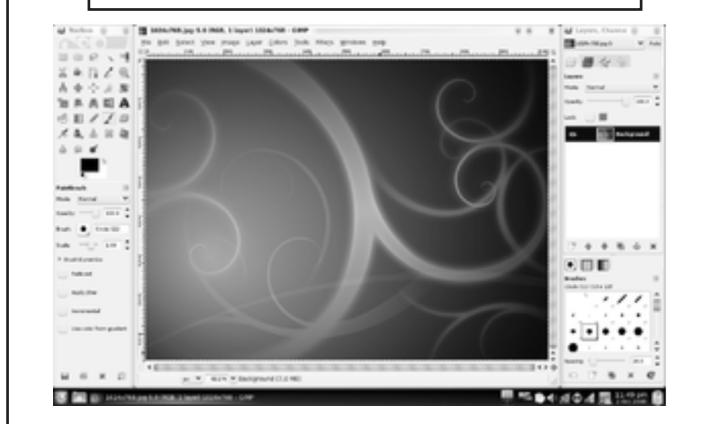
Notes

The GIMP has long been touted as the open-source competitor to Adobe Photoshop. Many people are quick to point out GIMP's shortcomings, claiming it is not a true Photoshop replacement, but in the process they overlook what GIMP has accomplished. Without the extremely polished and commercially driven Photoshop to stand against, GIMP is almost entirely unrivalled in sophistication. Colour correction, channel mixing, advanced cloning, paths, and layered compositions are all part of the GIMP package. There is very little the average Photoshop user does that cannot be done in GIMP, and if you are not working for a company footing the bill for Photoshop, the free-as-in-beer price tag looks mighty fine.

In addition to detailed image retouching and free-form drawing, GIMP can accomplish essential image editing tasks such as resizing, editing, and cropping photos, photomontages combining multiple images, and converting between different image formats. GIMP can also be used to create animated images in many formats such as GIF and MPEG through the Animation Plugin.

The GIMP's product vision is that GIMP is a free software high-end graphics application for the editing and creation of original images, icons, graphical elements of Web pages and art for user interface elements.

Figure 10.11: GIMP 2.6 Manipulating an Image



The GIMP originally stood for the General Image Manipulation Program. The GIMP's original creators, Spencer Kimball and Peter Mattis, began developing GIMP in 1995 as a semester-long project at the University of California, Berkeley. The first public release of GIMP (0.54) was made in January 1996. In 1997 GIMP became a part of the GNU Project, and the acronym GIMP was changed to the GNU Image Manipulation Program. Currently GIMP is maintained and enhanced by a group of volunteers under the auspices of the GNOME Project. GIMP was originally created for UNIX systems; GNU/Linux, SGI IRIX and HP-UX were supported in the first release. Since the first release GIMP was rapidly adopted and a community emerged consisting of users who created tutorials, artwork and shared techniques. Since the initial release, GIMP has been ported to many operating systems, including Microsoft Windows and Mac OS X; the original port to the Windows 32-bit platform was started by Finnish programmer Tor Lillqvist (tml) in 1997 and was supported in the GIMP 1.1 release.

The GIMP has used three graphical user interface (GUI) toolkits since its inception; GIMP originally used Motif on the first public release (0.54). Eventually, Peter Mattis became disenchanted with Motif and developed his own GUI toolkit named the GIMP toolkit (GTK); GTK had successfully replaced Motif in the 0.60 release of GIMP. Finally GTK was re-written to be object oriented and was renamed GTK+; this was first visible in GIMP 0.99.

User interface**Notes**

The GIMP uses multiple windows to contain all of GIMPs' functionality, including opening each image in a separate window. By default tools and tool settings and other dialogues are on the right. GIMPs dialogues are re-arrangeable and by default less commonly used dialogues are not shown.

Figure 10.12: GIMP, Version 2.4.3. GIMP is Freely Distributed Software



This windowing format has been criticised and users have been vocal about GIMPs' interface, this has led the maintainers of GIMP to oversee the formation of a usability team and the redesign of GIMPs UI to provide a Single Window mode to be released in GIMP 2.8.

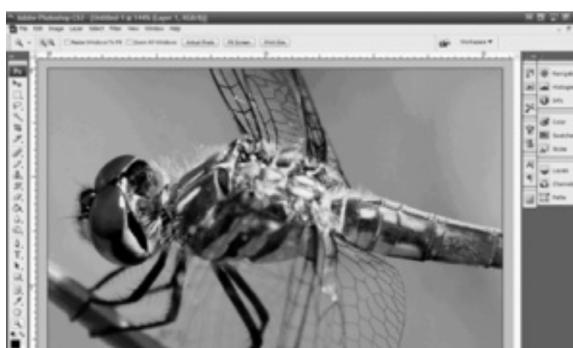
In order to construct its interface GIMP uses the GIMP tool kit (GTK+). GTK+ was designed to replace Motif, a proprietary toolkit upon which GIMP depended. Originally GTK+ was a part of the GIMP source tree, but has since been made into a standalone library. While originally being designed to run on Unix-like operating systems, GIMP and GTK+ have been ported to Microsoft Windows, Mac OS X, and other operating systems.

Adobe Photoshop

Adobe Photoshop is a graphics editing program developed and published by Adobe Systems Incorporated.

Adobe's 2003 "Creative Suite" rebranding led to Adobe Photoshop 8's renaming to Adobe Photoshop CS. Thus, Adobe Photoshop CS5 is the 12th major release of Adobe Photoshop. The CS rebranding also resulted in Adobe offering numerous software packages containing multiple Adobe programs for a reduced price. Adobe Photoshop is released in two editions: Adobe Photoshop, and Adobe Photoshop Extended, with the Extended having extra 3D image creation, motion graphics editing, and advanced image analysis features. Adobe Photoshop Extended is included in all of Adobe's Creative Suite offerings except Design Standard, which includes the Adobe Photoshop edition.

Figure 10.13: Adobe Photoshop Editing



Notes

Photoshop has achieved such status in the design community and such widespread recognition by the general public that even non-designers recognize what someone is saying when they exclaim, "That is photoshopped!" Many of the techniques and methods that are standard across photo editing software were pioneered in Photoshop, like layers, slices, and image correcting macros and filters. On its own Photoshop is a titan of photo editing power, but thanks to a nearly complete dominance in the graphic editing industry, there are entire companies devoted to creating plugins for it. When it comes to manipulating images, if you cannot do it in Photoshop, there's a strong chance you want to be able to do it at all.

Photo by HVarga

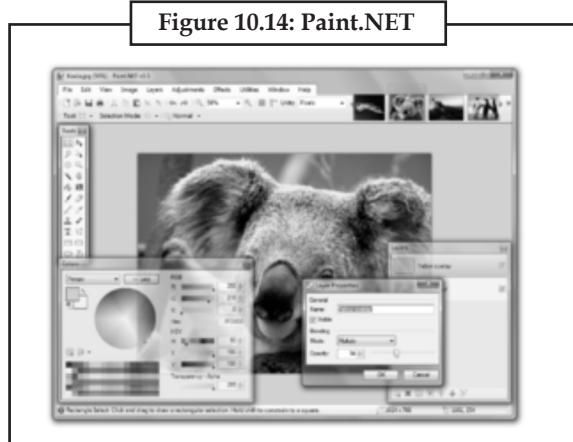
Alongside Photoshop and Photoshop Extended, Adobe also publishes Photoshop Elements and Photoshop Lightroom, collectively called "The Adobe Photoshop Family". In 2008, Adobe released Adobe Photoshop Express, a free Web-based image editing tool to edit photos directly on blogs and social networking sites; in 2011 a version was released for the Android operating system and the iPhone.

Adobe only supports Windows and Macintosh versions of Photoshop, but using Wine Photoshop CS4 can run on Linux.

Paint.NET (Windows, Free)

Paint.NET is a proprietary freeware raster graphics editor program for Microsoft Windows, developed on the .NET Framework. Originally created by Rick Brewster as a Washington State University student project, Paint.NET has evolved from a simple replacement for the Microsoft Paint program, which is included with Windows, into a powerful editor with support for layers, blending, transparency, and plugins.

Figure 10.14: Paint.NET



Paint.NET is primarily programmed in the C# programming language. Its native image format, .PDN, is a compressed representation of the application's internal object format, which preserves layering and other information. Excluding the installer, text, and graphics, Paint.NET was released under a modified version of the MIT License. It was initially released as completely open source, but due to breaches of license, all resource files (such as interface text and icons) were released under a Creative Commons license forbidding modification, and the installer was made closed-source.

Version 3.36 was initially released as partial open source as described above, but the sources were later removed by Brewster, citing problems with plagiarism. In version 3.5, the license was altered to reflect this, and users are now prohibited from modifying the software. As free licenses cannot be revoked, developers can still legally develop forks based on version 3.36 and earlier. Unlike most proprietary software licenses, however, the new license allows users to decompile and reverse engineer the software, provided that no modifications are made.

Brewster later stated that he hoped to release portions of the source code back into the public.

Adobe Lightroom**Notes**

Adobe Photoshop Lightroom is a photography software program developed by Adobe Systems for Mac OS X and Microsoft Windows, designed to assist Adobe Photoshop users in managing large quantities of digital images and doing post production work. It is not a file browser like Adobe Bridge, but rather an image management application database which helps in viewing, editing, and managing digital photos, the same way photographers used to do in the non-digital world.



Figure 10.15: Adobe Lightroom.

Lightroom is on the same branch of the editing family tree as Picasa: a hybrid of an organizational tool and a photo editor. Unlike its big brother Photoshop, Lightroom was not designed to be a detailed pixel-by-pixel editing tool. Lightroom focuses on being a digital darkroom for modern photographers, allowing them to quickly make the corrections necessary to their workflows. Lightroom excels at batch work and advanced colour balance corrections; photographers can even tether their cameras to their computers with Lightroom integrating directly into their editing workflow. Photoshop might be the appropriate tool for giving a single image a deep and intense workover, but Lightroom is the tool you call on when you have a huge batch of images from a photoshoot that need to be cropped, corrected, and made print ready as soon as possible. *Photo by M. Keefe.*

Pinta (software)

Pinta is a lightweight open-source, cross-platform bitmap image drawing and editing program inspired by Paint.NET, a similar image editing program which is limited to Microsoft Windows. Pinta aims to offer a free and open-source simpler alternative to GIMP on the GNOME desktop environment. It also aims to be portable to more operating systems than Paint.NET, which inspired its creation.



Task Take an image and crop it by using different software in such a manner that its original quality will not be affected.

Self Assessment

Choose the correct answer:

1. is the process of developing a mathematical representation.

- | | |
|------------------|-------------------|
| (a) 3D modelling | (b) 2D modelling |
| (c) 3D canvas | (d) None of these |

2. is the process of taking a 3D object and getting it to move.

- | | |
|----------------------|-----------------|
| (a) Cropping | (b) Animation |
| (c) Both (a) and (b) | (d) Wave Surfer |

10.4 Sound Editing Tools

A Sound editing tools is a computer application for audio editing, i.e. manipulating digital audio. Digital audio editors are the main software component of a digital audio workstation.

A digital audio editor is defined as a computer application for manipulating digital audio. As a multimedia creator, we normally use audio editor for recording audio, edit the duration and timeline, mix multiple sound tracks, apply simple effects for audio enhancement and create conversion between different audio file formats.

There are countless ways that digital audio editor can be used, and fortunately there are plenty of good and free digital audio editors out there to help you with your own implementation. So if you are thinking to purchase a license for Adobe Audition, Cool Edit or Soundforge, hold that thought first. Not to say they are not cool, but it is always wiser to tryout free applications before going to the pay deal.

10.4.1 For use with Music

Editors designed for use with music typically allow the user to do the following:

- Record audio from one or more inputs and store recordings in the computer's memory as digital audio
 - Edit the start time, stop time, and duration of any sound on the audio timeline
 - Fade into or out of a clip (e.g. an S-fade out during applause after a performance), or between clips (e.g. crossfading between takes)
 - Mix multiple sound sources/tracks, combine them at various volume levels and pan from channel to channel to one or more output tracks
 - Apply simple or advanced effects or filters, including compression, expansion, flanging, reverb, audio noise reduction and equalization to change the audio
 - Playback sound (often after being mixed) that can be sent to one or more outputs, such as speakers, additional processors, or a recording medium
 - Conversion between different audio file formats, or between different sound quality levels.

Typically these tasks can be performed in a manner that is both non-linear and non-destructive.

10.4.2 For use with Speech

Editors designed for use in speech research add the ability to make measurements and perform acoustic analyses such as extracting and displaying a fundamental frequency contour or spectrogram. They typically lack most or all of the effects of interest to musicians.

10.5 Types of Sound Editing Tools

Some of the popular sound editing tools are as follows:

10.5.1 Audacity

Audacity is free, open source software for recording and editing sounds. It allows you to record live audio, converts tapes and records into digital recordings or CDs, edit Ogg Vorbis, mp3, wav

or aiff sound files. You also can cut, copy, splice or mix sounds together with Audacity. Built-in effects are given to remove static, hiss, hum or other constant background noises.

Notes

10.5.2 Power Sound Editor

Power Sound Editor Free is a visual audio editing and recording software solution, which supports many advanced and powerful operations with audio data.

You can use Power Sound Editor Free to record your own music, voice, or other audio files, edit it, mix it with other audio or musical parts, add effects like Reverb, Chorus, and Echo, and burn it on a CD, post it on the World Wide Web or e-mail it.

10.5.3 mp3DirectCut

mp3DirectCut is a fast and extensive audio editor and recorder for compressed mp3. You can directly cut, copy, paste or change the volume with no need to decompress your files for audio editing. Using Cue sheets, pause detection or Auto cue you can easily divide long files.

10.5.4 Music Editor Free

Music Editor Free (MEF) is a multi-award winning music editor software tool. MEF helps you to record and edit music and sounds. It lets you make and edit music, voice and other audio recordings. When editing audio files you can cut, copy and paste parts of recordings and, if required, add effects like echo, amplification and noise reduction.

10.5.5 Wavosaur

Wavosaur is a free sound editor, audio editor, wav editor software for editing, processing and recording sounds, wav and mp3 files. Wavosaur has all the features to edit audio (cut, copy, paste, etc.) produce music loops, analyze, record, batch convert. Wavosaur supports VST plugins, ASIO driver, multichannel wav files, real time effect processing. The program has no installer and does not write in the registry. Use it as a free mp3 editor, for mastering, sound design.

10.5.6 Traverso DAW

Traverso DAW is a GPL licensed, cross platform multitrack audio recording and editing suite, with an innovative and easy to master User Interface. It is suited for both the professional and home user, who needs a robust and solid DAW. Adding and removal of effects plugins, moving Audio Clips and creating new Tracks during playback are all perfectly safe, giving you instant feedback on your work!

10.5.7 Ardour

Ardour is a digital audio workstation. You can use it to record, edit and mix multi-track audio. You can produce your own CDs, mix video soundtracks, or just experiment with new ideas about music and sound. Ardour capabilities include: multichannel recording, non-destructive editing with unlimited undo/redo, full automation support, a powerful mixer, unlimited tracks/busses/plugins, timecode synchronization, and hardware control from surfaces like the Mackie Control Universal. If you have been looking for a tool similar to ProTools, Nuendo, Pyramix, or Sequoia, you might have found it.

10.5.8 Rosegarden

Rosegarden is a well-rounded audio and MIDI sequencer, score editor, and general-purpose music composition and editing environment. Rosegarden is an easy-to-learn, attractive application that runs on Linux, ideal for composers, musicians, music students, and small studio or home recording environments.

Notes

10.5.9 Hydrogen

Hydrogen is an advanced drum machine for GNU/Linux. Its main goal is to bring professional yet simple and intuitive pattern-based drum programming.

10.5.10 WavePad Sound Editor

WavePad Sound Editor lets you make and edit music, voice and other audio recordings. When editing audio files you can cut, copy and paste parts of recordings and, if required, add effects like echo, amplification and noise reduction. WavePad works as a wav editor or mp3 editor but it also supports a number of other file formats including vox, gsm, real audio, au, aif, flac, ogg and more.

10.5.11 Sound Engine

Sound Engine is the best tool for personal use because it enables you to easily edit a wave data while it has many functions required for a mastering process.

10.5.12 Expstudio Audio Editor

Expstudio Audio Editor is a visual music file editor that has many different options and a multiple functionality to edit your music files like editing text files. With a given audio data it can perform many different operations such as displaying a waveform image of an audio file, filtering, applying various audio effects, format conversion and more.

10.5.13 DJ Audio Editor

The DJ Audio Editor is easy-to-use and well-organized audio application which allows you to perform various operations with audio data. You can create and edit audio files professionally, also displaying a waveform image of audio file makes your work faster.

10.5.14 Eisenkraut

Eisenkraut is a cross-platform audio file editor. It requires Java 1.4+ and SuperCollider 3. It supports multi-channel and multi-mono files and floating-point encoding. An OSC scripting interface and experimental sonogramme functionality are provided.

10.5.15 FreeWave mp3 Editor

Free Wave mp3 Editor is a sound editor program for Windows. This software lets you make and edit voice and other audio recordings. You can cut, copy and paste parts of recording and, if required, add effects like echo, amplification and noise reduction.

10.5.16 Kangas Sound Editor

Fun Kangaroo-themed program that allows the user to create music and sound effects. It uses a system of frequency ratios for pitch control, rather than conventional music notation and equal temperament. It allows instruments, both musical and percussion, to be created.

10.5.17 Ecawave

Ecawave is a simple graphical audio file editor. The user-interface is based on Qt libraries, while almost all audio functionality is taken directly from ecasound libraries. As ecawave is designed for editing large audio files, all processing is done direct-to-disk. Simple waveform caching is used to speed-up file operations. Ecawave supports all audio file formats and effect algorithms provided by ecasound libraries. This includes JACK, ALSA, OSS, aRts, over 20 file formats, over 30 effect types, LADSPA plugins and multi-operator effect presets.

10.5.18 Audiobook Cutter

Audiobook Cutter splits your mp3 audio books and podcasts in a fast and user friendly way. The split files can easily be used on mobile mp3 players because of their small-size. Their duration

allows smooth navigation through the book. The split points are determined automatically based on silence detection.

Notes

10.5.19 Jokosher

Jokosher is a simple yet powerful multi-track studio. With it, you can create and record music, podcasts and more, all from an integrated simple environment.

10.5.20 LMMS

The LMMS is a free cross-platform alternative to commercial program like FL Studio, which allow you to produce music with your computer. This includes the creation of melodies and beats, the synthesis and mixing of sounds, and arranging of samples. You can have fun with your MIDI-keyboard and much more; all in a user-friendly and modern interface.

10.5.21 mp3Splt

mp3Splt-project is a utility to split mp3 and ogg files selecting a begin and an end time position, *without decoding*. It is very useful to split large mp3/ogg to make smaller files or to split entire albums to obtain original tracks. If you want to split an album, you can select split points and filenames manually or you can get them automatically from CDDB (internet or a local file) or from .cue files. Supports also automatic silence split, that can be used also to adjust cddb/cue splitpoints. You can extract tracks from mp3Wrap or AlbumWrap files in few seconds.

10.5.22 Qtractor

Qtractor is an Audio/MIDI multi-track sequencer application written in C++ with the Qt4 framework. Target platform is Linux, where the Jack Audio Connection Kit (JACK) for audio, and the Advanced Linux Sound Architecture (ALSA) for MIDI, are the main infrastructures to evolve as a fairly-featured Linux desktop audio workstation GUI, specially dedicated to the personal home-studio.

10.5.23 ReZound

ReZound aims to be a stable, open source, and graphical audio file editor primarily for.

10.5.24 Sweep

Sweep is an audio editor and live playback tool for GNU/Linux, BSD and compatible systems. It supports many music and voice formats including wav, AIFF, Ogg Vorbis, Speex and mp3, with multichannel editing and LADSPA effects plugins.

10.5.25 WaveSurfer

WaveSurfer is an Open Source tool for sound visualization and manipulation. It has been designed to suit both novice and advanced users. WaveSurfer has a simple and logical user interface that provides functionality in an intuitive way and which can be adapted to different tasks.



“Disseminating our Learning”

Case Study

Context

Dissemination of learning is often maximized through the capturing and sharing of “real-life” examples. In doing so, challenges and successes can be presented in a way that allows others to benefit from the learning’s identified.

Contd...

| Notes | <h2>The Challenge</h2> <p>It is recognized that documentation and dissemination of written material does not serve as the sole source of sharing and learning. It is often the challenge of community organizers to be creative in the transfer of Case Study learning's. These learning's are often needed to be transferred from beyond themselves, to others who can potentially benefit from experiences captured in the field. Others may include network members, community volunteers and stakeholders.</p> |
|-------|--|
| | <h3>Potential Benefits</h3> <p>For those community organizers who are successful in transferring Case Study learning's to other network members, community volunteers and stakeholders, numerous benefits could be achieved. For example:</p> <ul style="list-style-type: none"><li data-bbox="463 664 1303 687">• increasing buy-in and commitment to planning and visioning;<li data-bbox="463 702 1303 725">• increasing skills and understanding of complex planning processes;<li data-bbox="463 743 1303 763">• capitalizing on what has, and has not worked so well in similar past planning processes;<li data-bbox="463 797 1303 817">• Are there other benefits you can identify? <h3>Questions:</h3> <ol style="list-style-type: none"><li data-bbox="463 905 1303 925">1. What are the challenges of community organizers?<li data-bbox="463 943 1303 963">2. What are the benefits of community organizers? |

Self Assessment

Choose the correct answer:

10. Audacity is free, open source software for recording and editing

Notes

- | | |
|----------------------|------------|
| (a) video | (b) image |
| (c) Both (a) and (b) | (d) sounds |

10.6 Summary

- 3D modelling is the process of developing a mathematical representation of any three-dimensional surface of object via specialized software.
- 3D models are created by manipulating polygon meshes and moulding them into objects, characters and scenes.
- A Sound editing tools is a computer application for audio editing, i.e. manipulating digital audio.
- Image editing encompasses the processes of altering images, whether they be digital photographs, traditional analogue photographs, or illustrations.
- 3D art is used in everything from print ads, Web sites, television, movies, video games and beyond.
- A recent tool in digital image editing software is the image slicer.

10.7 Keywords

Animation: It is the process of taking a 3D object and getting it to move.

Audiobook cutter: It splits your mp3 audio books and podcasts in a fast and user friendly way.

Cropping: It creates a new image by selecting a desired rectangular portion from the image being cropped.

Picasa: It is an image organizer and image viewer for organizing and editing digital photos, plus an integrated photo-sharing Web site.

Wave pad: It is a sound editing tool that helps to you make and edit music, voice and other audio recordings.



1. Select an image and use clone tool on it.
2. Select an image and crop using appropriate tool.

Lab Exercise

10.8 Review Questions

1. Write short notes on the following:

| | |
|------------------|---------------|
| (a) 3D modelling | (b) 3D Canvas |
|------------------|---------------|
2. Discuss the qualities of a 3D artist.
3. Enlist and describe the various types of 3D art.
4. Explain in brief about advanced character meshes.
5. Define the following with two examples of each:

| | |
|-------------------|-------------------|
| (a) Image editing | (b) Sound editing |
|-------------------|-------------------|

Notes

6. Write short notes on the following:
 - (a) Automatic Image Enhancement
 - (b) Digital Data Compression
7. Describe in brief various image editing features.
8. Describe in brief any five image editing tools.
9. Compare the use of sound editing tool in music versus speech.
10. Discuss any five sound editing tools.

Answer to Self Assessment

- | | | | | |
|--------|--------|--------|--------|---------|
| 1. (a) | 2. (b) | 3. (a) | 4. (c) | 5. (a) |
| 6. (b) | 7. (b) | 8. (a) | 9. (a) | 10. (d) |

10.9 Further Readings



Books

Adobe Photoshop CS5 for Photographers: A Professional Image Editor's Guide ...
by Martin Evening.

Multimedia Technologies By Banerji.



Online link

en.wikipedia.org/wiki/3D_computer_graphics_software

Unit 11: Compression

Notes

CONTENTS

- Objectives
- Introduction
- 11.1 CODEC
- 11.2 Compression Quality
- 11.3 Types of Compression
 - 11.3.1 Lossless Compression Algorithms
 - 11.3.2 Lossy Compression Algorithms
- 11.4 Redundancies and its Types
 - 11.4.1 Coding Redundancy
 - 11.4.2 Interpixel Redundancy
 - 11.4.3 Psychovisual Redundancy
- 11.5 Image Compression Models
 - 11.5.1 The Source Encoder and Decoder
 - 11.5.2 The Channel Encoder and Decoder
- 11.6 Summary
- 11.7 Keywords
- 11.8 Review Questions
- 11.9 Further Readings

Objectives

After studying this unit, you will be able to:

- Understand codec
- Explain compression quality
- Describe compression quality
- Understand redundancies and its types
- Explain image compression models

Introduction

Multimedia compression is employing tools and techniques in order to reduce the file size of various media formats. With the development of World Wide Web the importance of compress algorithm was highlighted because it performs faster in networks due to its highly reduced file size. Furthermore with the popularity of voice and video conferencing over the Internet, compression method for multimedia has reached it next generation to provide smooth service even in unreliable network infrastructure. Although many methods are used for this purpose, in general, these methods can be divided into two broad categories named Lossless and Lossy methods.

11.1 CODEC

The “Codec” is a technical name for “compression/decompression”. It also stands for “compressor/decompressor” and “code/decode”. All of these variations mean the same thing:

Notes a codec is a computer program that both shrinks large movie files, and makes them playable on your computer. Codec programs are required for your media player to play your downloaded music and movies.

The codec is a short name for coder-decoder, the software that takes a raw data file and turns it into a compressed file. Since compressed files only contain some of the data found in the original file, the codec is the necessary “translator” that decides what data makes it in to the compressed version and what data gets discarded.

Different codecs translate in different ways, so a video file compressed using the Intel Indeo codec will be different from a file compressed using the Cinepak codec. For example, sometimes the difference is noticeable, sometimes not, but it is good to be aware of what codecs are best for what you are trying to do in order to maintain the best ratio of file size to quality.

11.2 Compression Quality

- **Lossy codecs:** Many of the more popular codecs in the software world are lossy, meaning that they reduce quality by some amount in order to achieve compression. Often, this type of compression is virtually indistinguishable from the original uncompressed sound or images, depending on the codec and the settings used. Smaller data sets ease the strain on relatively expensive storage sub-systems such as non-volatile memory and hard disk, as well as write-once-read-many formats such as CD-ROM, DVD and Blu-ray Disc. Lower data rates also reduce cost and improve performance when the data is transmitted.
- **Lossless codecs:** There are also many lossless codecs which are typically used for archiving data in a compressed form while retaining all of the information present in the original stream. If preserving the original quality of the stream is more important than eliminating the correspondingly larger data sizes, lossless codecs are preferred. This is especially true if the data is to undergo further processing (for example editing) in which case the repeated application of processing (encoding and decoding) on lossy codecs will degrade the quality of the resulting data such that it is no longer identifiable (visually, audibly or both). Using more than one codec or encoding scheme successively can also degrade quality significantly.



Did u know? The decreasing cost of storage capacity and network bandwidth has a tendency to reduce the need for lossy codecs for some media.

11.3 Types of Compression

11.3.1 Lossless Compression Algorithms

There will be no data loss in this type of compression as it is defined by the name. Both original data and the compressed data are the same in this compression. The algorithms for the compression and decompression are exact inverse of each other in the Lossless Compression. The main mechanism in this compression is removing the redundant data in the compression and adding them in the decompression.

Advantage: The original format of the data remains even it is compressed.

Disadvantage: Reduction of the size of the data is a small. Sometimes the size can increase instead of decrease.

Run-length Encoding

Run-length encoding can be named as the simplest method of encoding. Any combination of symbols can be compressed by this encoding technique. The concept of this algorithm is removing continuous sequence of symbols using another shorten symbol which represent it. Practically what is does is to replace the number of occurrences with the numeric value and the symbol itself. For example, a text like ‘AAAACBBBBB’ is replace by ‘A04C01B05’. This method is very much efficient when there are only two symbols.

Huffman Coding**Notes**

This is a little bit complicated than the previous one. First, the frequency of each appearing character is taken. Then the characters that have least frequencies being taken to give values '1' for the higher one and '0' for the lower one and there wise it is continued. Then the each available character is represented by a separated code included with 1s and 0s.

Lempel Ziv Encoding

This system does the encoding as two processes. They are indexing and compressing a string of symbols. When there is a set of characters, first step is to check whether an index have the minimum available character combination that appears. If available then put the index number in the string. If not, it will be added to the index. This compression technique is more effective as it has a two way compression method.

Lossless Compression File Formats**Audio**

- Waveform Audio Format (WAF)
- Free Lossless Audio Codec (FLAC)
- Apple Lossless Audio Codec (ALAC)
- ATRAC Advanced Lossless
- Audio Lossless Coding
- MPEG-4 SLS
- Direct Stream Transfer (DST)
- DTS-HD Master Audio
- Meridian Lossless Packing (MLP)
- Monkey's Audio APE
- RealPlayer – RealAudio Lossless
- Shorten – SHN, TTA – True Audio Lossless
- WMA Lossless

Graphics

- Adaptive Binary Optimization (ABO)
- JPEG XR
- Progressive Graphics File (PGF)
- Portable Network Graphics (PNG)
- Tagged Image File Format (TIFF)

Video

- Animation Codec
- CorePNG, Dirac
- FFV1
- JPEG 2000
- Huffuyv
- Lagarith
- MSU Lossless Video Codec
- SheerVideo

11.3.2 Lossy Compression Algorithms

It is the compression technique which will lose data in the original source while trying to keep the visible quality at the almost same amount. The compression ratio will be very high. Most probably

Notes the ratio will be a value near 10. It reduces non-sensitive information to the human eyes and the compressed media will not be the media that was available before compression.

Advantage: Can reduce the file size more than in the lossless compression.

Disadvantage: The original file cannot be taken after the decompression.

Mathematical and Wavelet Transformation

In this process, images are converted to the mathematical functions. Discrete Cosine Transformation uses series of cosine functions to approximate image. This technique is used with JPEG, MPEG1 and MPEG 2 formats. A wavelet function is used to approximate the image. This can be used with the JPEG 2000 and MPEG 4 formats.

JPEG Encoding

In this encoding, an image is represented by a two dimensional array of pixels. A Grayscale picture of 307*200 pixels is represented by 2,457,600 bits and a colour picture is represented by 7,372,800 bits. Due to the number of calculations to be had in a JPEG format of a grayscale picture, it is divided into blocks of 8*8 pixels. The number of the units' id equal to the number of mathematical equations of each picture. The whole idea of JPEG is to change the picture into a linear set of numbers that reveals the redundancies. In addition to those techniques, MPEG is also a Lossy Compression technique. It is a way to encode the moving images and audio included in it. It supports many video formats from mobile phone to HD TV.

H.261, H.263, H.264

The H.261 is designed for video telephony and video conferencing applications. It was developed in 1988-1990. Data rate is a multiplication of a 64 kb/s. The H.263 is a video coding technique for low bit rate communication. In addition, a 30% of bit saving can be done by this technique when it is compared to the MPEG-1. The H.264 is a joint project of ITU-Ts Video Experts Group and the ISO/IEC MPEG group. All those three methods use different methods of reducing redundant data. There for the output differs from bit rate, quality and latency.



task Compress an image using lossy compression technique.

Self Assessment

Choose the correct answer:

11.4 Redundancies and its Types

Notes

The term data compression refers to the process of reducing the amount of data required to represent a given quantity of information. A clear distinction must be made between data and information. They are not synonymous. In fact, data are the means by which information is conveyed. Various amounts of data may be used to represent the same amount of information. Such might be the case, for example, if a long-winded individual and someone who is short and to the point where to relate the same story. Here, the information of interest is the story; words are the data used to relate the information. If the two individuals use a different number of words to tell the same basic story, two different versions of the story are created, and at least one includes nonessential data. That is, it contains data (or words) that either provide no relevant information or simply restate that which is already known. It is thus said to contain data redundancy. Data redundancy is a central issue in digital image compression. It is not an abstract concept but a mathematically quantifiable entity. If n_1 and n_2 denote the number of information-carrying units in two data sets that represent the same information, the relative data redundancy RD of the first data set (the one characterized by n_1) can be defined as

$$R_D = 1 - \frac{1}{C_R}$$

where C_R , commonly called the compression ratio, is

$$C_R = \frac{n_1}{n_2}$$

For the case $n_2 = n_1$, $C_R = 1$ and $R_D = 0$, indicating that (relative to the second data set) the first representation of the information contains no redundant data. When $n_2 \ll n_1$, $C_R \rightarrow \infty$ and $R_D \rightarrow 1$, implying significant compression and highly redundant data. Finally, when $n_2 \gg n_1$, $C_R \rightarrow 0$ and $R_D \rightarrow \infty$, indicating that the second data set contains much more data than the original representation. This, of course, is the normally undesirable case of data expansion. In general, C_R and R_D lie in the open intervals $(0, \infty)$ and $(-\infty, 1)$, respectively. A practical compression ratio, such as 10 (or 10 : 1), means that the first data set has 10 information carrying units (say, bits) for every 1 unit in the second or compressed data set. The corresponding redundancy of 0.9 implies that 90% of the data in the first data set is redundant.

In digital image compression, three basic data redundancies can be identified and exploited: Coding redundancy, interpixel redundancy and psychovisual redundancy.

11.4.1 Coding Redundancy

In this, we utilize formulation to show how the grey-level histogram of an image also can provide a great deal of insight into the construction of codes to reduce the amount of data used to represent it.

Let us assume, once again, that a discrete random variable r_k in the interval $[0, 1]$ represents the grey levels of an image and that each r_k occurs with probability $p_r(r_k)$.

$$P_r(r_k) = \frac{n_k}{n} \quad k = 0, 1, 2, \dots, L - 1$$

where, L is the number of grey levels, n_k is the number of times that the k th grey level appears in the image, and n is the total number of pixels in the image. If the number of bits used to represent each value of r_k is $l(r_k)$, then the average number of bits required to represent each pixel is

$$L_{\text{avg}} = \sum_{k=0}^{L-1} l(r_k)p_r(r_k).$$

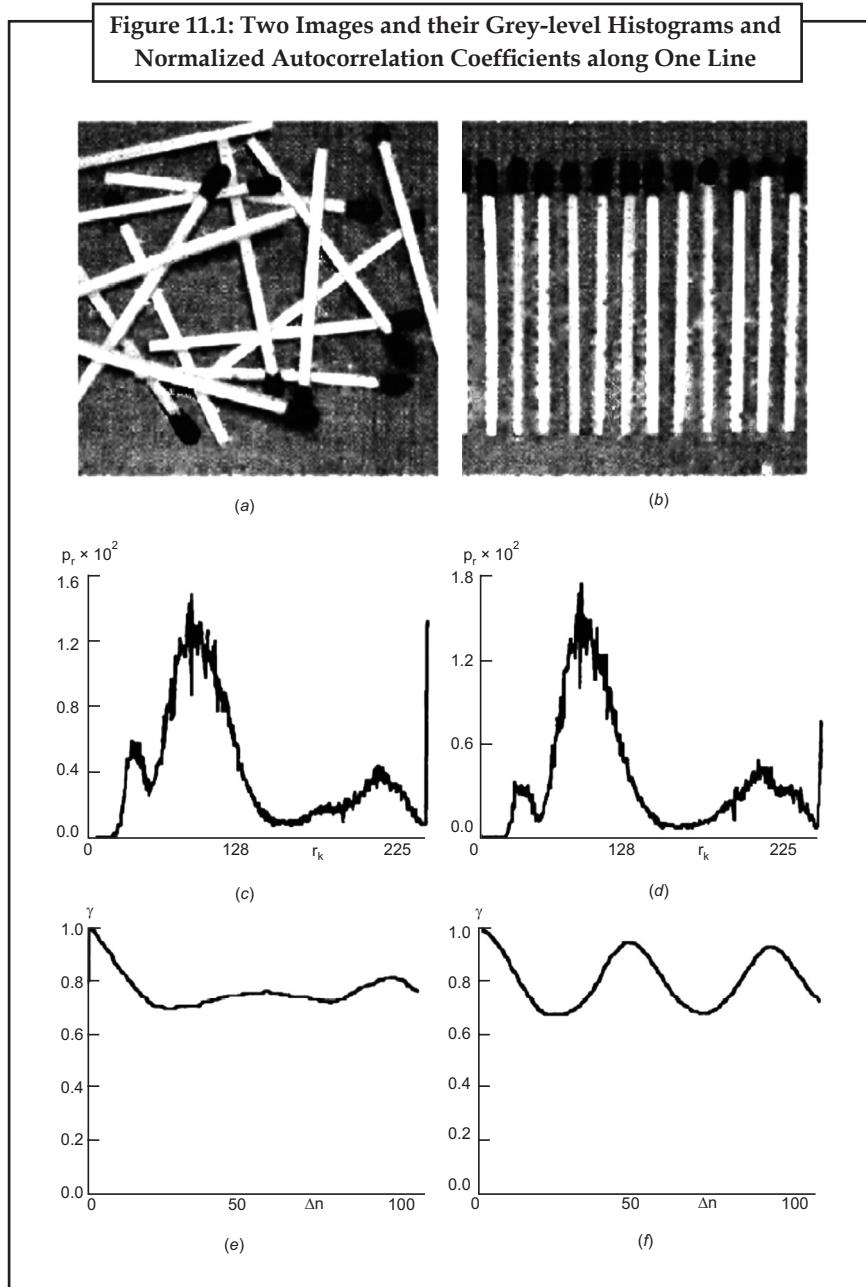
That is, the average length of the code words assigned to the various grey-level values is found by summing the product of the number of bits used to represent each grey-level and the probability that the grey-level occurs. Thus, the total number of bits required to code an $M \times N$ image is MNL_{avg} .

Notes

11.4.2 Interpixel Redundancy

Consider the images shown in Figures 11.1 (a) and (b). As Figs. 11.1 (c) and (d) shows, these images have virtually identical histograms. Note also that both histograms are trimodal, indicating the presence of three dominant ranges of grey-level values. Because the grey levels in these images are not equally probable, variable-length coding can be used to reduce the coding redundancy that would result from a straight or natural binary encoding of their pixels. The coding process, however, would not alter the level of correlation between the pixels within the images. In other words, the codes used to represent the grey levels of each image have nothing to do with the correlation between pixels. These correlations result from the structural or geometric relationships between the objects in the image.

Figure 11.1: Two Images and their Grey-level Histograms and Normalized Autocorrelation Coefficients along One Line



Figs. 11.1 (e) and (f) show the respective autocorrelation coefficients computed along one line of each image.

Notes

$$\gamma(\Delta n) = \frac{A(\Delta n)}{A(0)}$$

where,

$$A(\Delta n) = \frac{1}{N - \Delta n} \sum_{y=0}^{N-1-\Delta n} f(x, y)f(x, y + \Delta n).$$

The scaling factor in equation above accounts for the varying number of sum terms that arise for each integer value of Δn . Of course, Δn must be strictly less than N , the number of pixels on a line. The variable x is the coordinate of the line used in the computation. Note the dramatic difference between the shape of the functions shown in Figs. 11.1(e) and (f). Their shapes can be qualitatively related to the structure in the images in Figs. 11.1(a) and (b). This relationship is particularly noticeable in Fig. 11.1 (f), where the high correlation between pixels separated by 45 and 90 samples can be directly related to the spacing between the vertically oriented matches of Fig. 11.1(b). In addition, the adjacent pixels of both images are highly correlated. When Δn is 1, γ is 0.9922 and 0.9928 for the images of Figs. 11.1 (a) and (b), respectively. These values are typical of most properly sampled television images.

These illustrations reflect another important form of data redundancy – one directly related to the interpixel correlations within an image. Since the value of any given pixel can be reasonably predicted from the value of its neighbours, the information carried by individual pixels is relatively small. Much of the visual contribution of a single pixel to an image is redundant; it could have been guessed on the basis of the values of its neighbours. A variety of names, including spatial redundancy, geometric redundancy and interframe redundancy, have been coined to refer to these interpixel dependencies. We use the term interpixel redundancy to encompass them all.

In order to reduce the interpixel redundancies in an image, the 2D pixel array normally used for human viewing and interpretation must be transformed into a more efficient (but usually “nonvisual”) format. For example, the differences between adjacent pixels can be used to represent an image. Transformations of this type (that is, those that remove interpixel redundancy) are referred to as mappings. They are called reversible mappings if the original image elements can be reconstructed from the transformed data set.

11.4.3 Psychovisual Redundancy

The brightness of a region, as perceived by the eye, depends on factors other than simply the light reflected by the region. For example, intensity variations (Mach bands) can be perceived in an area of constant intensity. Such phenomena result from the fact that the eye does not respond with equal sensitivity to all visual information. Certain information simply has less relative importance than other information in normal visual processing. This information is said to be psychovisually redundant. It can be eliminated without significantly impairing the quality of image perception.

In general, an observer searches for distinguishing features such as edges or textural regions and mentally combines them into recognizable groupings. The brain then correlates these groupings with prior knowledge in order to complete the image interpretation process. Unlike coding and interpixel redundancy, psychovisual redundancy is associated with real or quantifiable visual information. Its elimination is possible only because the information itself is not essential for normal visual processing. Since the elimination of psychovisually redundant data results in a loss of quantitative information, it is commonly referred to as quantization.

This terminology is consistent with normal usage of the word, which generally means the mapping of a broad range of input values to a limited number of output values. As it is an irreversible operation (visual information is lost), quantization results in lossy data compression.

Notes

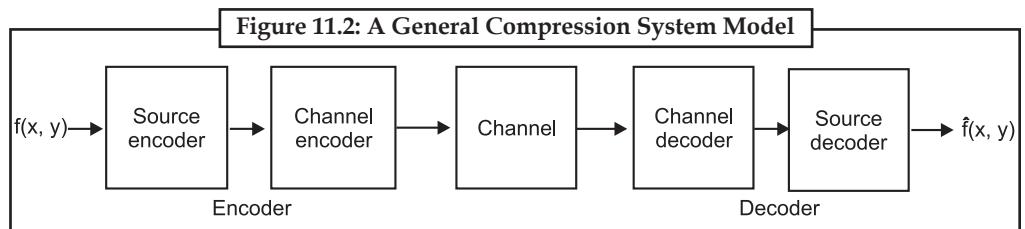
The psychovisual redundancies exist should not come as a surprise, since human perception of the information in an image normally does not involve quantitative analysis of every pixel value in the image.



The world's first commercial broadcast automation audio compression system was developed by Oscar Bonello, an Engineering professor at the University of Buenos Aires.

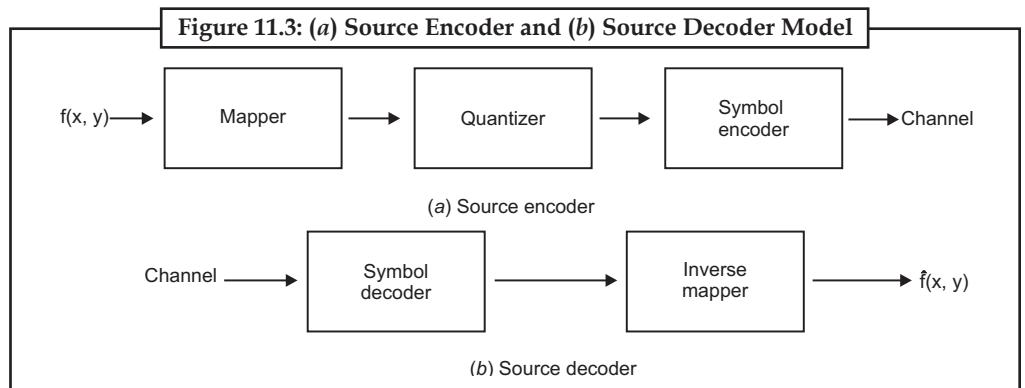
11.5 Image Compression Models

A compression system consists of two distinct structural blocks: an encoder and a decoder. An input image $f(x, y)$ is fed into the encoder, which creates a set of symbols from the input data. After transmission over the channel, the encoded representation is fed to the decoder, where a reconstructed output image $\hat{f}(x, y)$ is generated. In general, $\hat{f}(x, y)$ may or may not be an exact replica of $f(x, y)$. If it is, the system is error free or information preserving; if not, some level of distortion is present in the reconstructed image. Both the encoder and decoder shown in Figure 11.2 consist of two relatively independent functions or sub-blocks. The encoder is made up of a source encoder, which removes input redundancies, and a channel encoder, which increases the noise immunity of the source encoder's output. As would be expected, the decoder includes a channel decoder followed by a source decoder. If the channel between the encoder and decoder is noise free (not prone to error), the channel encoder and decoder are omitted, and the general encoder and decoder become the source encoder and decoder, respectively.



11.5.1 The Source Encoder and Decoder

The source encoder is responsible for reducing or eliminating any coding, interpixel or psychovisual redundancies in the input image. The specific application and associated fidelity requirements dictate the best encoding approach to use in any given situation. Normally, the approach can be modelled by a series of three independent operations. As Figure 11.3 (a) shows, each operation is designed to reduce one of the three redundancies. Figure 11.3 (b) depicts the corresponding source decoder. In the first stage of the source encoding process, the mapper transforms the input data into a (usually nonvisual) format designed to reduce interpixel redundancies in the input image. This operation generally is reversible and may or may not reduce directly the amount of data required to represent the image.



Run-length coding is an example of a mapping that directly results in data compression in this initial stage of the overall source encoding process. The representation of an image by a set of transform coefficients is an example of the opposite case. Here, the mapper transforms the image into an array of coefficients, making its interpixel redundancies more accessible for compression in later stages of the encoding process.

Notes

The second stage, or quantizer block in Fig. 11.3 (a), reduces the accuracy of the mapper's output in accordance with some pre-established fidelity criterion. This stage reduces the psychovisual redundancies of the input image. This operation is irreversible. Thus it must be omitted when error-free compression is desired.

In the third and final stage of the source encoding process, the symbol coder creates a fixed- or variable-length code to represent the quantizer output and maps the output in accordance with the code. The term symbol coder distinguishes this coding operation from the overall source encoding process. In most cases, a variable-length code is used to represent the mapped and quantized data set. It assigns the shortest code words to the most frequently occurring output values and thus reduces coding redundancy. The operation, of course, is reversible.

Fig. 11.3 (a) shows the source encoding process as three successive operations, but all three operations are not necessarily included in every compression system. Recall, for example, that the quantizer must be omitted when error-free compression is desired. In addition, some compression techniques normally are modeled by merging blocks that are physically separate in Figure 11.3 (a). In the predictive compression systems, for instance, the mapper and quantizer are often represented by a single block, which simultaneously performs both operations.

The source decoder shown in Fig. 11.3 (b) contains only two components: a symbol decoder and an inverse mapper. These blocks perform, in reverse order, the inverse operations of the source encoder's symbol encoder and mapper blocks. Because quantization results in irreversible information loss, an inverse quantizer block is not included in the general source decoder model shown in Fig. 11.3 (b).

11.5.2 The Channel Encoder and Decoder

The channel encoder and decoder play an important role in the overall encoding-decoding process when the channel of Fig. 11.2 is noisy or prone to error. They are designed to reduce the impact of channel noise by inserting a controlled form of redundancy into the source encoded data. As the output of the source encoder contains little redundancy, it would be highly sensitive to transmission noise without the addition of this "controlled redundancy." One of the most useful channel encoding techniques was devised by R. W. Hamming. It is based on appending enough bits to the data being encoded to ensure that some minimum number of bits must change between valid code words. Hamming showed, for example, that if 3 bits of redundancy are added to a 4-bit word, so that the distance between any two valid code words is 3, all single-bit errors can be detected and corrected. (By appending additional bits of redundancy, multiple-bit errors can be detected and corrected.) The 7-bit Hamming (7, 4) code word $h_1, h_2, h_3, \dots, h_6, h_7$ associated with a 4-bit binary number $b_3b_2b_1b_0$ is

$$h_1 = b_3 \oplus b_2 \oplus b_0 \quad h_3 = b_3$$

$$h_2 = b_3 \oplus b_1 \oplus b_0 \quad h_5 = b_2$$

$$h_4 = b_2 \oplus b_1 \oplus b_0 \quad h_6 = b_1$$

$$h_7 = b_0$$

where \oplus denotes the exclusive OR operation. Note that bits h_1, h_2 , and h_4 are even-parity bits for the bit fields $b_3b_2b_0$, $b_3b_1b_0$, and $b_2b_1b_0$, respectively. (Recall that a string of binary bits has even

Notes

parity if the number of bits with a value of 1 is even.) To decode a Hamming encoded result, the channel decoder must check the encoded value for odd parity over the bit fields in which even parity was previously established. A single-bit error is indicated by a nonzero parity word $c_4c_2c_1$, where

$$\begin{aligned}c_1 &= h_1 \oplus h_3 \oplus h_5 \oplus h_1 \\c_2 &= h_2 \oplus h_3 \oplus h_6 \oplus h_2 \\c_4 &= h_4 \oplus h_5 \oplus h_6 \oplus h_7\end{aligned}$$

If a nonzero value is found, the decoder simply complements the code word bit position indicated by the parity word. The decoded binary value is then extracted from the corrected code word as $h_3h_5h_6h_7$.



Task

Select a video clip and compress it using a video converter. Write its step in your notebook.



Case Study

A Brief History of Compression “*If you think of it, it exists somewhere*” – David Byrne

Digital video compression techniques have played an important role in the world of telecommunication and multimedia systems where bandwidth is still a valuable commodity. Hence, video compression techniques are of prime importance for reducing the amount of information needed for picture sequence without losing much of its quality, judged by human viewers. Modern compression techniques involve very complex electronic circuits and the cost of these can only be kept to an acceptable level by high volume production of LSI chips (for a short introduction to how LSI chips are manufactured, visit Jim’s site here). This means that we have to standardize the techniques of video compression.

The history of compression begins in the 1960s. An analogue videophone system had been tried out in the 1960s, but it required a wide bandwidth and the postcard-size black-and-white pictures produced did not add appreciably to voice communication! In the 1970s, it was realized that visual speaker identification could substantially improve a multiparty discussion and videoconference services were considered. Interest increased with improvements in picture quality and digital coding.

With the available technology in the 1980s, the COST211 video codec (Encoder/Decoder), based on differential pulse code modulation, DPCM (Pulse Code Modulation is still used in CD audio files, so they are called PCM/.wav files), was standardized by CCITT, under the H.120 standard. For more information on the history of conferencing, follow this link. This codec’s target bitrate was 2 Mbit/s for Europe and 1.544 Mbit/s for North America, suitable for their respective first levels of digital hierarchy. However, the image quality, although having very good spatial resolution (due to the nature of DPCM working on a pixel-by-pixel basis), had a very poor temporal quality. It was soon realized that in order to improve the image quality, without exceeding the target bitrate, less than one bit should be used to code each pixel. This was only possible if a group of pixels (a “block”) were coded together, such that the bit per pixel is fractional. This led to the design of so-called *block-based codecs*.

During the late 1980s study period, of the 15 block based videoconferencing proposals submitted to the ITU-T (formerly the CCITT), 14 were based on the Discrete Cosine Transform (DCT) and only one on Vector Quantization (VQ). The subjective quality of video sequences

Contd...

presented to the panel showed hardly any significant differences between the two coding techniques. In parallel to ITU-T's investigation during 1984-88, the Joint Photographic Experts Group (JPEG) was also interested in compression of static images. They chose the DCT as the main unit of compression, mainly due to the possibility of progressive image transmission. JPEG's decision undoubtedly influenced the ITU-T in favouring DCT over VQ. By now there was a worldwide activity in implementing the DCT in chips and on DSPs.

In the late 1980s it was clear that the recommended ITU-T videoconferencing codec would use a combination of interframe DPCM for minimum coding delay and the DCT. The codec showed greatly improved picture quality over H.120. In fact, the image quality for videoconferencing applications was found reasonable at 384 kbit/s or higher and good quality was possible at significantly higher bitrates if around 1 Mbit/s. This effort was later extended to systems based on multiples of 64 kbit/s (upto 30 multiples of this value). The standard definition was completed in late 1989 and is officially called the H.261 standard, and the coding method is referred to as the "p × 64" method (p is an integer between 1 and 30).

In the early 1990s, the Motion Picture Experts Group (MPEG) started investigating coding techniques for storage of video, such as CD-ROMs. The aim was to develop a video codec capable of compressing highly active video such as movies, on hard disks, with a performance comparable to that of VHS quality. In fact, the basic framework of the H.261 generation of MPEG, called the MPEG-1 standard, was capable of accomplishing this task at 1.5 Mbit/s. Since for the storage of video, encoding and decoding delays are not a major constraint, one can trade delay for compression efficiency. For example in the temporal domain a DCT might be used rather than DPCM, or DPCM used but with much improved motion estimation, such that the motion compensation removes temporal correlation. This later option was adopted with MPEG-1.

These days, MPEG-1 decoders/players are becoming commonplace for multimedia on computers. The MPEG-1 decoder plug-in hardware boards (e.g., MPEG magic cards) have been around for a while, and now software MPEG-1 decoders are available with the release of operating systems or multimedia extensions for PC and Mac platforms. Since in all standard video codecs, only the decoders have to comply with proper syntax, software based encoding has added the extra flexibility that might even improve the performance of MPEG-1 in the future.

The MPEG-1 was originally optimized for typical applications using non-interlaced video of 25 frames per second (fps), in European format and 29.9 fps in North American format, in the range of 1.2–1.5 Mbit/s for image quality comparable to home VCRs, it can certainly be used at higher bitrates and resolutions. Early versions of MPEG-1 for interlaced video, such as those used in broadcast, were called MPEG1+. A new generation of MPEG, called MPEG-2 was soon adopted by broadcasters (who were initially reluctant to use any compression on video!). The MPEG-2 codes for interlaced video at bit rates 4–9 Mbit/s, and is now well on its way to making a significant impact in a range of applications such as digital terrestrial broadcasting, digital satellite TV, digital cable TV, digital versatile disc (DVD) and many others. Television broadcasters have started using MPEG-2 coded digital forms since the late 1990s.

A slightly improved version of MPEG-2, called MPEG-3, was to be used for coding of High Definition (HD) TV, but since MPEG-2 could itself achieve this, MPEG-3 standards were folded into MPEG-2.

It is foreseen that by 2014, the existing transmission of NTSC North America format will cease and instead HDTV with MPEG-2 compression will be used in terrestrial broadcasting.

Questions:

1. Explain the term block-based codecs.
2. Prepare a list of MPEG standards.

Notes

Notes

Self Assessment

Choose the correct answer:

11.6 Summary

- The codec is a short name for coder-decoder that takes a raw data file and turns it into a compressed file.
 - In lossless compression, both original data and the compressed data are the same.
 - Data redundancy is a central issue in digital image compression.
 - A compression system consists of two distinct structural blocks: an encoder and a decoder.
 - A variable-length code is used to represent the mapped and quantized data set.

11.7 Keywords

Codec programs: They are required for your media player to play your downloaded music and movies.

Lossless compression: It is used to removing the redundant data in the compression and adding them in the decompression.

Lossy compression: It is the compression technique which will lose data in the original source while trying to keep the visible quality at the almost same amount.

Multimedia compression: It is employing tools and techniques in order to reduce the file size of various media formats.

Source encoder: The source encoder is responsible for reducing or eliminating any coding, interpixel or psychovisual redundancies in the input image.



Lab Exercise

1. Give the steps to reduce the code redundancy.

2. Create a general compression system model for an image.

11.8 Review Questions

Notes

1. Define the term compression.
2. What do you mean by codec?
3. Explain the different types of compression.
4. Describe lossless compression file formats.
5. What do you mean by redundancy?
6. Describe different types of redundancy.
7. What do you mean by image compression models?
8. Define channel encoder and decoder.
9. Explain Huffman coding.
10. Describe lossy codecs and lossless codecs.

Answers to Self Assessment

1. (a) 2. (c) 3. (a) 4. (a) 5. (b)
6. (b) 7. (b) 8. (a)

11.9 Further Readings



Books

"Principles of Multimedia", by Ranjan Parekh, Tata McGraw Hill Author
Coundex DTP Course KIT, by Vikas Gupta, Wiley, 2008.



Online link

<http://books.google.co.in/books?>

Unit 12: Image Format

CONTENTS

Objectives

Introduction

12.1 Basics of Image Format

 12.1.1 Image or Graphic

 12.1.2 Raster

 12.1.3 Pixels and the Web

 12.1.4 Meta/Vector Image Formats

 12.1.5 Compression

12.2 Image Formats Types

 12.2.1 Bitmapped Graphics

 12.2.2 Structured Graphics

12.3 Graphic Interchange Format (GIF)

12.4 Joint Photographic Experts Group (JPEG)

 12.4.1 JPEG Fundamentals

 12.4.2 Human Visual System

 12.4.3 Colour System

 12.4.4 JPEG File Format

12.5 Moving Picture Experts Group (MPEG)

 12.5.1 Standards

12.6 Fractal Image Compression

 12.6.1 Fractal Basics

12.7 Summary

12.8 Keywords

12.9 Review Questions

12.10 Further Reading

Objectives

After studying this unit, you will be able to:

- Discuss the basics of image format
- Explain the image formats types
- Discuss the graphic interchange format (GIF)
- Discuss the joint photographic experts group (JPEG)
- Explain the moving picture experts group (MPEG)
- Understand the fractal image compression

Introduction

Notes

When developing a Web site you may not think much about what image format you use but you could end up saving yourself or your organization a chunk of change in bandwidth costs by making your choice more wisely. On the Web today there are three main image format types to choose from and all have their advantages and disadvantages. You have a choice of three different compressed image formats: GIF, JPEG or PNG. They each use different techniques to compress the image information.

GIF

The GIF uses a lossless compression which means that no quality is lost in the compression. The uncompressed image stores its information in a linear fashion. Each line of pixels is read from left to right. An interlaced GIF file stores the lines of the image in a different order. First lines 4, 8, 12, 16 and 20 may be read in. Then lines 2, 6, 10, 14, and 18 and soon until the entire image is read. When the image is read in this way, a user with a slower internet connection may be able to understand or read the image before it has fully loaded.

The GIF format achieves its compression by removing repeated patterns within the GIF file and storing references to these sections in a list, also known as a hash. Images with horizontal lines of the same colour or pattern benefit most from the GIF format. This would include images like background graphics, images with text and patterned images.

Another great advantage is the ability to create animated images. You have no doubt seen them throughout the internet. Especially if you were around for the heyday of the 90's! An animated GIF is essentially a sequence of GIF files with some timing information included. Animated GIFs, however, can run into large file sizes awfully quickly and with very few frames of animation. While it may be a fairly ubiquitous format, if you have to do animation, you may be better off going with Macromedia Flash. If one frame is 15 kB then 20 frames could suddenly find you well over 100 kB just for one animated image.

Another advantage to GIF files is transparency. A colour within the colour table can be selected as the transparent colour. In doing so, wherever that colour occurs, you will be able to see through to the HTML background. One of the largest downfalls to the GIF format is its inability to have a colour palette of more than 256 colours. This can create poor-looking images when used on a photograph which may originally have thousands of different colours.

JPEG

JPEG uses a loss compression which means that image quality is lost in the process of compressing the image. The JPEG compression works by first converting the image from RGB to YUV which stores information about each pixel using brightness, hue and saturation. Then it reduces the amount of information it stores for hue and saturation since differences are less noticeable to the human eye. In trying to decrease the file size of the JPEG (for example, when using the quality slider in Photoshop), you will tend to notice artefacts occur in flat colour areas and especially near edges. As a result, JPEG is best used for images that have more of a variation in colours. For example, images with gradients or photographs can handle a lower quality setting with little noticeable loss in quality. Images with text or large solid backgrounds are best left for GIF or PNG.

PNG

The PNG is the relative newcomer to the list of available image formats and it is a formidable one. It is similar to GIF in many ways but even better in others. It is lossless like GIF but supports 24 bit colour, unlike GIF which only supports 8. The PNG supports alpha transparency, whereas GIF only supports one-colour transparency. The PNG uses various compression filters to minimize overall image size and can apply different filters on a per-line basis to achieve higher compression. The big attraction to PNGs is its ability to do alpha transparency. Unfortunately, Internet Explorer currently does not have full support for it, although there are hacks out there that can pull it off.

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If you are not using alpha transparency or do not need more than 256 colours then exporting as an 8-bit PNG is the way to go. On average, 8-bit PNG will be smaller in file size than GIF with absolutely no difference in image quality. The PNG and GIF are also very similar in that they both work better with large lines of the same pattern or colour. If you do not need alpha transparency but wish to use a colour palette greater than 256 colours then you are looking at a 24-bit PNG. It will be important to test between a 24-bit PNG and JPEG to see which achieves better results. The PNG still suffers the same problem as GIF in that they cannot optimize photographs as well as JPEG can.

12.1 Basics of Image Format

Image file formats are standardized means of organizing and storing digital images. Image files are composed of pixels, vector (geometric) data, or a combination of the two. Whatever the format, the files are rasterized to pixels when displayed on most graphic displays. The pixels that constitute an image are ordered as a grid (columns and rows); each pixel consists of numbers representing magnitudes of brightness and colour.

12.1.1 Image or Graphic

Technically, neither if you really want to be strict, computer pictures are files, the same way WORD documents or solitaire games are files. They are all a bunch of ones and zeros all in a row. But we do have to communicate with one another so let's decide. We will use "image". That seems to cover a wide enough topic range.

That "graphic" is more of an adjective, as in "graphic format." You see, we denote images on the Internet by their graphic format. The GIF is not the name of the image. The GIF is the compression factors used to create the raster format set up by CompuServe.

12.1.2 Raster

Raster Image Formats (RIFs) should be the most familiar to Internet users. A Raster format breaks the image into a series of coloured dots called pixels. The number of ones and zeros (bits) used to create each pixel denotes the depth of colour you can put into your images.

Bump that up to 4 bits-per-pixel and you are able to set that colour dot to one of 16 colours. If you go even higher to 8 bits-per-pixel, you can save that colour dot at up to 256 different colours.

Does that number, 256 sounds familiar to anyone? That is the upper colour level of a GIF image. Sure, you can go with less than 256 colours, but you cannot have over 256.

That is why a GIF image does not work overly well for photographs and larger images. There are a whole lot more than 256 colours in the world. Images can carry millions. But if you want smaller icon images, GIFs are the way to go.

Raster image formats can also save at 16, 24, and 32 bits-per-pixel. At the two highest levels, the pixels themselves can carry up to 16,777,216 different colours. The image looks great! Bitmaps saved at 24 bits-per-pixel are great quality images, but of course they also run about a megabyte per picture. There's always a trade-off, is not there?

The three main Internet formats, GIF, JPEG, and Bitmap, are all Raster formats.

Some other Raster formats include the following:

| | |
|-----|------------------|
| CLP | Windows Clipart |
| DCX | ZOFT Paintbrush |
| DIB | OS/2 Warp format |
| FPX | Kodak's FlashPic |
| IMG | GEM Paint format |

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Notes

| | |
|------|---|
| JIF | JPEG Related Image format |
| MAC | MacPaint |
| MSP | MacPaint New Version |
| PCT | Macintosh PICT format |
| PCX | ZSoft Paintbrush |
| PPM | Portable Pixel Map (UNIX) |
| PSP | Paint Shop Pro format |
| RAW | Unencoded image format |
| RLE | Run-Length Encoding (Used to lower image bit rates) |
| TIFF | Aldus Corporation format |
| WPG | WordPerfect image format |



Caution The GIF file format does not support some basic image properties such as print resolution. You should use different file format like PNG.

12.1.3 Pixels and the Web

There is a delicate balance between the crispness of a picture and the number of pixels needed to display it. Let's say you have two images, each is 5 inches across and 3 inches down. One uses 300 pixels to span those five inches, the other uses 1500. Obviously, the one with 1500 uses smaller pixels. It is also the one that offers a crisper, detailed look. The more pixels, the more detailed the image will be. Of course, the more pixels the more bytes the image will take up.

So, how much is enough? That depends on whom you are speaking to, and right now you are speaking. It always go with 100 pixels per inch. That creates a ten-thousand pixel square inch. It found that allows for a pretty crisp image without going overboard on the bytes. It also allows some leeway to increase or decrease the size of the image and not mess it up too much.

The lowest go is 72 pixels per-inch, the agreed upon low end of the image scale. In terms of pixels per square inch, it is a whale of a drop to 5184. Try that.

12.1.4 Meta/Vector Image Formats

You may not have heard of this type of image formatting, not that you had heard of Raster, either. This formatting falls into a lot of proprietary formats, formats made for specific programs. CorelDRAW (CDR), Hewlett-Packard Graphics Language (HGL), and Windows Metafiles (EMF) are a few examples.

Where the Meta/Vector formats have it over Raster is that they are more than a simple grid of coloured dots. They are actual vectors of data stored in mathematical formats rather than bits of coloured dots. This allows for a strange shaping of colours and images that can be perfectly cropped on an arc. A squared-off map of dots cannot produce that arc as well. In addition, since the information is encoded in vectors, Meta/Vector image formats can be blown up or down (a property known as "scalability") without looking jagged or crowded (a property known as "pixelating").

So that do not receive e-mail from those in the computer image know, there is a difference in Meta and Vector formats. Vector formats can contain only vector data whereas Meta files, as is implied by the name, can contain multiple formats. This means there can be a lovely Bitmap plopped right in the middle of your Windows Meta file.

12.1.5 Compression

"Compression" is a computer term that represents a variety of mathematical formats used to compress an image's byte size. Let's say you have an image where the upper right-hand corner

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has four pixels all the same colour. Why not find a way to make those four pixels into one? That would cut down the number of bytes by three-fourths, at least in the one corner. That is a compression factor.

Bitmaps can be compressed to a point. The process is called “run-length encoding.” Runs of pixels that are all the same colour are all combined into one pixel. The longer the run of pixels, the more compression. Bitmaps with little detail or colour variance will really compress. Those with a great deal of detail do not offer much in the way of compression. Bitmaps that use the run-length encoding can carry either the common “.bmp” extension or “.rle”. Another difference between the two files is that the common Bitmap can accept 16 million different colours per pixel. Saving the same image in run-length encoding knocks the bits-per-pixel down to 8. That locks the level of colour in at no more than 256. That is even more compression of bytes to boot.

12.2 Image Formats Types

One of the initial decisions you have to make as you are creating graphics for your presentations or pages is what files formats to use for your graphics. File formats break down into two categories: bitmapped and structured or vector.

12.2.1 Bitmapped Graphics

Bitmapped graphics work by saving the colour information for every pixel of the image. As a result, the larger the image, the larger the file size. In addition, the more colours the graphic can use, the larger the image size, since more information has to be stored for each pixel (see Table 12.1).

Table 12.1: Common Bitmap Colour Depths and the Number of Colours Supported

| Bit Depth | Number of Colours |
|-----------|--|
| 1 bit | 2 colours |
| 8-bit | 256 colours |
| 16-bit | 65.5 thousand colours |
| 24-bit | 16.77 million colours |
| 32-bit | 16.77 million colours plus 8-bit alpha channel |

The most common bitmapped graphic formats you will run across are:

- Windows Bitmap format (.bmp extension)
- Graphic Interchange Format (.gif extension), which is widely used for Web graphics
- Portable Network Graphics format (.png extension), implemented as an alternative to the .gif format,
- Macintosh Picture format (.pic extension) and
- Tagged Interchange Format (.tif extension), which is often used for cross-platform (Macintosh and Windows) graphics.

Another way of considering the basic formats is when you would typically use them (see Table 12.2).

Table 12.2: Typical Bitmapped Formats Organized by Application

| Application | Typical Formats |
|-----------------------|--|
| Presentation Software | .BMP (Windows) .PIC (Macintosh) .JPG |
| Web Pages | .GIF .JPG .PNG |

Table 12.3 provides a comparison of the Web bitmapped formats largely taken from the electronic documentation for Macromedia's Fireworks image creation program.

Notes

| Table 12.3: Comparison of Bitmapped Formats used for Web Pages | | | |
|--|--|---|---|
| | GIF | JPG | PNG |
| Colour depth | 8-bit maximum (256 colours) | Up to 24-bit (16.77 million colours) | Up to 32-bit [24-bit colour and 8-bit alpha channel] |
| Compression | Lossless (Means that there is no loss of image quality in the compression); compresses solid areas of colour well | Lossy (means there is irretrievable loss of image data in the compression); compresses subtle colour transitions well | Lossless |
| Transparency support | Yes | No | Yes |
| Advantages | <ul style="list-style-type: none"> • Lossless compression • Transparency • Most efficient for illustrations or drawings | <ul style="list-style-type: none"> • Ability to control quality loss in compression • Excellent compression of photographic images | <ul style="list-style-type: none"> • Lossless compression • Alpha transparency • High colour support |
| Disadvantages | <ul style="list-style-type: none"> • Maximum of 256 colours • Does not compress gradient colours well | <ul style="list-style-type: none"> • No transparency • Loss of quality when compressed | <ul style="list-style-type: none"> • Despite its advantages, not widely used • Can't be displayed by older browsers |
| Typical uses | <ul style="list-style-type: none"> • Carton images • Logos • Animated banners | <ul style="list-style-type: none"> • Scanned photographs • Images with complex textures • Images with complex gradient colours | <ul style="list-style-type: none"> • Images with high numbers of colours • Complex, live transparency |

12.2.2 Structured Graphics

Rather than saving each pixel of an image, the structured formats save formulas for drawing the images (e.g., use a line this colour and width, start drawing at this point, move to this point, fill with this colour, etc.). As a result, the file sizes are much smaller than those for bitmapped images. However, the structured formats are generally only used for illustrations (images which look like drawings), rather than photo-realistic images. The most common "generic" structured formats for Windows are the Windows Meta File (.wmf format), the standard vector-based file format for Windows and the WordPerfect Graphic format (.wpg extension) used by DrawPerfect and the clip art which comes with WordPerfect. Adobe's Illustrator, Macromedia's FreeHand and Corel's CorelDraw are all structured graphic programs.

Web browsers cannot display the structured formats; clip art would have to be changed into one of the bitmapped formats to be displayed on a page. As a result, structured file formats would typically be used for graphic elements in presentations. However, because of the bandwidth problems on the Web and because structured graphics produce small file sizes, there is a trend to introduce some structured formats into Web usage. Macromedia's Flash, recently made an open standard for everyone to use, works with structured formats that (at this point) require plug-ins to display.

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12.3 Graphic Interchange Format (GIF)

The Graphics Interchange Format (GIF) is a bitmap image format that was introduced by CompuServe in 1987 and has since come into widespread usage on the World Wide Web due to its wide support and portability.

The format supports up to 8 bits-per-pixel thus allowing a single image to reference a palette of up to 256 distinct colours. The colours are chosen from the 24-bit RGB colour space. It also supports animations and allows a separate palette of 256 colours for each frame. The colour limitation makes the GIF format unsuitable for reproducing colour photographs and other images with continuous colour, but it is well-suited for simpler images such as graphics or logos with solid areas of colour.

The GIF images are compressed using the Lempel Ziv Welch (LZW) lossless data compression technique to reduce the file size without degrading the visual quality. This compression technique was patented in 1985.

(.GIF files extension) There have been raging debates about the pronunciation. The designers of GIF say it is correctly pronounced to sound like Jiff. But that seems counter-intuitive, and up in my hills, we say it sounding like Gift (without the t).

The GIF show images online (in 1987 for 8 bit video boards, before JPG and 24 bit colour was in use). The GIF uses indexed colour, which is limited to a palette of only 256 colours (next page). The GIF was a great match for the old 8 bit 256 colour video boards, but is inappropriate for today's 24 bit photo images.

The GIF files do not store the image's scaled resolution ppi number, so scaling is necessary every time one is printed. This is of no importance for screen or Web images. Our printers did not print images in 1987, so it was useless information, and CompuServe simply did not bother to store the printing resolution in GIF files.

The GIF is still an excellent format for graphics, and this is its purpose today, especially on the Web. Graphic images (like logos or dialog boxes) use few colours. Being limited to 256 colours is not important for a 3 colour logo. A 16 colour GIF is a very small file, much smaller, and clearer than any JPG, and ideal for graphics on the Web.

Graphics generally use solid colours instead of graduated shades, which limits their colour count drastically, which is ideal for GIF's indexed colour. The GIF uses lossless LZW compression for relatively small file size, as compared to uncompressed data. The GIF files offer optimum compression (smallest files) for solid colour graphics, because objects of one exact colour compress very efficiently in LZW. The LZW compression is lossless, but of course the conversion to only 256 colours may be a great loss. The JPG is much better for 24 bit photographic images on the Web. For those continuous tone images, the JPG file is also very much smaller (although lossy). But for graphics, GIF files will be smaller, and better quality, and (assuming no dithering) pure and clear without JPG artifacts.

If GIF is used for continuous tone photo images, the limited colour can be poor, and the 256 colour file is quite large as compared to JPG compression, even though it is 8 bit data instead of 24 bits. Photos might typically contain 100,000 different colour values, so the image quality of photos is normally rather poor when limited to 256 colours. The 24 bit JPG is a much better choice today. The GIF format may not even be offered as a save choice until you have reduced the image to 256 colours or less.

So for graphic art or screen captures or line art, GIF is the format of choice for graphic images on the Web. Images like a company logo or screen shots of a dialog box should be reduced to 16 colours if possible and saved as a GIF for smallest size on the Web. A complex graphics image that

may look bad at 16 colours might look very good at say 48 colours (or it may require 256 colours if photo-like). But often 16 colours are fine for graphics, with the significance that the fewer number of colours, the smaller the file, which is extremely important for Web pages.

Notes

The GIF optionally offers transparent backgrounds, where one palette colour is declared transparent, so that the background can show through it. The GIF File - Save As dialog box usually has an Option Button to specify which one GIF palette index colour is to be transparent.

Interlacing is an option that quickly shows the entire image in low quality, and the quality sharpens as the file download completes. Good for Web images, but it makes the file slightly larger.

The GIF files use a palette of indexed colours, and if you thought 24 bit RGB colour was kind a complicated, then you are not seen nuthin' yet (next page).

For GIF files, a 24 bit RGB image requires conversion to indexed colour. More specifically, this means conversion to 256 colours, or less. Indexed colour can only have 256 colours maximum. There are however selections of different ways to convert to 256 colours.

Self Assessment

Choose the correct answer:

1. Image file formats are not standardized means of organizing and storing digital images.

| | |
|----------|-----------|
| (a) True | (b) False |
|----------|-----------|
2. should be the most familiar to Internet users.

| | |
|-------------------|-------------------------------|
| (a) Image formats | (b) Raster image formats |
| (c) Pixels | (d) Meta/Vector Image Formats |
3. work by saving the colour information for every pixel of the image.

| | |
|-------------------|--------------------------|
| (a) Image formats | (b) Raster image formats |
| (c) Pixels | (d) Bitmapped graphics |
4. is a computer term that represents a variety of mathematical formats used to compress an image's byte size.

| | |
|-----------------|--------------------------|
| (a) Compression | (b) Raster image formats |
| (c) Pixels | (d) Bitmapped graphics |

12.4 Joint Photographic Experts Group (JPEG)

The JPEG standard defines four variations for compression of images. These are known as follows Sequential DCT based mode. This is the JPEG baseline format.

Sequential Lossless Mode: This format is defined for applications in which it would be desirable to have no image detail lost in the compression process. This is not widely used as the compression statistics for this method is modest compared to the other styles.

Progressive DCT Based Mode: This format is very similar to the Baseline mode; however instead of processing information in one scan of the image, this mode processes in a series of scans, each one better defining the image from the last scan that was processed.

Hierarchical Mode: This format allows a number of different resolution images to be held within one file. This means that only one image file needs to be made for a number of resolutions it could be viewed at. Again it uses more than one scan to define the image, the decoder simply uses scans in order until it has reached the resolution it requires.

Notes

The JPEG Baseline is the defect standard that is used, and is the version for which this project is based. The reasons for this are that is the simplest algorithm as well as being the most widely supported because the JPEG standard specifies that all JPEG decoders must support the baseline version, even if it uses some of the other features within the JPEG standard.



JPEGs are cross platform, i.e. the software that can run on multiple types of computer systems.

12.4.1 JPEG Fundamentals

A number of concepts need to be developed before JPEG encoding can be discussed in depth. The JPEG standard is applicable to both grey scale and colour images. This is done by breaking a picture down in to a number of components. When each component is put together, the end image can be viewed. For example, a black and white image would have only one component which would depict the grey scale of the image, whereas a colour image generally has three components (one for each primary colour, red green and blue or equivalent).

Each component is made up of x columns and y rows of samples. These samples are simply the actual “pixel” data of the image. In JPEG Baseline the number of samples is the same as the resolution of the image. A single pass through a component and its samples is known as a scan. In JPEG Baseline this does not mean a great deal as only one scan of the image is used.

In JPEG encoding the data is broken into a number of blocks called Minimum Coded Units (MCU's). These MCU's are simply made by taking a number of 8×8 pixel sections of the source image. The MCU's are used to break down the image into workable blocks of data as well as to allow manipulation of local image correlation at a given part of the image by the encoding algorithm.

When processing each MCU, the algorithm always moves through the component from the left to right, then top to bottom order.

There are two methods of processing MCU's and components. The first method is whereby each MCU contains data from a single component only, and hence is comprised of only one unit of data. The second method is where the data from each component is interleaved within a single MCU. This means that each MCU contains all the data for a particular physical section of an image, rather than a number of MCUs containing each component of that section. This project uses the latter option

Further to this, there are horizontal and vertical sampling factors. These sampling factors dictate how many 8×8 pixel sections are to be placed within an MCU when the component data is interleaved.

12.4.2 Human Visual System

A number of inherent properties of images and the human visual system can be manipulated to allow for greater compression through the JPEG algorithm.

One of these is the tendency for the human eye to notice variations of brightness intensity much more than variations of colour in an image. The JPEG algorithm can take advantage of this by applying different rules for brightness and colour variations.

Another property is that real world images generally do not have sharp boundaries for brightness intensity changes and colour changes. This means that spatial frequencies detected within an image are generally low order, i.e. gradual change rather than quick changes over a localized area of an image.

12.4.3 Colour System

The JPEG algorithm generally does not use the RGB (Red, Green, and Blue) colour format. Instead it uses a derivative of this called YCbCr (Luminance and Chrominance).

The YCbCr colour format is ideal for JPEG compression as it enables brightness and colour information from an image to be separated. This is desirable as, described previously; the human eye tends to notice brightness variation more than colour variation. By separating these two properties we can apply different tolerances and compression ratios to each so as to get optimal compression at the best image quality possible.

Notes

The RGB colour scheme is simply a method of storing the Red, Green and Blue colour components of a pixel. It uses a byte of data per colour component for full colour (or 24 bit) values. In other words, each colour component has a range of 0 to 65535 for the value of the colour being described. Note that this is not the same as 16 bit colour which allows only a subset of the 24 bit colour field.

Taking the RGB values and inputting them into a set of equations as follows derives the YCbCr colour format coefficients,

$$Y = 0.3 \times R + 0.6 \times G + 0.1 \times B - 128$$

$$Cb = -0.15 \times R - 0.3 \times G + 0.45 \times B$$

$$Cr = 0.4375 \times R - 0.375 \times G - 0.0625 \times B$$

Where R, G, B and Y are unsigned 8 bit numbers and Cb and Cr are signed 8 bit numbers.

This gives 8 bit values for the Brightness and the two Chrominance coefficients. This now gives more meaningful variables for the JPEG algorithm to work with.



The YCbCr or YCbCr, sometimes written $YC_B C_R$ or $Y'C_B C_R'$, is a family of colour spaces used as a part of the colour image pipeline in video and digital photography systems. Y' is the luma component and C_B and C_R are the blue-difference and red-difference chrome components.

12.4.4 JPEG File Format

The File format that was used for this project was JFIF (JPEG File Interchange Format). This is not strictly a part of the JPEG standard, but was developed to attempt to standardize the JPEG formats so that greater compatibility between platforms and applications could be obtained. Currently JFIF is the main file format that is used, especially for JPEG Baseline compressed images.

The JPEG standard defines a number of header fields and sections to allow the JPEG encoded image to be decoded. It also left a number of sections open so that applications could make use of them as they saw fit. The result was that a large amount of incompatible versions of JPEG were released, as the header format of the file was not compatible. The JFIF solved this problem by standardizing the application specific sections so that compatibility could be introduced.

There are quite a number of header sections in the JPEG that defined, but are not applicable in JPEG baseline. For simplicity, this section will only document the sections that this project actually used, but the reader should be aware that there are quite a few more.

Table 12.4: Complete List of Available Segments in JPEG

| Description | Symbol | Marker |
|--|--------|--------|
| Baseline DCT, Huffman | SOF0 | FFC0H |
| Extended sequential DCT, Huffman | SOF1 | FFC1H |
| Progressive DCT, Huffman | SOF2 | FFC2H |
| Spatial (sequential) lossless, Huffman | SOF3 | FFC3H |
| Differential Sequential DCT, Huffman | SOF5 | FFC5H |
| Differential progressive DCT, Huffman | SOF6 | FFC6H |

Contd...

Notes

| | | |
|---|-------|------------|
| Differential spatial, Huffman | SOF7 | FFC7H |
| Reserved for JPEG extensions, Arithmetic | JPG | FFC8H |
| Extended sequential DCT, Arithmetic | SOF9 | FFC9H |
| Progressive DCT, Arithmetic | SOF10 | FFCAH |
| Spatial (sequential) lossless, Arithmetic | SOF11 | FFCBH |
| Differential sequential DCT, Arithmetic | SOF13 | FFCDH |
| Differential progressive DCT, Arithmetic | SOF14 | FFCEH |
| Differential spatial, Arithmetic | SOF15 | FFCFH |
| Define Huffman Table(s) | DHT | FFC4H |
| Define Arithmetic coding conditioning | DAC | FFCCH |
| Restart | RSTm | FFD0-FFD7H |
| Start of Image | SOI | FFD8H |
| End of Image | EOI | FFD9H |
| Start of Scan | SOS | FFDAH |
| Define Quantisation Table | DQT | FFDBH |
| Define number of Lines | DNL | FFDCH |
| Define Restart Interval | DRI | FFDDH |
| Define Hierarchical progression | DHP | FFDEH |
| Expand reference components | EXP | FFDFH |
| Reserved for Application Segments | APPn | FFE0-FFEFH |
| Reserved for JPEG extensions | JPGn | FFF0-FFFDH |
| Comment | COM | FFFEH |
| Temporary arithmetic Coding | TEM | FF01H |
| Reserved | RES | FF02-FFBFH |

Start of Image (SOI) Segment

This segment is always 2 bytes long and always contains the marker FFD8H

JFIF Application (APP0) Segment

This segment contains the following information in order. The purpose of this segment is to define higher level details such as image size and miscellaneous version control information. The number in brackets indicates the number of bytes the information is stored in.

- Segment marker (2). Is always FFE0H
- Section length (2). Does not include the segment marker
- Application code (4). Is always "JFIF"
- JFIF major version number (2)
- JFIF minor version number (2)
- Horizontal pixel density of the image (2)
- Vertical pixel density of the image (2)
- Width of thumbnail image (1)
- Height of thumbnail image (1)

This segment contains information detailing the Quantization Tables for the encoded image. The number in brackets indicates the number of bytes the information is stored in:

- Segment marker (2). Is always FFD8H
- Section length (2). Does not include the segment marker
- Quantization table header (1). Top nibble denotes the precision of the table, low nibble denotes the Table ID
- Data for relevant table (64). Each entry is one byte each and is ordered as per the zig-zag method used in quantization.

Notes

Steps 3 and 4 are repeated for each Quantization table defined.

Start of Frame (SOF) Segment

This segment details information at a lower level such as which component uses what Quantization table, sampling factors etc. The number in brackets indicates the number of bytes the information is stored in.

- Segment marker (2). Is always FFC0H
- Section length (2). Does not include the segment marker
- Precision of samples (1). This is always 08H
- Horizontal resolution of image (2).
- Vertical resolution of image (2)
- Number of components in image (1).
- Component ID (1).
- Sampling factor for component (1). High nibble is vertical sampling factor; low nibble is horizontal sampling factor.
- Quantization table ID for component (1)

Steps 7 through 9 are repeated for each component used in the image. The JFIF also specifies that if the YCbCr colour format is used, then the component ID for Y should be 01H, the ID for Cb should be 02H and Cr should be 03H.

Define Huffman Table (DHT) Segment

This segment defines the contents of the Huffman Code Libraries. This entire segment is repeated once for each Huffman Code Library used. The number in brackets indicates the number of bytes the information is stored in.

- Segment Marker (2). Is always FFC4H
- Section length (2). Does not include the segment marker
- Table ID (1).
- Number of table entries with a certain code length (n) i.e. first byte is for the number of codes with 1 bit code length, the second byte is for the number of codes with 2 bit code length and so on until the biggest code length is reached.
- Symbols for either the SSSS or the RUN-SIZE values calculated in the Huffman coding procedure (m). The symbols are each one byte and are entered in order of size i.e. the symbol of code length 1 (if any) is entered first, followed by any symbols of code length 2 and so on.

Note that if the JPEG Standard Huffman code libraries are being used, then the entries for steps 4 and 5 are defined in the standard (also they are attached to this report as an appendix).

Notes

Start of Scan (SOS) Segment

This segment contains header information as well as actual scan data. Multiple SOS Segments can be found if there is more than one scan. The number in brackets indicates the number of bytes the information is stored in.

- Segment marker (2). Is always FFDAH
- Section length (2). Does not include the segment marker. This also only includes header information; it does not include compressed image data.
- Number of components in scan (1).
- Component ID (1). This was defined in the SOF segment, step 7.
- Huffman Table used for component in step 4 (1). High nibble is DC Table ID and Low nibble is AC Table ID.

Steps 4 and 5 are repeated for each component defined in the SOF segment

- Start of spectral selection (1). Not used in JPEG Baseline. Always 00H
- End of spectral selection (1). Not used in JPEG Baseline. Always 3FH
- Spectral Selection high and low bits (1). Not used in JPEG Baseline. Always 00H

Appended to this is the actual compressed image data.

Each consecutive MCU data is added bit by bit with no padding *i.e.* there are no byte boundaries from one MCUs data to the next. The only padding that occurs is at the end of the scan when the remaining bits in the last byte to be filled with 1 are if the byte is incomplete.

If ever, throughout the scan, a situation occurs where a byte contains an FFH then a 00H must be inserted after it to ensure the decoder does not mistake it for a new segment.

End of Image (EOI) Segment

This segment is always 2 bytes long and always contains the marker FFD9H.



Task Select an image in JPEG format and convert it into PNG format with help of multimedia tools.

12.5 Moving Picture Experts Group (MPEG)

The MPEG is not actually a format but short for Moving Picture Experts Group, a working group of ISO/IEC that develops video and audio encoding standards. But in most cases MPEG is taken for the name of the standard formats introduced by that group.

There are several MPEG formats, all standardized:

- MPEG-1 is initial video and audio compression standard. The video quality of this standard is almost as good as a VHS tape.
- MPEG-2 compared with MPEG-1, it has better quality of coding, multi-channel sound and higher image resolution. Due to all this MPEG-2 became standard in digital television and DVD industry.
- MPEG Audio Layer-3 is used for audio compression and creates almost CD quality sound. Previous versions were MPEG Audio Layer 1 and 2. Today most people know this format as MP3.

- MPEG-4 was created to stream DVD quality video at lower data rates and smaller file sizes. The MPEG-4 supports video/audio “objects”, 3D content, sprites, text and other media types. The MPEG-4 has become extremely popular due to the ability to fit a two-hour movie to a CD file retaining comparatively high quality.
- MPEG-7 describes multimedia content.
- MPEG-21 is supposed to become a standard as a multimedia framework.

Notes

Did u know? The MPEG was established in 1988 by the initiative of Hiroshi Yasuda (Nippon Telegraph and Telephone) and Leonardo Chiariglione.

12.5.1 Standards

The MPEG standards consist of different Parts. Each part covers a certain aspect of the whole specification. The standards also specify Profiles and Levels. Profiles are intended to define a set of tools that are available, and Levels define the range of appropriate values for the properties associated with them. Some of the approved MPEG standards were revised by later amendments and/or new editions. The MPEG has standardized the following compression formats and ancillary standards:

- MPEG-1 (1993):** Coding of moving pictures and associated audio for digital storage media at up to about 1.5 Mbit/s (ISO/IEC 11172). The first MPEG compression standard for audio and video. It is commonly limited to about 1.5 Mbit/s although the specification is capable of much higher bit rates. It was basically designed to allow moving pictures and sound to be encoded into the bitrate of a Compact Disc. It is used on Video CD, SVCD and can be used for low-quality video on DVD Video. It was used in digital satellite/cable TV services before MPEG-2 became widespread. To meet the low bit requirement, MPEG-1 down samples the images, as well as uses picture rates of only 24–30 Hz, resulting in a moderate quality. It includes the popular MPEG-1 Audio Layer III (MP3) audio compression format.
- MPEG-2 (1995):** Generic coding of moving pictures and associated audio information (ISO/IEC 13818). Transport, video and audio standards for broadcast-quality television. MPEG-2 standard was considerably broader in scope and of wider appeal – supporting interlacing and high definition. The MPEG-2 is considered important because it has been chosen as the compression scheme for over-the-air digital television ATSC, DVB and ISDB, digital satellite TV services like Dish Network, digital cable television signals, SVCD and DVD Video. It is also used on Blu-ray Discs, but these normally use MPEG-4 Part 10 or SMPTE VC-1 for high-definition content.
- MPEG-3:** MPEG-3 dealt with standardizing scalable and multi-resolution compression and was intended for HDTV compression but was found to be redundant and was merged with MPEG-2; as a result there is no MPEG-3 standard. The MPEG-3 is not to be confused with MP3, which is MPEG-1 Audio Layer III.
- MPEG-4 (1998):** Coding of audio-visual objects (ISO/IEC 14496) MPEG-4 uses further coding tools with additional complexity to achieve higher compression factors than MPEG-2. In addition to more efficient coding of video, MPEG-4 moves closer to computer graphics applications. In more complex profiles, the MPEG-4 decoder effectively becomes a rendering processor and the compressed bitstream describes three-dimensional shapes and surface texture. The MPEG-4 supports Intellectual Property Management and Protection (IPMP), which provides the facility to use proprietary technologies to manage and protect content like digital rights management. It also supports MPEG-J, a fully programmatic solution for creation of custom interactive multimedia applications (Java application environment with a Java API) and many other features. Several new higher-efficiency video standards (newer than MPEG-2 Video) are included, notably:

Notes

- MPEG-4 Part 2 (or Simple and Advanced Simple Profile) and
- MPEG-4 AVC (or MPEG-4 Part 10 or H.264). The MPEG-4 AVC may be used on HD DVD and Blue-ray Discs, along with VC-1 and MPEG-2.

In addition, the following standards, while not sequential advances to the video encoding standard as with MPEG-1 through MPEG-4, are referred to by similar notation:

- **MPEG-7 (2002):** Multimedia content description interface. (ISO/IEC 15938)
- **MPEG-21 (2001):** Multimedia framework (MPEG-21). (ISO/IEC 21000) MPEG describes this standard as a multimedia framework and provides for intellectual property management and protection.

Moreover, more recently than other standards above, MPEG has started following international standards; each of the standards holds multiple MPEG technologies for a way of application. (For example, MPEG-A includes a number of technologies on multimedia application format.)

- **MPEG-A (2007):** Multimedia application format (MPEG-A). (ISO/IEC 23000) (e.g., Purpose for multimedia application formats, MPEG music player application format, MPEG photo player application format and others).
- **MPEG-B (2006):** MPEG systems technologies. (ISO/IEC 23001) (e.g., Binary MPEG format for XML, Fragment Request Units, Bit stream Syntax Description Language (BSDL) and others).
- **MPEG-C (2006):** MPEG video technologies. (ISO/IEC 23002) (e.g., Accuracy requirements for implementation of integer-output 8x8 inverse discrete cosine transform and others).
- **MPEG-D (2007):** MPEG audio technologies. (ISO/IEC 23003) (e.g., MPEG Surround, SAOC-Spatial Audio Object Coding and USAC-Unified Speech and Audio Coding).
- **MPEG-E (2007):** Multimedia Middleware. (ISO/IEC 23004) (a.k.a. M3W) (e.g., Architecture, Multimedia application programming interface (API), Component model and others).
- **Supplemental media technologies (2008). (ISO/IEC 29116) Part 1:** Media streaming application format protocols will be revised in MPEG-M Part 4 - MPEG extensible middleware (MXM) protocols.
- **MPEG-V (2011):** Media context and control. (ISO/IEC 23005) (a.k.a. Information exchange with Virtual Worlds) (e.g., Avatar characteristics, Sensor information, Architecture and others).
- **MPEG-M (2010):** MPEG extensible Middleware (MXM). (ISO/IEC 23006) (e.g., MXM architecture and technologies, API, MPEG extensible middleware (MXM) protocols).
- **MPEG-U (2010):** Rich media user interfaces. (ISO/IEC 23007) (e.g., Widgets).

Table 12.5: MPEG Groups of Standards

| Acronym for a group of standards | Title | ISO/IEC standards | First public release date (First edition) | Description |
|----------------------------------|---|-------------------|---|-------------|
| MPEG-1 | Coding of moving pictures and associated audio for digital storage media. Commonly limited to about 1.5 Mbit/s although specification is capable of much higher bit rates | ISO/IEC 11172 | 1993 | |

Contd...

| | | | | Notes |
|---------|--|-------------------------|-------------------|---|
| MPEG-2 | Generic coding of moving pictures and associated audio information | ISO/IEC 13818 | 1995 | |
| MPEG-3 | | | | abandoned, incorporated into MPEG-2 |
| MPEG-4 | Coding of audio-visual objects | ISO/IEC 14496 | 1999 | |
| MPEG-7 | Multimedia content description interface | ISO/IEC 15938 | 2002 | |
| MPEG-21 | Multimedia framework (MPEG-21) | ISO/IEC 21000 | 2001 | |
| MPEG-A | Multimedia application format (MPEG-A) | ISO/IEC 23000 | 2007 | |
| MPEG-B | MPEG systems technologies | ISO/IEC 23001 | 2006 | |
| MPEG-C | MPEG video technologies | ISO/IEC 23002 | 2006 | |
| MPEG-D | MPEG audio technologies | ISO/IEC 23003 | 2007 | |
| MPEG-E | Multimedia Middleware | ISO/IEC 23004 | 2007 | |
| (none) | Supplemental media technologies | ISO/IEC 29116 | 2008 | will be revised in M P E G - M Part4-MPEG extensible middleware (MXM) protocols |
| MPEG-V | Media context and control | ISO/IEC 23005 | 2011 | |
| MPEG-M | MPEGextensible middleware (MXM) | ISO/IEC 23006 | 2010 | |
| MPEG-U | Rich media user interfaces | ISO/IEC 23007 | 2010 | |
| MPEG-H | High-Efficiency Video Coding | (planned ISO/IEC 23008) | Under development | |



Task

Select an image and convert into mpeg-1, mpeg-2, mpeg-3, mp3, mpeg-4, and mp4 using online convertor.

12.6 Fractal Image Compression

Fractal encoding is a mathematical process used to encode bitmaps containing a real-world image as a set of mathematical data that describes the fractal properties of the image. Fractal encoding relies on the fact that all natural, and most artificial, objects contain redundant information in the form of similar, repeating patterns called fractals.

12.6.1 Fractal Basics

A fractal is a structure that is made up of similar forms and patterns that occur in many different sizes. The term fractal was first used by Benoit Mandelbrot to describe repeating patterns that

Notes

he observed occurring in many different structures. These patterns appeared nearly identical in form at any size and occurred naturally in all things. Mandelbrot also discovered that these fractals could be described in mathematical terms and could be created using very small and finite algorithms and data.

Let's look at a real-world example. If you look at the surface of an object such as the floor currently beneath your feet, you will notice that there are many repeating patterns in its texture. The floor's surface may be wood, concrete, tile, carpet, or even dirt, but it still contains repeating patterns ranging in size from very small to very large.

If we make a copy of a small part of the floor's surface and compare it to every other part of the floor, we would find several areas that are nearly identical in appearance to our copy. If we change the copy slightly by scaling, rotating, or mirroring it, we can make it match even more parts of the floor. Once a match is found, we can then create a mathematical description of our copy, including any alterations we have made, and can store it, and the location of all of the parts of the floor it matches, as data.

If we repeat this process for the entire floor, we will end up with a set of mathematical equations called fractal codes that describe the entire surface of the floor in terms of its fractal properties. These mathematical equations can then be used to recreate an image of the entire floor.

The process illustrated in this example is very similar in concept to vector (2D) and 3D graphics, where mathematical descriptions of objects, rather than actual pictures of the objects themselves, are stored. The important difference between vector and fractal graphics is that fractal descriptions are derived from actual factual patterns found in real-world objects, while vector and 3D objects are purely artificially generated structures that do not naturally contain fractal patterns.

Fractal encoding is largely used to convert bitmap images to fractal codes. Fractal decoding is just the reverse, in which a set of fractal codes are converted to a bitmap.

The encoding process is extremely computationally intensive. Millions or billions of iterations are required to find the fractal patterns in an image. Depending upon the resolution and contents of the input bitmap data, and output quality, compression time, and file size parameters selected, compressing a single image could take anywhere from a few seconds to a few hours (or more) on even a very fast computer.

Decoding a fractal image is a much simpler process. The hard work was performed finding all the fractals during the encoding process. All the decoding process needs to do is to interpret the fractal codes and translate them into a bitmap image.

Two tremendous benefits are immediately realized by converting conventional bitmap images to fractal data. The first is the ability to scale any fractal image up or down in size without the introduction of image artifacts or a loss in detail that occurs in bitmap images. This process of "fractal zooms" is independent of the resolution of the original bitmap image, and the zooming is limited only by the amount of available memory in the computer.

The second benefit is the fact that the size of the physical data used to store fractal codes is much smaller than the size of the original bitmap data. In fact, it is not uncommon for fractal images to be more than 100 times smaller than their bitmap sources. It is this aspect of fractal technology, called fractal compression that has promoted the greatest interest within the computer imaging industry.

Fractal compression is loss. The process of matching fractals does not involve looking for exact matches, but instead looking for "best fit" matches based on the compression parameters (encoding time, image quality, and size of output). But the encoding process can be controlled to the point where the image is "visually lossless." That is, you should not be able to notice where the data was lost.

Fractal compression differs from other lossy compression methods, such as JPEG, in a number of ways. The JPEG achieves compression by discarding image data that is not required for the human eye to perceive the image. The resulting data is then further compressed using a lossless method of compression. To achieve greater compression ratios, more image data must be discarded, resulting in a poorer quality image with a pixelized (blocky) appearance.

Notes

Fractal images are not based on a map of pixels, nor is the encoding weighted to the visual characteristics of the human eye. Instead, bitmap data is discarded when it is required to create a best-fit fractal pattern. Greater compression ratios are achieved using greater computationally intensive transforms that may degrade the image, but the distortion appears much more natural due to the fractal components.

Most other loss methods are also symmetrical in nature. That is, a particular sequence of steps is used to compress an image, and the reverse of those steps is used to decompress it. Compression and decompression will take about the same amount of time as well. Fractal compression is an asymmetrical process, taking much longer to compress an image than to decompress it. This characteristic limits the usefulness of fractally compressed data to applications where image data is constantly decompressed but never recompressed. Fractal compression is therefore highly suited for use in image databases and CD-ROM applications.

The content and resolution of the source bitmap can greatly affect fractal compression. Images with a high fractal content (e.g., faces, landscapes, and intricate textures) result in much higher compression ratios than images with a low fractal content (e.g., charts, diagrams, text, and flat textures). High-resolution images may be compressed to achieve higher compression ratios and will still retain a high image quality. To retain a high quality for lower resolution images, the resulting compression ratio will be much lower. Images with a greater bit depth (such as 24-bit true colour images) will also compress more efficiently than images with fewer bits per pixel (such as 8-bit gray-scale images).

The process of fractal compression is by no means in the public domain. There are many patents claiming a method of image data compression based on fractal transforms. Also, the exact process used by some fractal packages—including Barnsley's Fractal Transform—is considered proprietary.



The Humble GIF

Case Study

The Birth of the GIF

In 1987, CompuServe released the GIF format for graphics, as a free and open specification. In other words, any Web developer or graphics creator was free to create, post, trade, fold, spindle, and mutilate GIFs as they saw fit. The creators used the LZW (Lempel Ziv Welch) method of data compression to reduce the size of the files, and herein lies the copyright issue. Note that the LZW compression method is also used in TIFF graphics and several older file compression utilities, but because relatively few people use either TIFF graphics or these older file compression programs, I will focus on the usage of GIFs.

The LZW was described by Terry A. Welch in the June 1984 issue of IEEE's Computer magazine. Unisys held, and still holds a patent, but describing the algorithm made no mention of this. Welch, a Sperry employee, extended the work of previous developers Lempel and Ziv. Sperry Corporation was granted the U.S. patent in 1985. Sperry and Burroughs merged in 1986 to form Unisys, thus Unisys became the owner of the Sperry patents. CompuServe saw no reason to place any restrictions on GIF usage, and GIF graphics quickly became a staple of the World Wide Web. They were relatively easy to create, relatively compact, and quite flexible. *Contd...*

Notes

Unfortunately, the issue of patent infringement came up almost immediately. Although Unisys did not enforce their copyright for many years, the idea of the format having copyright issues at all was a cause for concern. Some CompuServe users immediately removed all the GIFs on their sites, or converted their graphics to JPEG or other formats that were not covered by the Unisys patents. Many other Web designers continued to use GIFs with little concern for the legalities, or were ignorant of the entire question. CompuServe quickly backed off of the issue. They claimed that they would have nothing to do with the debate, and any legal arguments were between Unisys and third parties. Interestingly, Unisys's original patent is due to expire in 2003; no word yet as to whether Unisys intends to extend their patent.

Unisys Enforces its Copyright

Unisys did not begin to enforce its copyright until December 1994, when it announced that, as it owned the compression method used to make GIFs, any Websites that used GIFs not produced by Unisys-licensed software must pay the company a staggering \$5,000. Unisys required:

"[a] one-time payment of \$5,000.00 U.S. for each license agreement (limited to two servers at each licensed Website), or [sic] a single payment of \$7,500 U.S. for a license for both Billboard and Intranet."

The idea came under fire immediately. According to the outraged owners of BurnAllGifs, an organization opposed to Unisys's assertion of control over the GIF format:

"The fact that Unisys was able to patent LZW is due to a flaw in the US patent system that makes even pencil-and-paper calculations patentable. You could violate some US patents just doing the story problems in a math or computer science textbook!"

When Unisys first announced that it would begin to enforce its copyright claims, they stated that they had no interest in pursuing patent infringement claims on anyone using GIFs for non-profit or personal uses, or against freeware developers who created GIF-making utilities. However, in September 1999, they issued a "clarification" that stated anyone using GIFs was subject to a patent infringement claim from Unisys if they used GIFs on any Internet or intranet site. You can imagine the furor that particular claim has caused. There's a strong movement on the Web that advocates the abandonment of the GIF entirely in defiance of Unisys's claims, but as we well know, GIFs are still the graphic of choice for many Web designers.

The Fate of the Humble GIF

Where that leaves today's GIF users is not completely clear. While legal opinion varies, most lawyers involved in the issue seriously doubt that GIF users, such as myself and SitePoint, are in any danger of breaking any patent law — only the makers of graphics utilities that are capable of creating GIFs are responsible for any copyright or licensure fees. The best guess seems to be that if you are using GIFs created by licensed programs (and most of the big boys like Paint Shop Pro, Illustrator, etc. have long since paid their fees to Unisys), you are OK. If you maintain a personal or non-profit Website, you might technically be in violation, but Unisys is not going to bother you. However, if you are using GIFs on your for-profit page, or you are a software developer who markets a GIF creation program without a license from Unisys, you might get contacted one of these fine days.

Obviously this is NOT intended to be any kind of legal opinion or guideline; if in doubt, talk to a lawyer familiar with the issue, or contact Unisys at LZW_INFO@unisys.com.

Questions:

1. What is meant by LZW? Explain its use in image formatting.
2. What was the main purpose to develop GIF graphics?

Self Assessment

Notes

Choose the correct answer:

5. The JPEG standard is applicable to both grey scale and colour images.

| | |
|----------|-----------|
| (a) True | (b) False |
|----------|-----------|
6. The colour format is ideal for JPEG compression as it enables brightness and colour information from an image to be separated.

| | |
|----------|-----------|
| (a) JPEG | (b) YCbCr |
| (c) RGB | (d) MCU |
7. The is supposed to become a standard as a multimedia framework.

| | |
|------------|-------------|
| (a) MPEG-1 | (b) MPEG-2 |
| (c) MPEG-4 | (d) MPEG-21 |
8. is therefore highly suited for use in image databases and CD-ROM applications.

| | |
|-----------------|--------------------------|
| (a) Compression | (b) Raster image formats |
| (c) Pixels | (d) Fractal compression |

12.7 Summary

- Image file formats are standardized means of organizing and storing digital images.
- Meta/Vector formats have it over Raster is that they are more than a simple grid of coloured dots. They are actual vectors of data stored in mathematical formats rather than bits of coloured dots.
- Compression is a computer term that represents a variety of mathematical formats used to compress an image's byte size.
- The structured formats are only used for illustrations (images which look like drawings), rather than photo-realistic images.
- GIF images are compressed using the Lempel Ziv Welch (LZW) lossless data compression technique to reduce the file size without degrading the visual quality.
- The JPEG algorithm generally does not use the RGB (Red, Green, and Blue) colour format.
- The MPEG is not actually a format but short for Moving Picture Experts Group, a working group of ISO/IEC that develops video and audio encoding standards.

12.8 Keywords

Fractal: A fractal is a structure that is made up of similar forms and patterns that occur in many different sizes.

Graphics Interchange Format (GIF): The GIF is a bitmap image format that was introduced by CompuServe in 1987 and has since come into widespread usage on the World Wide Web due to its wide support and portability.

Joint Photographic Experts Group (JPEG): The JPEG is an abbreviated form of Joint Photographic Experts Group, the independent committee that created it as a standard for photography compression.

Notes

Moving Picture Experts Group (MPEG): The MPEG is a working group of experts that was formed by ISO and IEC to set standards for audio and video compression and transmission.

Raster Image Formats (RIFs): Raster graphics are the most common type of image files. They are comprised of a grid of pixels where each pixel represents an individual colour within the image.



Lab Exercise

1. Convert the MPEG files to GIF files.
2. Create the JPEG files from the GIF files

12.9 Review Questions

1. Discuss the basics of image format.
2. Explain the type of image formats.
3. What is the graphic interchange format?
4. Discuss the file format of joint photographic experts group.
5. Explain the moving picture experts group.
6. What is the fractal image compression?
7. Discuss the standards of moving picture experts group.
8. What are uses of GIF, JPEG, and MPEG in image format?
9. What is the raster format?
10. Discuss the meta/vector image formats.

Answers to Self Assessment

- | | | | | |
|--------|--------|--------|--------|--------|
| 1. (b) | 2. (b) | 3. (d) | 4. (a) | 5. (a) |
| 6. (b) | 7. (d) | 8. (d) | | |

12.10 Further Reading



Books

Principles of Multimedia, by Ranjan Parekh, Ranjan



Online link

<http://books.google.co.in/books?>

Unit 13: Multimedia Tools for WWW

Notes

CONTENTS

- Objectives
- Introduction
- 13.1 Multimedia Tools in the Information Commons
 - 13.1.1 Audio
 - 13.1.2 Photo
 - 13.1.3 Text Scanning and OCR
 - 13.1.4 Video
- 13.2 Font Editing and Design Tools
 - 13.2.1 Making Pretty Text
 - 13.2.2 Hypermedia and Hypertext
 - 13.2.3 Hypermedia Structures
 - 13.2.4 Searching for Words
- 13.3 Text Editing and Word Processing Tools
- 13.4 Image Editing Tools
- 13.5 Painting and Drawing Tools
- 13.6 Sound Editing Tools
 - 13.6.1 Digitized Audio
 - 13.6.2 MIDI (Musical Instrument Digitization Interface)
 - 13.6.3 Comparison between MIDI and Digitized Audio
- 13.7 Animation, Video and Digital Movie Tools
 - 13.7.1 Video Formats
 - 13.7.2 Common Organization of Video Formats
 - 13.7.3 QuickTime
- 13.8 Summary
- 13.9 Keywords
- 13.10 Review Questions
- 13.11 Further Reading

Objectives

After studying this unit, you will be able to:

- Discuss the multimedia tools in the information commons
- Explain the font editing and design tools
- Discuss the text editing and word processing tools
- Discuss the image-editing tools
- Discuss the painting and drawing tools
- Define the sound editing tools
- Explain the animation, video and digital movie tools

Notes

Introduction

The basic tools set for building multimedia project contains one or more authoring systems and various editing applications for text, images, sound, and motion video. A few additional applications are also useful for capturing images from the screen, translating file formats and tools for the making multimedia production easier.

13.1 Multimedia Tools in the Information Commons

Following multiple tools are available for the creation, recording, editing, and transfer of multimedia.

- Audio
- Photo
- Text scanning and OCR
- Video

13.1.1 Audio

You can record and edit audio for stand-alone use or for inclusion in other multimedia projects. Computers in the IC that will burn CDs have a silver ring around the power button.

Editing

- Audacity (Windows/Mac)

Export

- ImgBurn CD/DVD Burning software (Windows)
- Record to CD
- Save files in a variety of file formats

Import

- Audio cassette, using Sony tape deck
- CD
- Microphone

13.1.2 Photo

You can import both digital and printed photographs, edit them for slideshows, presentations, or Internet-ready or print-ready formats, and make colour prints or export photograph files to CD or DVD formats.

Import

- Direct camera connection
- Removable media:
 - CompactFlash
 - Memory Stick
 - Secure Digital/MultiMediaCard
 - SmartMedia

Editing

- Adobe Photoshop CS (Windows/Mac)
- iPhoto (Mac)

Notes**Export**

- Print in color in sizes up to 36" × 108":
 - BusinessColor (LaserJet), 8.5" × 11"
 - GraphicsColor (DesignJet), 13" × 19"
 - Plotter, Plotter2 (glossy finish, matte available upon request), 36" wide
 - Save files in variety of file formats
 - Save photograph files to CD or DVD

13.1.3 Text Scanning and OCR

You can scan printed texts, use OCR (optical character recognition) to convert the scanned image to text, and save and edit the text in a variety of formats.

OCR and export

- Adobe Acrobat Pro (Windows/Mac)
- Save files in variety of file formats, including plain text, HTML, PDF, and Microsoft Word.

13.1.4 Video

You can make movies or other video from a wide variety of video and audio sources, create and edit video projects using either consumer or professional-level software, and save finished products to a variety of digital and analog media.

Editing

- Consumer editing software: Windows Movie Maker (Windows), iMovie (Mac)
- Professional editing software: Adobe Premiere (Windows/Mac), Final Cut Pro (Mac)
- Visual effect software: Adobe AfterEffects (Windows/Mac)

Export

- Record to DVD, using iDVD or DVD Studio Pro (Mac), and Toast Titanium 9 (Mac)
- Record to tape, both miniDV and VHS
- Save files in a variety of file formats, including streaming media formats for use on the Internet

Import

- Analog video camera, via a connection through the VCR
- Digital camera, via a direct connection
- Removable media, including USB 2.0 and FireWire hard drives
- Tape, both Mini DV using Sony HD VCR and VHS using JVC SR-VS30 VCR



Did u know? The OCR and ICR software technology are analytical artificial intelligence systems that consider sequences of characters rather than whole words or phrases.

Notes

13.2 Font Editing and Design Tools

There is several software that can be used to create customized font. These tools help a multimedia developer to communicate his idea or the graphic feeling. Using these software different typefaces can be created.

In some multimedia projects it may be required to create special characters. Using the font editing tools it is possible to create a special symbols and use it in the entire text.

Special font editing tools can be used to make your own type so you can communicate an idea or graphic feeling exactly. With these tools professional typographers create distinct text and display faces.

13.2.1 Making Pretty Text

To make your text look pretty you need a toolbox full of fonts and special graphics applications that can stretch, shade, color and anti-alias your words into real artwork. Pretty text can be found in bitmapped drawings where characters have been tweaked, manipulated and blended into a graphic image.

13.2.2 Hypermedia and Hypertext

Multimedia is the combination of text, graphic, and audio elements into a single collection or presentation – becomes interactive multimedia when you give the user some control over what information is viewed and when it is viewed.

When a hypermedia project includes large amounts of text or symbolic content, this content can be indexed and its element then linked together to afford rapid electronic retrieval of the associated information.

When text is stored in a computer instead of on printed pages, the computer's powerful processing capabilities can be applied to make the text more accessible and meaningful. This text can be called as hypertext.

13.2.3 Hypermedia Structures

Two Buzzwords used often in hypertext are link and node. Links are connections between the conceptual elements, and the nodes is mainly consists of text, graphics, sounds or related information in the knowledge base.

13.2.4 Searching for Words

Following are typical methods for a word searching in hypermedia systems: Categories, Word Relationships, Adjacency, Alternates, Association, Negation, Truncation, Intermediate words, Frequency.



Task

Design games by using multimedia concepts.

13.3 Text Editing and Word Processing Tools

A word processor is usually the first software tool computer users rely upon for creating text. The word processor is often bundled with an office suite.

Word processors such as Microsoft Word and WordPerfect are powerful applications that include spellcheckers, table formatters, thesauruses and prebuilt templates for letters, resumes, purchase orders and other common documents in the following top 10 Word Processing Tools.

The PC World Online readers in the same fix have discovered that File World, our file archive, is well stocked with just the things you need. These ten files are among the most popular downloads for proofing, e-mailing, faxing, archiving, and just generally dominating text files.

Notes

1. **Microsoft Word 97 Viewer:** Use this file viewer to view Word files if you use another word processor.
2. **Office Toys for Word 97:** Expand your Word processing horizons with utilities and add-ons for Word.
3. **Business Card Creator:** Quickly lay out and format business cards.
4. **CyberSpell:** Catch embarrassing spelling mistakes in e-mail before sending it.
5. **Wordware 97 for Word for Windows:** Pump up Word 97 with these macros, templates, and extras.
6. **Word 97 Document Converter:** Move files back and forth between different Word versions.
7. **SuperFax for Word for Windows:** This utility makes faxing from Word easy and quick.
8. **DoublePage Macro for Microsoft Word for Windows:** Save you a lot of steps with a macro that creates an efficient format.
9. **WOPR 95 Plus Pak:** This bundle includes file management, macro helpers, and more.
10. **Internet Assistant for Word 7.0:** This utility simplifies Word file conversion to HTML format.



Caution The OCR inherits the redundancy of the disk group. If you want high redundancy for OCR, you must configure the disk group with high redundancy when you create it.

Self Assessment

Choose the correct answer:

1. You can record and edit for stand-alone use or for inclusion in other multimedia projects.

| | |
|-------------------|-----------|
| (a) photo | (b) audio |
| (c) text scanning | (d) video |
2. is several software that can be used to create customized font.

| | |
|-----------------------------------|--|
| (a) Font editing and design tools | (b) Text editing and word processing tools |
| (c) Image-editing tools | (d) Painting and drawing tools |
3. Multiple windows that provide views of more than one image at a time.

| | |
|----------|-----------|
| (a) True | (b) False |
|----------|-----------|

13.4 Image Editing Tools

Image-editing application is specialized and powerful tools for enhancing and retouching existing bitmapped images. These applications also provide many of the feature and tools of painting and drawing programs and can be used to create images from scratch as well as images digitized from scanners, video frame-grabbers, digital cameras, clip art files, or original artwork files created with a painting or drawing package.

Notes Here are some features typical of image-editing applications and of interest to multimedia developers:

- Multiple windows that provide views of more than one image at a time.
- Conversion of major image-data types and industry-standard file formats.
- Direct inputs of images from scanner and video sources.
- Employment of a virtual memory scheme that uses hard disk space as RAM for images that require large amounts of memory.
- Capable selection tools, such as rectangles, lassos, and magic wands, to select portions of a bitmap.
- Image and balance controls for brightness, contrast, and colour balance.
- Good masking features.
- Multiple undo and restore features.
- Anti-aliasing capability, and sharpening and smoothing controls.
- Colour-mapping controls for precise adjustment of colour balance.
- Tools for retouching, blurring, sharpening, lightening, darkening, smudging, and tinting.
- Geometric transformation such as flip, skew, rotate, and distort and perspective changes.
- Ability to resample and resize an image.
- 134-bit colour, 8- or 4-bit indexed colour, 8-bit gray-scale, black-and-white, and customizable colour palettes.
- Ability to create images from scratch, using line, rectangle, square, circle, ellipse, polygon, airbrush, paintbrush, pencil, and eraser tools, with customizable brush shapes and user-definable bucket and gradient fills.
- Multiple typefaces, styles, sizes, and type manipulation and masking routines.
- Filters for special effects, such as crystallize, dry brush, emboss, facet, fresco, graphic pen, mosaic, pixelize, poster, ripple, smooth, splatter, stucco, twirl, watercolor, wave, and wind.
- Support for third-party special effect plug-ins.
- Ability to design in layers that can be combined, hidden, and reordered.

Plug-ins

Image-editing programs usually support powerful plug-in modules available from third-party developers that allow to wrap, twist, shadow, cut, diffuse, and otherwise “filter” your images for special visual effects.



Plug-ins appeared as early as the mid 1970s, when the EDT text editor running on the Unisys VS/9 operating system using the Univac 90/60 series mainframe computer provided the ability to run a program from the editor and to allow such a program to access the editor buffer, thus allowing an external program to access and edit session in memory

13.5 Painting and Drawing Tools

Painting and drawing tools, as well as 3-D modelers, are perhaps the most important items in the toolkit because, of all the multimedia elements, the graphical impact of the project will likely have the greatest influence on the end user. If the artwork is amateurish, or flat and uninteresting, both the creator and the users will be disappointed.

Painting software, such as Photoshop, Fireworks, and Painter, is dedicated to producing crafted bitmap images. Drawing software, such as CorelDraw, FreeHand, Illustrator, Designer, and Canvas, is dedicated to producing vector-based line art easily printed to paper at high resolution.

Notes

Some software applications combine drawing and painting capabilities, but many authoring systems can import only bitmapped images. Typically, bitmapped images provide the greatest choice and power to the artist for rendering fine detail and effects, and today bitmaps are used in multimedia more often than drawn objects. Some vector based packages such as Macromedia's Flash are aimed at reducing file download times on the Web, and may contain both bitmaps and drawn art. The anti-aliased character shown in the bitmap of Color Plate 5 is an example of the fine touches that improve the look of an image.

Look for these features in a drawing or painting packages:

- An intuitive graphical user interface with pull-down menus, status bars, palette control, and dialog boxes for quick, logical selection.
- Scalable dimensions, so you can resize, stretch, and distort both large and small bitmaps.
- Paint tools to create geometric shapes, from squares to circles and from curves to complex polygons.
- Ability to pour a colour, pattern, or gradient into any area.
- Ability to paint with patterns and clip art.
- Customizable pen and brush shapes and sizes.
- Eyedropper tool that samples colours.
- Auto trace tool that turns bitmap shapes into vector-based outlines.
- Support for scalable text fonts and drop shadows.
- Multiple undo capabilities, to let you try again.
- Painting features such as smoothing coarse-edged objects into the background with anti-aliasing, airbrushing in variable sizes, shapes, densities, and patterns; washing colors in gradients; blending; and masking.
- Support for third-party special effect plug-ins.
- Object and layering capabilities that allow you to treat separate elements independently.
- Zooming, for magnified pixel editing.
- All common colour depths: 1-, 4-, 8-, and 16-, 134-, or 313-bit colour, and grayscale.
- Good colour management and dithering capability among colour depths using various colour models such as RGB, HSB, and CMYK.
- Good palette management when in 8-bit mode.
- Good file importing and exporting capability for image formats such as PIC, GIF, TGA, TIF, WMF, JPG, PCX, EPS, PTN, and BMP.

13.6 Sound Editing Tools

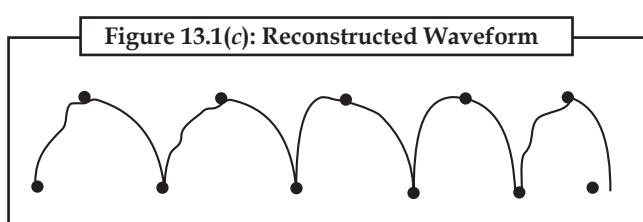
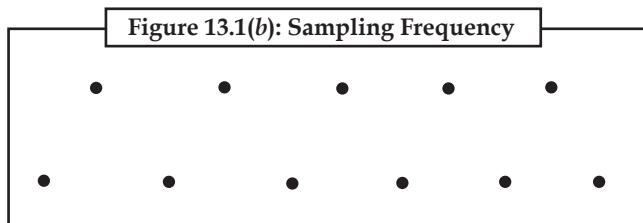
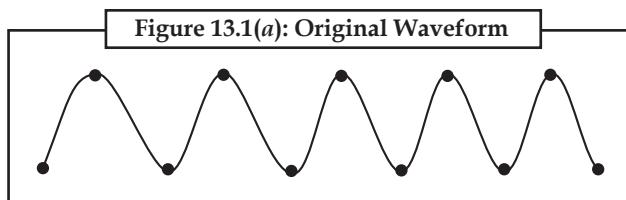
Sound editing tools for both digitized and MIDI sound let's hear music as well as create it. By drawing a representation of a sound in fine increments, whether a score or a waveform, it is possible to cut, copy, paste and otherwise edit segments of it with great precision.

System sounds are shipped both Macintosh and Windows systems and they are available as soon the Operating system is installed. For MIDI sound, a MIDI synthesizer is required to play and

Notes record sounds from musical instruments. For ordinary sound there are varieties of software such as Sound edit, MP3cutter, Wave studio.

13.6.1 Digitized Audio

Audio Signal can be stored as digitized one in the form of numbers. An audio signal is represented in digital memory with a binary code that stores a massive amount of numbers that are used to represent a signal. An ADC (Analog to Digital Converter) is a computer chip that is used to convert an analog signal into digital information. This process is called sampling. Digitized sound is normally called wave files and end with the extension wav for PC and with .aif or .aiff for Macintosh. Digitized sound is nothing but a sampled sound. Every nth sample of the signal is taken and stored as digital data in the form of bytes. Three sampling frequencies used in multimedia systems are 44.1 KHz, 22.05 KHz and 11.025 KHz. Sample sizes are 1byte or 2 bytes. Audio resolution determines the accuracy with which the sound can be digitized. The digital waveform to be reconstructed depends on the sampling frequency selected. It is very difficult to reconstruct the waveform if the sampling frequency selected is very low. Figures 13.1 below show the analog waveform converted into digital one using the sampling frequency.



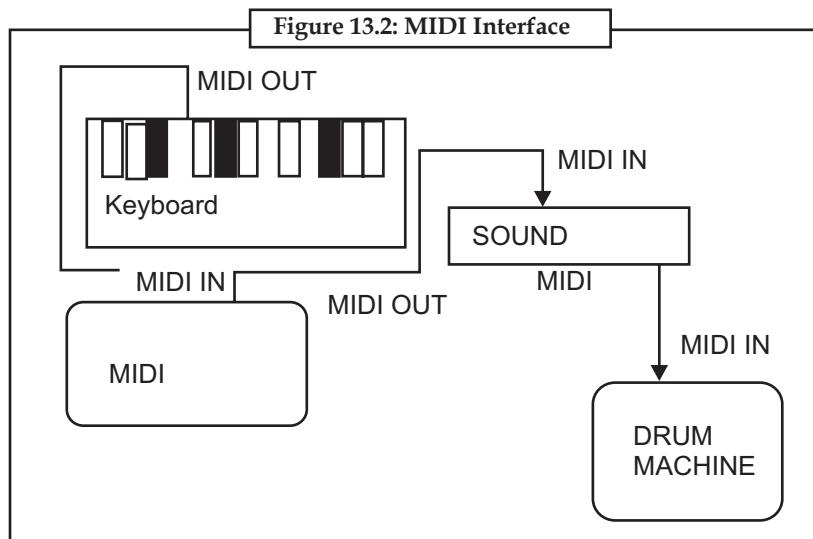
Once the signal is represented as binary numbers, the signal is then converted back to an analog signal through a DAC (Digital to Analog Converter). Each sample value is rounded off to the nearest integer to create the waveform. This process is called quantization. But this process can create unwanted noise. Digital audio technologies include digital broadcasting techniques namely Digital Audio Broadcasting (DAB), HD Radio, Digital radio Mondiale (DRM), in band on channel (IBOC) and storage techniques like digital audio player, digital audio tape, CD, DVD, digital audio workstation and various audio file formats.

13.6.2 MIDI (Musical Instrument Digitization Interface)

Musical Instrument Digitization Interface (MIDI) provides a protocol or a set of rules, using which the musical note is directly recorded into the computer from musical instruments. A MIDI file is basically a list of commands to produce the sound. For example, pressing of a guitar key can be

represented as a computer command. When the MIDI device processes this command, the result will be the sound from the guitar. The protocol provides an effective means of conveying musical information as electronic data. Since MIDI files are small in size, these can be embedded while loading of Web pages and promptly played. Length of the MIDI files can be changed without degrading the quality of the signal. As the signals are stored as the notes played on the musical instrument, working on the MIDI files require knowledge of the music theory. The MIDI data stream is a unidirectional asynchronous bit stream at 31.25 Kbits/sec with 10 bits transmitted per byte (a start bit, 8 data bits, and one stop bit). The MIDI interface includes three different MIDI connectors, labeled as IN, OUT, and THRU. The MIDI data stream is usually originated by a MIDI controller, such as a musical instrument keyboard, or by a MIDI sequencer. A MIDI controller is a device which is played as an instrument, and it translates that into a MIDI data stream in real time. A MIDI sequencer is a device which allows MIDI data sequences to be captured, stored, edited, combined, and replayed. The MIDI data output from a MIDI controller or sequencer is transmitted via the devices' MIDI OUT connector. The recipient of this MIDI data stream is commonly a MIDI sound generator or sound module, which will receive MIDI messages at its MIDI IN connector, and respond to these messages by playing sounds. Figure 13.2 shows a simple MIDI system, consisting of a MIDI keyboard controller and a MIDI sound module.

Notes



13.6.3 Comparison between MIDI and Digitized Audio

| Comparison | MIDI | Digitized Audio |
|---------------------|--|--|
| Representation | Shorthand representation of music stored in numeric form | Sampling is done to convert the data into digital form |
| Device Independence | Device dependent | Device Independent |
| File Size | 200 to 1000 times smaller than Digitized Audio | Larger File Size |
| Memory Requirement | Less storage space | Large Storage space |
| Edit Options | Easily editable and all the information retainable | Difficult to edit. |
| Quality | Better when played on high quality MIDI device | Not so better |
| Playback | Does not have consistent playback quality | Consistent playback quality |

| Notes | Comparison | MIDI | Digitized Audio |
|---------------------|---------------------|---------------------------------|-----------------|
| Analogy | Vector Graphics | Bitmap Image | |
| Ease to incorporate | Must have knowledge | Does not require much knowledge | |

13.7 Animation, Video and Digital Movie Tools

Animation and digital movies are sequences of bitmapped graphic scenes (frames, rapidly played back. Most authoring tools adapt either a frame or object oriented approach to animation.

Moviemaking tools typically take advantage of QuickTime for Macintosh and Microsoft Video for Windows and lets the content developer to create, edit and present digitized motion video segments.

13.7.1 Video Formats

A video format describes how one device sends video pictures to another device, such as the way that a DVD player sends pictures to a television or a computer to a monitor. More formally, the video format describes the sequence and structure of frames that create the moving video image.

Video formats are commonly known in the domain of commercial broadcast and consumer devices; most notably to date, these are the analog video formats of NTSC, PAL, and SECAM. However, video formats also describe the digital equivalents of the commercial formats, the aging custom military uses of analog video (such as RS-170 and RS-343), the increasingly important video formats used with computers and even such offbeat formats such as color field sequential.

Video formats were originally designed for display devices such as CRTs.

Since other kinds of displays have common source material and video formats enjoy wide adoption and have convenient organization, video formats are a common means to describe the structure of displayed visual information for a variety of graphical output devices.

13.7.2 Common Organization of Video Formats

A video format describes a rectangular image carried within an envelope containing information about the image. Although video formats vary greatly in organization, there is a common taxonomy:

- A frame can consist of two or more fields, sent sequentially, that are displayed over time to form a complete frame. This kind of assembly is known as interlace. An interlaced video frame is distinguished from a progressive scan frame, where the entire frame is sent as a single intact entity.
- A frame consists of a series of lines, known as scan lines. Scan lines have a regular and consistent length in order to produce a rectangular image. This is because in analog formats, a line lasts for a given period of time; in digital formats, the line consists of a given number of pixels. When a device sends a frame, the video format specifies that devices send each line independently from any others and that all lines are sent in top-to-bottom order.
- As above, a frame may be split into fields – odd and even (by line “numbers”) or upper and lower, respectively. In NTSC, the lower field comes first, then the upper field, and that is the whole frame. The basics of a format are Aspect Ratio, Frame Rate, and Interlacing with field order if applicable: Video formats use a sequence of frames in a specified order. In some formats, a single frame is independent of any other (such as those used in computer

video formats), so the sequence is only one frame. In other video formats, frames have an ordered position. Individual frames within a sequence typically have similar construction. However, depending on its position in the sequence, frames may vary small melements within them to represent additional information. For example, MPEG-13 compression may eliminate the information that is redundant frame-to-frame in order to reduce the data size, preserving the information relating to changes between frames.

Notes**Analog Video Formats**

- NTSC
- PAL
- SECAM

Digital Video Formats

These are MPEG13 based terrestrial broadcast video formats

- ATSC Standards
- DVB
- ISDB

These are strictly the format of the video itself, and not for the modulation used for transmission.

| Broadcast video formats | |
|-------------------------|---|
| Analog broadcast | 5135 lines: NTSE • NTSC-J • PAL-M |
| | 6135 lines: PAL • PAL-N • PAL plus • SECAM |
| | <i>Multichannel audio:</i> BTSC (MTS) • NICAM-7138 • Zweiton (A13, IGR) |
| Analog broadcast | Interlaced: SDTV (480i, 576i) • HDTV (1080i) Progressive: LDTV (1340p, 1388p, 1seg) • EDTV (480p, 576p) • HDTV (7130p, 1080p) Digital TV standards (MPEG-13): ATSC, DVB, ISDB, DMB-T/H Digital TV standards (MPEG-4 AVC): DMB-T/H, DVB, SBTVD, ISDB (1 seg) <i>Multichannel audio:</i> AAC (5.1) • Musicam • PCM • LPCM <i>Digital cinema:</i> UHDV (13540p, 43130p) • DCI |

13.7.3 QuickTime

QuickTime is a multimedia framework. capable of handling various formats of digital video, media clips, sound, text, animation, music, and several types of interactive panoramic images. Available for Classic Mac OS, Mac OS X and Microsoft Windows operating systems, it provides essential support for software packages including iTunes, QuickTime Player (which can also serve as a helper application for Web browsers to play media files that might otherwise fail to open) and Safari.

The QuickTime technology consists of the following:

1. The QuickTime Player application created by Apple, which is a media player.

Notes

2. The QuickTime framework, which provides a common set of APIs for encoding and decoding audio and video.
3. The QuickTime Movie (.mov) file format, an openly-documented media container.

QuickTime is integral to Mac OS X, as it was with earlier versions of Mac OS. All Apple systems ship with QuickTime already installed, as it represents the core media framework for Mac OS X. QuickTime is optional for Windows systems, although many software applications require it. Apple bundles it with each iTunes for Windows download, but it is also available as a stand-alone installation.

QuickTime Players

QuickTime is distributed free of charge, and includes the QuickTime Player application.

Some other free player applications that rely on the QuickTime framework provide features not available in the basic QuickTime Player. For example:

- iTunes can export audio in WAV, AIFF, MP3, AAC.
- In Mac OS X, a simple AppleScript can be used to play a movie in full-screen mode. However, since version 7.13 the QuickTime Player now also supports full-screen viewing in the non-pro version.

QuickTime Framework

The QuickTime framework provides the following:

- Encoding and transcoding video and audio from one format to another.
- Decoding video and audio, and then sending the decoded stream to the graphics or audio subsystem for playback. In Mac OS X, QuickTime sends video playback to the Quartz Extreme (OpenGL) Compositor.
- A plug-in architecture for supporting additional codecs (such as DivX).

The framework supports the following file types and codecs natively:

Audio

- Apple Lossless
- Audio Interchange (AIFF)
- Digital Audio: Audio CD - 16-bit (CDDA), 134-bit, 313-bit integer and floating point, and 64-bit floating point
- MIDI
- MPEG-1 Layer 3 Audio (.mp3)
- MPEG-4 AAC Audio (.m4a, .m4b, .m4p)
- Sun AU Audio
- ULAW and ALAW Audio
- Waveform Audio (WAV)

Video

- 3GPP & 3GPP13 file formats
- AVI file format
- Bitmap (BMP) codec and file format
- DV file (DV NTSC/PAL and DVC Pro NTSC/PAL codecs)

- Flash and FlashPix files
- GIF and Animated GIF files
- H.1361, H.1363, and H.1364 codecs
- JPEG, Photo JPEG, and JPEG-13000 codecs and file formats
- MPEG-1, MPEG-13, and MPEG-4 Video file formats and associated codecs (such as AVC)
- QuickTime Movie (.mov) and QTVR movies
- Other video codecs: Apple Video, Cinepak, Component Video, Graphics, and Planar RGB
- Other still image formats: PNG, TIFF, and TGA

Notes

Specification for QuickTime File Format

| QuickTime Movie | |
|--------------------------|---------------------------|
| File extension: | .mov |
| | .qt |
| MIME type: | video/quicktime |
| Type code: | MooV |
| Uniform Type Identifier: | com.apple.quicktime-movie |
| Developed by: | Apple Inc. |
| Type of format: | Media container |
| Container for: | Audio, video, text |

The QuickTime (.mov) file format functions as a multimedia container file that contains one or more tracks, each of which stores a particular type of data: audio, video, effects, or text (for subtitles, for example). Other file formats that QuickTime supports natively (to varying degrees) include AIFF, WAV, DV, MP3, and MPEG-1. With additional QuickTime Extensions, it can also support Ogg, ASF, FLV, MKV, DivX Media Format, and others.



Task

Create a Website page using multimedia software tools.



Case Study

Developing a Multimedia Tool for Increased International Science Collaboration

In 1998, the International Space Station brought together scientists from 16 countries to solve crucial problems in various areas of science. Many of the project's scientists did not speak the same language, which created a collaborative hurdle.

Under a CRDF Global grant, Russian scientists with experience in the design and construction of nuclear weapons are working with U.S. Company Arkmedia to create a SNAPSE™ multimedia software toolset that will provide a multi-lingual collaborative environment. This technology will not only facilitate motion picture, still photo and audio usage, but will also support education, sharing of cultural resources, media object licensing, media management, communication and entertainment.

Contd...

| | |
|-------------------|---|
| Notes | A team of ten Russian scientists, headed by Yury Alexandrovich Bukhshtab of the Keldysh Institute of Applied Mathematics and J. Johnson of Arkmedia, plans to develop a pilot version of this Web-based toolset and deploy it on Russian Archives Online. The technology will be distributed to end-users globally for free, relying on sponsors and media object licensing commission fees to generate revenue. The project is currently in development with plans for completion in early 2007. |
| Questions: | <ol style="list-style-type: none">1. Explain the uses of multimedia technology.2. Give the year of developing Arkmedia project. |

Self Assessment

Choose the correct answer:

13.8 Summary

- A word processor is first software tool computer users rely upon for creating text. The word processor is often bundled with an office suite.
 - Image-editing application is specialized and powerful tools for enhancing and retouching existing bitmap images.
 - Painting and drawing tools, as well as 3D modelers, are perhaps the most important items in the toolkit because, of all the multimedia elements, the graphical impact of the project will likely have the greatest influence on the end user.
 - Sound editing tools for both digitized and MIDI sound let's hear music as well as create it.
 - Musical Instrument Digitization Interface provides a protocol or a set of rules, using which the musical note is directly recorded into the computer from musical instruments.

13.9 Keywords

Notes

Audio: Audio is an electrical or other representation of sound.

Digital audio: Digital audio is sound reproduction using pulse-code modulation and digital signals.

Musical Instrument Digital Interface (MIDI): The Musical Instrument Digital Interface protocol has been widely accepted and utilized by musicians and composers since its conception in 1983.

Optical Character Recognition (OCR): The OCR is the mechanical or electronic translation of scanned images of handwritten, typewritten or printed text into machine-encoded text.

Video: Video is the technology of electronically capturing, recording, processing, storing, transmitting, and reconstructing a sequence of still images representing scenes in motion.



1. Write a program to play “wave” or “MIDI” format sound file.

Lab Exercise

2. Write a program to show a bitmap image on your computer screen.

13.10 Review Questions

1. Discuss the multiple tools that are available for the creation, editing of multimedia.
2. Write a list of softwares that can be used for editing and creating fonts.
3. What are the important design tools in multimedia?
4. What is word processing? Explain the tools of word processing.
5. Discuss the image-editing tools.
6. Discuss the painting and drawing tools in multimedia.
7. What are uses of painting software in multimedia?
8. How do sound editing tools function in multimedia?
9. What are the differences between MIDI and digitized audio?
10. Explain the video and digital movie tools.

Answers to Self Assessment

- | | | | | |
|--------|--------|--------|--------|--------|
| 1. (b) | 2. (a) | 3. (a) | 4. (d) | 5. (c) |
| 6. (a) | 7. (c) | 8. (d) | | |

13.11 Further Reading



E-Learning Tools and Technologies: A Consumer's Guide for Trainers, Teachers, by William Horton, Katherine Horton



<http://books.google.co.in/books?>

Unit 14: Designing for World Wide Web (WWW)

CONTENTS

- Objectives
- Introduction
- 14.1 Plug-ins
 - 14.1.1 Purpose
 - 14.1.2 Features of Plug-ins
 - 14.1.3 History
 - 14.1.4 Most Useful Firefox Plug-ins for Web Developers
- 14.2 Text
 - 14.2.1 Concept of Text
 - 14.2.2 Fonts
 - 14.2.3 Font Standards
 - 14.2.4 Styles and Sizes
 - 14.2.5 File Formats
 - 14.2.6 Edit Text in a Web page with Internet Explorer 8 (IE8)
- 14.3 Image
 - 14.3.1 Optimizing Images for the Web
- 14.4 Sound
 - 14.4.1 When to use Sound
 - 14.4.2 When not to use Sound
 - 14.4.3 Tips for Using Sound
 - 14.4.4 Different Ways to Play a Sound from a Web Page
- 14.5 Animation
 - 14.5.1 Animation with JavaScript
 - 14.5.2 Carefully Select the Best Format
 - 14.5.3 User Control over Animated GIFs
 - 14.5.4 Uses of Animation on a Web Page
- 14.6 Summary
- 14.7 Keywords
- 14.8 Review Questions
- 14.9 Further Reading

Objectives

After studying this unit, you will be able to:

- Understand the concept of plug-ins
- Explain text used in Web
- Describe images in Web

- Understand the use of sound
- Explain animation in Web

Notes

Introduction

The World Wide Web (WWW) has become a very popular means for publishing information. A large number of information repositories (Websites) already exist and new ones are being created at a very rapid rate. Most of the pages on WWW repositories provide elements that allow users (readers) to interact with them. Thus, the people designing pages for the WWW are actually designing user interfaces.

The proliferation of pages with poor usability suggests that most of the designers of WWW pages have little knowledge of user interface design and usability engineering. This is a serious problem that needs to be addressed because pages with poor usability waste user time discourage exploration and could be responsible for a large amount of unnecessary traffic on the Internet. Thus, it is very important to develop practical methodologies for designing usable Web pages.

14.1 Plug-ins

Plug-ins are software modules that add to the functionality of an application. Many applications use plug-ins, including Photoshop, and Web browsers such as Firefox and Internet Explorer.

Plug-ins can have many different functions. Web browsers typically use plug-ins to expand the range of formats they can display (e.g., Acrobat documents, QuickTime or Adobe Flash content). When the Web browser encounters a format it does not support, it looks for a plug-in that does. A plug-in can launch its own viewer, appear within a browser window, appear in an embedded frame (within a window that may also contain HTML), or run in the background. Plug-ins work in similar ways with other kinds of programs.

How you install a plug-in depends on both the parent application and the plug-in itself. In many cases, the directory or folder where you place your plug-in(s) may have an installer.

14.1.1 Purpose

Applications support plug-ins for many reasons. Some of the main reasons include:

- to enable third-party developers to create abilities which extend an application
- to support easily adding new features
- to reduce the size of an application
- to separate source code from an application because of incompatible software licenses.

14.1.2 Features of Plug-ins

1. Add video, audio, photos and slideshows to your Website and e-mails
2. Works with any blog site
3. Upload video productions
4. Create amazing slideshows
5. Your audio, slideshows and video can be heard and seen worldwide
6. Instant and automatic updates for your galleries

Notes

14.1.3 History

Plug-ins appeared as early as the mid-1970s, when the EDT (text editor) running on the Unisys VS/9 operating system using the Univac 90/60 series mainframe computer provided the ability to run a program from the editor and to allow such a program to access the editor buffer, thus allowing an external program to access and edit session in memory. The plug-in program could make calls to the editor to have it perform text-editing services upon the buffer that the editor shared with the plug-in. The Waterloo Fortran compiler used this feature to allow interactive compilation of Fortran programs edited by EDT.

Very early PC software applications to incorporate plug-in functionality included HyperCard and QuarkXPress on the Macintosh, both released in 1987. In 1988, Silicon Beach Software included plug-in functionality in Digital Darkroom and SuperPaint, and Ed Bomke coined the term plug-in.

Currently, programmers typically implement plug-in functionality using shared libraries compulsorily installed in a place prescribed by the host application. HyperCard supported a similar facility, but more commonly included the plug-in code in the HyperCard documents (called stacks) themselves. Thus, the HyperCard stack became a self-contained application in its own right, distributable as a single entity that end-users could run without the need for additional installation-steps.

14.1.4 Most Useful Firefox Plug-ins for Web Developers

Firebug

Firebug integrates with Firefox to put a wealth of development tools at your fingertips while you browse. You can edit, debug, and monitor CSS, HTML and JavaScript live in any Web page. It is main plug-in for every Web developer.

Pixel Perfect

Pixel Perfect is a Firefox/Firebug extension that allows Web developers and designers to easily overlay a Web composition over top of the developed HTML.

FirePHP

FirePHP enables you to log to your Firebug Console using a simple PHP method call. All data is sent via response headers and will not interfere with the content on your page.

FireScope

FireScope is a Firefox add-on that integrates with Firebug, to extend it with reference material for HTML and CSS.

FireShot

FireShot is an extension for Firefox and Internet Explorer that captures, edits, annotates, organizes, exports and prints screenshots of your Web pages.

14.2 Text

Text is the most widely used and flexible means of presenting information on screen and conveying ideas. The designer should not necessarily try to replace textual elements with pictures or sound, but should consider how to present text in an acceptable way and supplementing it with other media. For a public system, where the eyesight of its users will vary considerably, a clear reasonably large font should be used. Users will also be put off by the display of large amounts of text and will find it hard to scan. To present tourist information about a hotel, for example, information

should be presented concisely under clear separate headings such as location, services available, prices, contact details, etc.

Notes

14.2.1 Concept of Text

Text is the graphic representation of speech. Unlike speech, however, text is silent, easily stored and easily manipulated. Text in multimedia presentations makes it possible to convey large amounts of information using very little storage space. Computers customarily represent text using the ASCII (American Standard Code for Information Interchange) system. The ASCII system assigns a number for each of the characters found on a typical typewriter. Each character is represented as a binary number which can be understood by the computer. On the Internet ASCII can be transmitted from one computer to another over telephone lines. Non-text files (like graphics) can also be encoded as ASCII files for transmission. Once received, the ASCII file can be translated by decoding software back into its original format.

14.2.2. Fonts

The graphic representation of speech can take many forms. These forms are referred to as fonts or typefaces. Fonts can be characterized by their proportionality and their serif characteristics.

Non-proportional fonts, also known as monospaced fonts, assign exactly the same amount of horizontal space to each character. Monospaced fonts are ideal for creating tables of information where columns of characters must be aligned. Text created with non-proportional fonts often look as though they were produced on a typewriter. Two commonly-used non-proportional fonts are Courier and Monaco on the Macintosh and Courier New and FixedSys on Windows.

Proportional fonts vary the spacing between characters according to the width required by each letter. For example, an "l" requires less horizontal space than a "d." Words created with proportional fonts look more like they were typeset by a professional typographer. Two commonly-used proportional fonts are Times and Helvetica on the Macintosh and Times New Roman and Arial on Windows.

Font Samples

Times and Times New Roman are proportional serif fonts.

Helvetica and Arial are proportional sans serif fonts.

Courier and Courier New are non-proportional serif fonts.

Monaco and FixedSys are non-proportional sans serif fonts.

14.2.3 Font Standards

There are basically two font standards of interest today. The first is called Postscript. Postscript fonts are designed to produce exceptionally good looking type when printed on a high-resolution printer. To use a Postscript font, a set of files must be installed on the host computer. These files include a printer font that is downloaded to the printer when a page containing the font is printed, and a set of screen fonts which represent the font on screen at various point sizes. If the user chooses to view the font at a size not provided for by the font file, the computer interpolates and produces an unattractive font on screen. The printed output, however, will always appear attractive. Postscript is a complete page description language that encompasses all elements of a printed page including high-resolution graphics.

The second standard is called TrueType. TrueType fonts use a variant of postscript technology. To use a TrueType font only one file must be installed on the host computer. This file is used by the printer and by the screen to produce attractive text at any point size. TrueType technology, however, is limited to text. For high-resolution graphics, Postscript is the standard to use.

Notes

Both Macintosh and Windows laptop and desktop computers commonly use TrueType fonts. Postscript technology, however, is much more commonly available on the Macintosh platform because of its dominance in the desktop publishing and multimedia production industries.



Postscript was created by Adobe in the mid-1980s.

14.2.4 Styles and Sizes

Styles such as **Bold**, Underlined, and *Italics* can be applied to most fonts.

The size of the font also can be altered through software commands.

14.2.5 File Formats

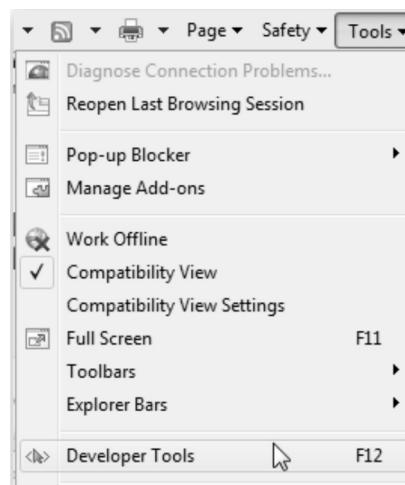
Text created on a computer is stored as a file on a hard disk or floppy disk. The ASCII file format is universally understood by all computer systems. A more complex standard called Rich Text Format (RTF) was developed by Microsoft to allow for the exchange of word processing files that include formatting such as text alignment, font styles and font sizes. Although RTF is proprietary technology, it has become a de facto standard for exchanging formatted text documents. A quickly-emerging replacement for RTF, however, is HTML (HyperText Markup Language) which is used for creating Web pages. The HTML files are really just ASCII text files. The content of HTML files, however, contains a standard set of markings to indicate text styles, alignments, hypertext links, graphics, and other formatting essentials. The HTML files can be read by Web browser software like Netscape Navigator. Many word processors today are also equipped to interpret HTML. Other file formats such as the native file formats used by Microsoft Word, WordPerfect, and AppleWorks are proprietary and not universally understood. When preparing electronic documents for a wide audience, therefore, it is best to use ASCII, RTF or HTML.

14.2.6 Edit Text in a Web page with Internet Explorer 8 (IE8)

The Internet Explorer is often decried as the worst browser for Web developers, but IE8 actually offers a very nice set of developer tools. Here we will look at a unique way to use them to edit the text on any Webpage.

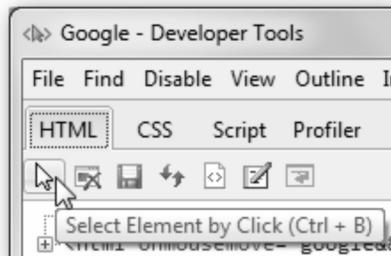
How to Edit Text in a Web Page

The developer tools make it easy to make changes to a Webpage and view them directly. Simply browse to the Webpage of your choice, and press the F12 key on your keyboard. Alternately, you can click the Tools button, and select Developer tools from the list.

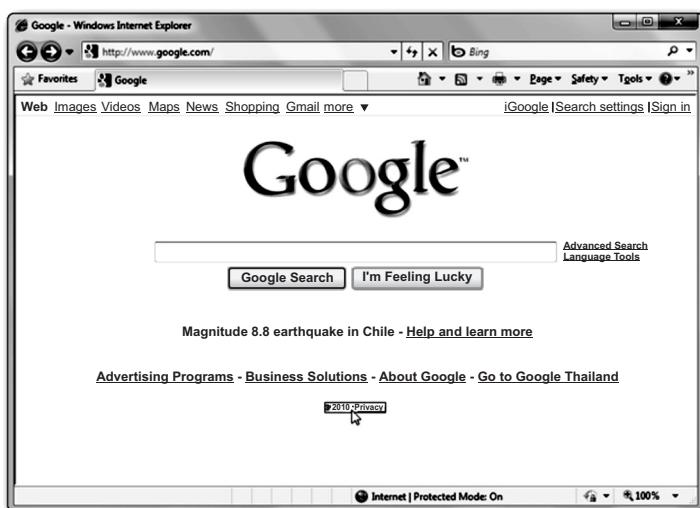


This opens the developer tools. To do our editing, we want to select the mouse button on the toolbar “Select Element by Click” tool.

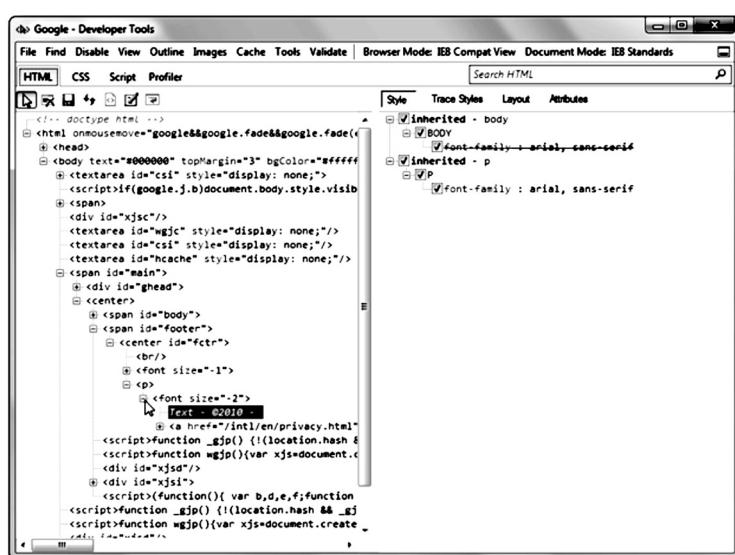
Notes



Now, click on any spot of the Webpage that you want to edit. Here, let's edit the footer of Google.com. Notice it places a blue box around any element you hover over to make it easy to choose exactly what you want to edit.



In the developer tools window, the element you selected before is now highlighted. Click the plus button beside that entry if the text you want to edit is not visible.



Now, click the text you wish to change, and enter what you wish in the box. For fun, we changed the copyright to say “©2010 Microsoft”.

Notes



Go back to IE to see the changes on the page!



You can also change a link on a page this way:



Or you can even change the text on a button:



Here is our edited Google.com:

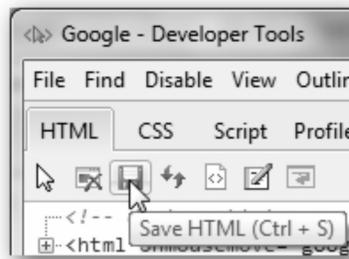
Notes



This may be fun for playing a trick on someone or simply for a funny screenshot, but it can be very useful, too. You could test how changes in font size would change how a Website looks, or see how a button would look with a different label. It can also be useful when taking screenshots. For instance, we want to show a friend how to do something in Gmail but do not want to reveal our e-mail address; we could edit the text on the top right before we took the screenshot. Here we changed our Gmail address to test@yahoo.com.



Please note that the changes will disappear when you reload the page. You can save your changes from the developer tools window, though and reopen the page from your computer if you wish.



We have found this trick very helpful at times, and it can be very fun too! Enjoy it, and let us know how you used it to help you!

Self Assessment

Choose the correct answer:

1. The plug-in depends on both the parent application and the plug-in itself.
 - (a) True
 - (b) False

2. is main plug-in for every Web developer.
 - (a) Pixel Perfect
 - (b) Firebug
 - (c) Firefox
 - (d) None of these

Notes

3. Non-text files (like graphics) can also be encoded as files for transmission.

| | |
|----------------|-------------------|
| (a) Monospaced | (b) FixedSys |
| (c) ASCII | (d) None of these |
4. Non-proportional fonts, also known as bispaced fonts.

| | |
|----------|-----------|
| (a) True | (b) False |
|----------|-----------|
5. The HTML files can be read by Web browser software like

| | |
|------------------------|-------------------|
| (a) Rich Text Format | (b) ASCII |
| (c) Netscape Navigator | (d) None of these |

14.3 Image

14.3.1 Optimizing Images for the Web

The Most Common Mistake

Once, we were asked to look at why a very simple Web page will have one small image and about 400 words of text took over 1 minute to load. The answer was simple and is a mistake we see over and over again.

The original image, which was large, was scaled to a small image size in a Website creation program, not an image editing program.

When you resize your image on your Web page to the size of a postage stamp, you really have not done anything to the image file size at all. What you are actually doing is telling the browser to re-scale the image on the fly. This creates a lot of work for the browser. The image that you thought is the size of a postage stamp is still that same large 8 x 10 inch image that takes over 2 minutes to download.

When you use an image editing program to resize the image, and you save it as a JPEG or GIF, you have actually created a smaller image. Now that postage stamp size image that you saved as a postage size JPEG will now load quickly on your visitor's computer.

GIF and JPEG: Two Image Formats You Need to Know About

If you want to optimize your images the first thing you need to know about is the two image formats recognized by your Web browser. These are GIF (pronounced jif as in Jiffy Peanut Butter) and JPEG (pronounced Jay-Peg). Both are compressed. That means the information has been organized inside the file in a special way in order to minimize the file size.

The difference between JPEG and GIF is the way that they compress the data. The JPEG compression is designed to optimize photographs or images with fine gradations of colour. The GIF compression is designed to optimize images with large continuous areas of colour, such as illustrations. Some examples of these image formats are given below:



Low Quality
JPEG Image:
size 3KB



Medium Quality
JPEG Image:
size 6KB

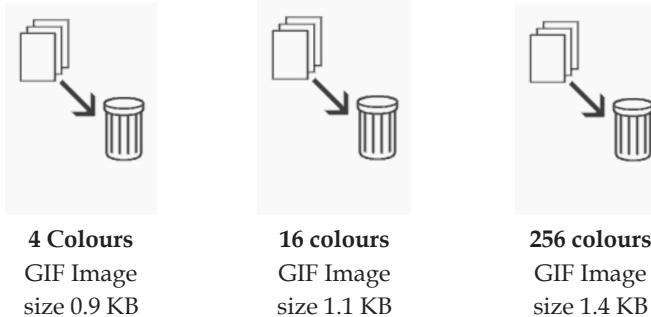


High Quality
JPEG Image:
size 8KB

Notice the more you compress a JPEG image, the more artifacts you begin to see. This is because you are actually losing information. The JPEG compression is therefore called lossy compression. You may also notice that the colour fidelity does not change. Colours are not lost in JPEG images. When you use JPEG compression you will trade off between image quality and image file size. In the example above, the Medium Quality image is acceptable and is 2 KB smaller than the high quality example.

Notes

Note: If you had tried to use GIF compression on the rose, the file size would be over 15 KB.



The GIF is a lossless compression in which. Data is not lost. However, colour fidelity is not preserved. This is because GIF indexes or limits the total number of colours to 256 or less. When using GIF compression, you trade-off between colour fidelity and image size. In the example above the 16 colour image gives acceptable colour fidelity and its file size is almost as small as the 4 colour image.

Note: That if you tried to use JPEG compression on this image, the file size would have been over 2.3K.

The following list is a summary of the types of graphic images that are acceptable on a Web page:

- **Navigation Buttons:** Used to help visitors navigate your Website. If designed well, these buttons can be much easier to read and find than text links.
- **Image Maps:** Also used to help visitors navigate your Website. If designed well, image maps greatly add to the visual appeal of a Web page but can considerably increase the page's download time.
- **Logo:** Used for your corporate or business identity. Logos increase brand name recognition and add visual appeal to any document or Web page.
- **Bullet Points:** Used to draw your visitors' eyes to the main points of your document. Also used to break up a Web page full of paragraphs.
- **Mastheads:** Also known as a title graphic. Main function is to let your visitors know which Web page they are on. Adding clip art or an illustration to a masthead adds more visual appeal.
- **Divider lines or horizontal rules:** Commonly used to separate footers, categories within a single Web page and FAQ questions and answers.
- **Background Images:** Used to enhance the visual appeal of a Web page and make a Website easier to navigate. One of the most common background images is a sidebar which usually contains the links to the other pages in your site.
- **Headings (text graphic):** Commonly used to preserve a typeface that many people do not have on their computers.
- **Photos:** Commonly used to make your Web pages seem more personal and more inviting.

Notes

Visitors' eyes are naturally drawn to photos of people. An absolute necessity to showcase products on certain e-commerce sites.

All graphic images on your Website should match in colour, typeface and special effects. For example, the text in all of your navigation buttons should use the same typeface and have the same special effects on them (such as a drop shadow). Your navigation buttons, mastheads, bullet points and divider lines look best if they are designed using one of the colours in your logo.



CompuServe introduced the GIF format in 1987 to provide a color image format.



Task

Select an image and compress it in gif format then upload on Web.

14.4 Sound

Sound on Web pages is a very contentious subject. Many people hate sound of any kind on Web pages, and even people who do not mind sound tend to hate automatic background music—especially if there are no controls to turn it off.

14.4.1 When to use Sound

Before you dismiss sound on Web pages out of hand, keep in mind that there are some legitimate uses for sound:

- **Musician and Artists Pages**

Any Website for a musician or video artist will need sound to showcase their work. These sites do best with links to the music and videos rather than having them autoplay.

- **Game Websites**

Most online games incorporate sound in some fashion. Sound provides interactivity and makes games more fun. But you should have a home page that does not have sound and perhaps a warning if the sounds are loud or start automatically without any muting available.

- **Forms, Especially Ajax Forms**

Sound can enhance Ajax and Web 2.0 pages by letting customers know that something has happened. For example, buttons can make a click sound when they are pressed and subtle timer sounds can help let the customer know that the Website is processing something. Be careful not to overdo this—keep it simple and use the sounds to enhance rather than overwhelm.

- **Web Pages Aimed at Children**

Websites designed for children might use sound to make the site more stimulating and engaging for an audience that has a shorter attention span. Sounds and background music can make pages more engaging and interesting. Remember that children have parents, and they may be annoyed by sound that cannot be turned off, or is too loud, even if the kids love it.

14.4.2 When not to use Sound

You should always be careful when you use sound on Web pages. After intrusive advertising, sound that turns on automatically and cannot be turned off is one of the most annoying aspects of poorly designed Web pages.

14.4.3 Tips for Using Sound

Notes

- *Always use the attribute controls="true"*. This gives the control of the sound back to your customers. If they want to hear the sound, they can, and if they do not, they can turn it off.
- *Do not use autoplay="true" or start="true"*. Sound starting when the page loads is a great way to get people to leave your site. They almost never stay long enough to "get into the mood" of your site. And even if they do not mind the music, they may have music of their own playing, which your background music will conflict with.
- *Link to sound files*. Let your readers decide if they want to listen to the music by clicking on the link. Just let them know that they are going to a sound file.
- *Do not use copyrighted songs without permission*. The ASCAP, BMI and the RIAA are very vigilant about pursuing copyright violations. Do not assume that because you found the song on the Web, even if it is converted into a MIDI or other electronic format, that it is free for use.

14.4.4 Different Ways to Play a Sound from a Web Page

Why it should be so difficult to replay a sound from a Web page remains a mystery. The following points demonstrate some of the many ways that have been tried over the years, from the use of a simple link to the use of the latest HTML 5 <AUDIO> tag. We will focus on the replay of simple uncompressed (aka PCM) WAV files, since that is what we use for perceptual experiments. Many of these techniques will work with MP3 or OGG compressed files, too.

Methods

1. Normal Hyperlink to a Sound File
2. Embedding a Sound File
3. Using a Background Sound and JavaScript
4. Using Dynamic HTML
5. Using HTML 5 Audio Tag.

1. Normal Hyperlink to a Sound File

This is the simplest way but usually causes a helper application to be launched to play the sound. These helper applications (plug-ins) are often not configured correctly. Sometimes the link will display a new page; sometimes it will just offer the file for download. Even if the helper application works, buffering the sound often causes problems. Either the replay starts too late and you have to wait for the whole audio to be downloaded, or it starts too early and runs out of data part way through.

```
<a href="success.wav">Play Sound</a>
```

2. Embedding a Sound File

The EMBED tag causes the sound file to be downloaded when the page itself is downloaded (just like an image would be). The browser then looks for a *Plug-in* to play the file. The Internet Explorer will typically use the Windows Media Player plug-in for sound files. Mozilla requires you to install a suitable plug-in such as Quick Time. A disadvantage of the EMBED tag is as follows: Since you do not know the dimensions or the name of the plug-in, it is hard to control the size and format of the player's appearance.

```
<embed src="success.wav" autostart=false loop=false>
```

Notes

3. Using a Background Sound and JavaScript

It is possible to do much the same as the above without the use of a hidden player if the browser supports the BGSOUND tag (in practice only Internet Explorer). Basically background sounds play as soon as the source sound is available; so the trick is to specify the source only in response to a JavaScript function. Here is the BGSOUND tag and the function:

```
<bgsound id="sound">  
<script>  
function PlaySound(url) {  
    document.all.sound.src = url;  
}  
</script>
```

Here are examples of a link, an image and a button calling the function.

```
<a href="#" onMouseOver="PlaySound('success.wav')">Move mouse here</A>  
Move mouse here.  
  
<form>  
<input type="button" value="Play Sound" onClick="PlaySound('success.  
wav')">  
</form>
```

4. Using Dynamic HTML

Dynamic HTML allows you to use JavaScript to write new HTML code into your page and let it be interpreted by the browser. The trick to using dynamic HTML for sound replay is to write into a region of the document the HTML of an embedded sound set to automatically start replay on load. Here we are going to use a region and write into it using its "innerHTML" attribute:

```
function DHTMLSound(surl) {  
    document.getElementById("dummyspan").innerHTML=  
        "<embed src='"+surl+"' hidden=true autostart=true loop=false>";  
}
```

We can now create the dummy span region and just pass the URL of the sound file to the function to play it:

```
<span id=dummyspan></span>  
<form>  
<input type="button" value="Play Sound" onClick="DHTMLSound('success.  
wav')">  
</form>
```

5. Using a Flash Audio Player

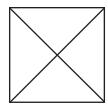
Although this method requires the Flash plug-in, that does seem to be quite commonly installed. There are a number of Flash players available, but many of them do not support WAV format files.

The latest version of the standalone player files can be downloaded from <https://github.com/francois2metz/WavPlayer>.

Copy the file wavplayer.swf to your Web folder.

The player itself is embedded using this code:

```
<object classid="clsid:d27cdb6e-ae6d-11cf-96b8-444553540000"
width="40"
height="40"
id="audio1"
align="middle">
<embed src="wavplayer.swf?gui=mini&h=20&w=300&sound=success.wav&"
bgcolor="#ffffff"
width="40"
height="40"
allowScriptAccess="always"
type="application/x-shockwave-flash"
/>
</object>
```



A little javascript provides a link to the player:

```
<script>
function getPlayer(pid) {
    var obj = document.getElementById(pid);
    if (obj.doPlay) return obj;
    for(i=0; i<obj.childNodes.length; i++) {
        var child = obj.childNodes[i];
        if (child.tagName == "EMBED") return child;
    }
}
function doPlay(fname) {
    var player=getPlayer("audio1");
    player.play(fname);
}
function doStop() {
    var player=getPlayer("audio1");
    player.doStop();
}
</script>
```

You can then drive the player from a link or a button like this:

```
<a href="javascript:doPlay()">doPlay()
doPlay()
<form>
<input type="button" value="Play Sound" onClick="doPlay()"/>
</form>
```

Notes

Notes

You can even change the audio file at play time:

```
<a href="javascript:doPlay('success.wav')">doPlay('success.wav')</a>  
doPlay('success.wav')
```



Caution To reduce the risk of sound injury, adjust the volume before putting on headphones, earbuds, or a headset.



Task Select a sound clip and upload on the Web.

14.5 Animation

14.5.1 Animation with JavaScript

Animation on Websites is controversial because the quality is often uneven. Well-done animation adds excitement and interest to a Web page, but bad animation distracts viewers and increases download times. You want to use animation to provide a sense of movement to the page--without inducing motion sickness in your visitors.

You can use some simple JavaScript techniques to include user-controlled animation that adds action without annoying visitors. The examples in this will show you how to include an animated GIF in your JavaScript code and also how to create a simple animation effect using a JavaScript rollover.

14.5.2 Carefully Select the Best Format

When you decide to include animation on your Website, you are constrained by two main factors: your ability and your audience's browser limitations. For instance, Java applets require that you have at least some basic Java programming ability. Shockwave and Flash effects must be created using Macromedia's tool sets and both require that your visitors have the plug-ins installed to view them.

JavaScript is easier to learn and more widely available to users. There are many ways to create animation effects with JavaScript: rollovers and cycling banners are the easiest, but you can also use more complex coding to create animated DHTML effects. Be careful with those because they will only work in Explorer and Netscape versions 4.0 and up.

The GIF is the most widely supported format since everyone using a graphical browser has the capability to view GIF images. In an animated GIF file, several GIF89 images are stored in a single file and then played in sequence. The image file is downloaded once and replayed from the computer's disk cache. Many software packages are available that help you to create animated GIFs (from images in the GIF89 format) and control their display.

Animated GIFs are so easy to create that novices often get carried away and create huge files that take forever to download. All the image optimization rules for regular GIFs still apply to animated ones. Speed up your file by optimizing each image with NetMechanic's free GIFBot tool before you combine them into a single file.

14.5.3 User Control over Animated GIFs

One of the most common complaints about animation is that the constant movement annoys visitors and detracts from the page's content. This is a valid argument; who has not been driven from at least one Website by an annoying animated graphic that repeats endlessly?

It is possible to include an animated GIF on your page and give the user some control over its display. If you can use the animation in a link, control it with a JavaScript rollover. The image only displays when the visitor moves the mouse over the graphic.

Notes

Preload your images in the HEAD tag:

```
<HEAD>
<script language = JAVASCRIPT>
<!-- Hide script from old browsers
if (document.images)
{
    redChile = new Image
    danceChile = new Image
    redChile.src = "chilePepper_lg.gif"
    danceChile.src = "dancingChile.gif"
}
// Stop hiding script from older browsers -->
</SCRIPT>
```

Next, include the rollover inside the <A> tag in the BODY section:

```
<A HREF="/news/vol3/design_no10.htm" onMouseover = "document.Chile.
src=danceChile.src" onMouseout = "document.Chile.src=redChile.src"><IMG
BORDER="0" SRC="chilePepper_lg.gif" ALT="Red Chile graphic" NAME="Chile"
WIDTH="89" HEIGHT="124"></A>
```

When your visitor moves the mouse over the chile pepper image, it begins to dance. The animation continues as long as the mouse stays over it. All a visitor has to do to stop the animation is move the mouse.

14.5.4 Uses of Animation on a Web Page

Animation on a Web page is any form of movement of objects or images. Animations are usually done in Adobe Flash, although Java and GIF animations are also used in many Websites. Streaming video in Flash is becoming increasingly popular.

Reasons to have motion on a Web page are to draw attention to something, to provide a demonstration or to entertain. The need for movement on a page depends on the purpose and content of the page. A financial institute would not really need animations on their pages, while an entertainment site obviously would have such movement.

Questions you may have include:

- How does animation draw attention?
- When is a demonstration needed?
- How is entertainment used?

Notes

Drawing Attention

You can use animation to draw attention to something you want the user to look at. This can range from blinking text to movement of items as in a cartoon. It is primarily used in online advertisement.

Entice you to action

For example, you all have seen banner ad in Websites. The animations in add are intended to attract your attention and entice you to take an action, like clicking on the banner to see more about the product or service. Another example is an animated company logo. Its movement draws your attention to the logo.

Too much no good

Unfortunately, too much of a good thing can backfire. Animated banner ads or company logos can become very irritating if they are continually blinking or moving while you are trying to read the content of the page. Certainly, the objective of the company is not to alienate customers, but that is often what they do through over-animation.

No value

Drawing attention to something of no use is also a negative application of animation. An example is an animated separator line. Cute, but of no real value.

Demonstrating

One reason to have animation is to help to demonstrate something you are explaining in your message.

Useful for products

Although a picture or illustration is useful, in some situations it is not sufficient to describe some action. An animation or video is necessary. An example of this is demonstrating how a device works.

Do not force users

Note that a demonstration is only effective if the user wants to see it. Some business sites force users to watch a demonstration of their product line, when they really wanted other information.

Slow loading time

Another problem is when animations or videos take too long to download. This often results in abandonment of the page.

Entertaining

If course, entertainment in the form of a game or a comic strip often uses motion fulfil its goal or to keep interest. There are many online game and entertainment sites on the Web.

Only when asked for

Entertainment when it is not asked for is a turn-off. This type of animation is also not appropriate for most business sites.

Can show creativity

Sites advertising creative services—especially related to graphical design, entertainment, or advertising—should have animation to show off their creativity.



Web Design Success Story

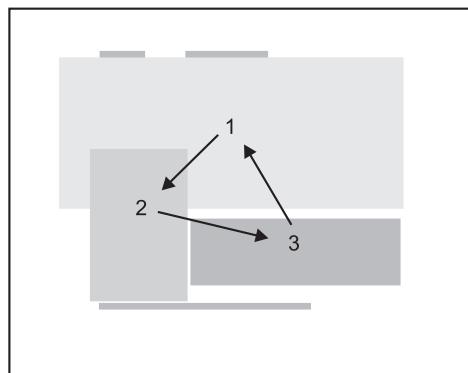
Case Study

Composition in Web design is similar to good composition in print design. It is a process of organizing and communicating in a way that is both functional and aesthetically pleasing. Web design is often even more complex because of the processes of navigation and multitude of variables in user interaction. Order and unity become vital communication ideals.

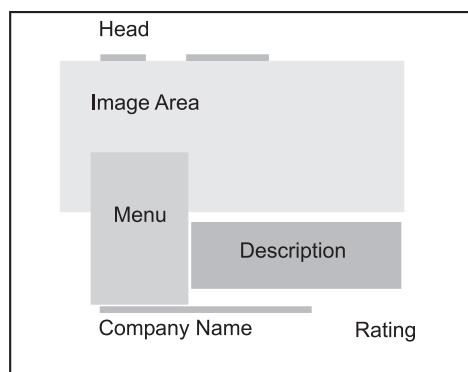
Contd...

SamataMason.com**SamataMason Website**

Many of the attributes of good Web design can be found on the Website of the well-known Chicago design firm, SamataMason. The introductory screen is simple and well organized. The elements of text blocks and image float on a gray background and can be readily brought up on either a small or large monitor without having to scroll left/right or top/bottom.

Hierarchy**Hierarchy and Composition**

The site has essentially a four tiered hierarchy that is emphasized by size and direction. The image, a horizontal rectangle, is the most important element and the top level of importance is emphasized by the large scale. The second level, a vertical rectangle, is a list of category choices. The third level, a horizontal rectangle, is a brief paragraph of descriptive information. Subordinate information including the heads, company name, and rating control complete the page.

Composition**Visual Analysis Diagram***Contd...***Notes***Contd...*

Notes

The scale of the major visual elements of image and text blocks is pleasing. The text blocks of the heads, menu and company name align and give a sense of order. The menu block overlaps the image on a transparent field that literally overlaps and attaches itself to the image and provides unity. The eye moves fluidly from the image to the menu to the description that is tucked in the negative space. This triangular movement feels comfortable, keeps the user focused on the centre of the page, and enhances the cohesive feel of the page.

Brevity

The simplicity of design makes the Website inviting from the start. Although there is a lot of information the user is met with an engaging organizational structure. Choices are clear and to the point, and the minimal descriptive text is well written. Long blocks of text sometimes turn-off the viewer because of the length, and are often ignored. Short blocks are much more enticing and in the case of SamataMason delightful to read.

Cropped Images

It is interesting that in all cases the images are not typical studio shots of a complete printed spread or an object but rather a tightly cropped detail of a larger image. The result is an intriguing composition that incites curiosity. Because of resolution constraints it is often difficult to show an entire image effectively. This system allows the viewer to appreciate the details of the design and get the gist of the project.

Visual Analysis

Submenu Choices, (right)

The visual analysis diagram breaks the elements on the Web page down into simple defined areas. The largest visual element is the image area, shown in light red, as a horizontal rectangle. This image area is systemized on each Web page and becomes a standard visual element for each page. This yields a sense of continuity and rhythm to the site even as the information changes.

Text information occupies four positions on the Web page. The top two blocks are short headlines. The long vertical text block is a menu with a series of choices that link to other text pages. The large horizontal text block is a short descriptive paragraph of informative copy. The company name occupies the bottom text block and aligns with a plus sign in brackets that when clicked invites the viewer to "rate the page."

Rating and Feedback

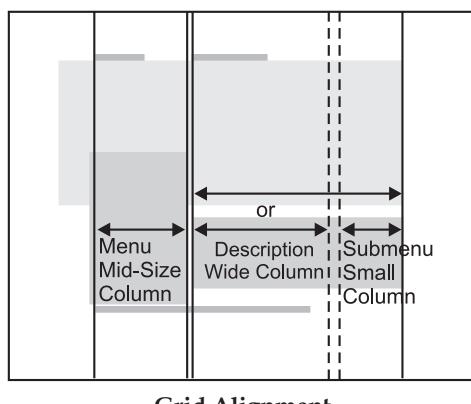
Rating and Feedback, (lower right)

Contd...

The page rating invitation gives the viewer an opportunity to provide direct feedback to SamataMason about the effectiveness of their Web presence. The viewer can quickly rate the page and if desired can click the "comments" category, which opens another window, to provide written feedback and rate the page as to content, design, usability, and overall. Clearly, the firm cares about the Web usability of the site and is interested in the opinion of the user.

Subsequent Web pages become only slightly more complex with the addition of another block of text to the right of the description. This block lists series choices within the category and serves to show the firm's range of capabilities. The viewer is readily engaged in the information because the choices are so clear that he/she knows immediately how to access information. There is no time lost figuring out how to navigate or return to a previous selection.

Grid System



Grid Alignment

Just as the image and text block proportions change from large to medium to small, so too does the grid. The system is a three column arrangement in three widths. The largest width is reserved for paragraphs of descriptive copy. The medium width contains the main menu choices, and the narrowest width is used when needed for additional submenu selections. If no submenu is used the description column occupies the entire width of the two right side columns.

The intent of the site is to inform the viewer of the capabilities and philosophy of the firm. It does so admirably and in the process persuades the user that SamataMason is experienced, organized, capable, and highly caring. How can you use these principals in your designs to create the same impact? Thoughtful design takes time and thought, but as you can see SamataMason spent both well and created something we can all learn from.

Questions:

1. Prepare a list of tools and techniques which are used to develop a Web page.
2. What are the points we should keep in mind before creating a Web page?

Notes

Self Assessment

Choose the correct answer:

6. To use a font only one file must be installed on the host computer.

| | |
|---------------|-------------------|
| (a) TrueType | (b) Postscript |
| (c) Macintosh | (d) None of these |
7. The compression is designed to optimize photographs or images with fine gradations of colour.

- | | | |
|-------|----------|----------|
| Notes | (a) GIF | (b) JPEG |
| | (c) TIFF | (d) BMP |
8. JavaScript is easier to learn and more widely available to users.
- | | |
|----------|-----------|
| (a) True | (b) False |
|----------|-----------|
9. also known as a title graphic.
- | | |
|-----------------------|-------------------|
| (a) Mastheads | (b) Bullet points |
| (c) Background images | (d) None of these |
10. The GIF is a compression.
- | | |
|-----------|-------------------|
| (a) lossy | (b) lossless |
| (c) JPEG | (d) None of these |

14.6 Summary

- A plug-in launch its own viewer, appear within a browser window, appear in an embedded frame or run in the background.
- Text in multimedia presentations makes it possible to convey large amounts of information using very little storage space.
- All graphic images on Website should match in colour, typeface and special effects.
- JavaScript techniques are used to include user-controlled animation that adds action without annoying visitors.
- Animated GIF's are the easiest way to create and implement.

14.7 Keywords

EMBED Tag: It causes the sound file to be downloaded when the page itself is downloaded.

FirePHP: It enables to log to Firebug Console using a simple PHP method call.

Plug-ins: They are software modules that add to the functionality of an application.

Postscript Fonts: They are designed to produce exceptionally good looking type when printed on a high-resolution printer.

Text: It is the most widely used and flexible means of presenting information on screen and conveying ideas.



- Lab Exercise* 1. Upload an animation on Web.

- Lab Exercise* 2. Write the JavaScript code to load an image using HEAD tag.

14.8 Review Questions

1. What do you mean by plug-ins? Explain its features.
2. Define text in respect of Web page.
3. What are the different types of font standards?
4. Describe JPEG and GIF file format.

5. What are the points should be kept in mind while using sounds in our Web page?
6. Explain the different ways used to play sound from Web page.
7. Mention any four Firefox plug-ins available for Web developers.
8. What do you mean by rich text format?
9. Explain the different types of graphic images that are acceptable on a Web page.
10. What are the circumstances when we should not use sound in our Web page?

Notes

Answers to Self Assessment

- | | | | | |
|--------|--------|--------|--------|---------|
| 1. (a) | 2. (b) | 3. (c) | 4. (b) | 5. (c) |
| 6. (a) | 7. (b) | 8. (a) | 9. (a) | 10. (b) |

14.9 Further Reading



Books

"Multimedia: Making it Work", by Tay Vaughan, TMH, 1999.



Online link

<http://books.google.co.in/books?>

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