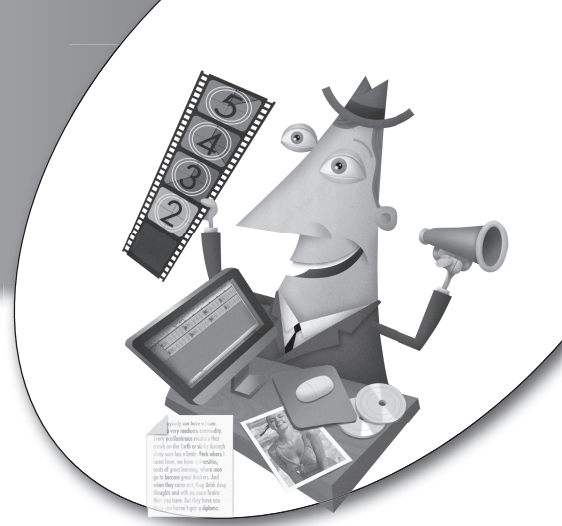


chapter 1

Introduction to Multimedia



In this chapter, you will become acquainted with the notion of multimedia and the technology behind it. Understanding the basic terms and concepts that relate to combining different types of media together is an important first step on our journey of exploring multimedia. So let's get the proverbial ball rolling!

CHAPTER OBJECTIVES

In this chapter, you will:

- Learn the definition of multimedia and what it means to use it
- Discover the kinds of media used in multimedia and understand how to combine them
- Distinguish between linear presentations and user-controlled interactive environments
- Find out about basic technical concepts and early desktop computers
- Learn a bit of multimedia history and understand the difference between older uses of media compared with current digital media uses

What Is Multimedia?

Multimedia is many things rolled into one. What do you think of when you hear the word *multimedia*? Is it merely a mashup of media elements? Or is it everything we see, hear, read, and touch in web sites, video games, phone apps, retail kiosks, and bank ATMs? These are all forms of multimedia, and the list of uses grows daily. We are drawn into multimedia at every turn, whether we like it or not. The goal of this book is to demystify the meaning and process of creating digital multimedia.

The simplest explanation of multimedia is “the combination of two or more media.” However, multimedia is vastly more complex than the term implies. It intertwines a myriad of media elements and, as a result, makes for a more comprehensive end product than when media components are experienced independently.

The *media* in multimedia comes in different forms: graphics, photography, text, audio (sound effects, music, voice-over, and so on), video, and animation. Individually, each one serves as a powerful communication vehicle for both expressive and practical purposes. Melded together, they allow for a more dynamic and engaging experience. The final result is improved on even further when there is cooperation and coordination between the disparate media components.

Marshall McLuhan was a leading and influential media communication theorist who coined the familiar phrase “The medium is the message” (*Understanding Media: The Extensions of Man*, NY, 1964). He believed that it is the “medium that shapes and controls the scale and form of human association and action.” To him, the focus should not be on the content or what is being said, but the medium by which it is delivered. The subject matter is by no means irrelevant, but the delivery format is a crucial factor in how the message comes across. This is where the immense power and influence of multimedia lie.

Media, by definition, is the plural of *medium*. It has evolved to mean “facilitating or linking communication”—be it via a phone, the Web, TV, or some other instrument. Speaking directly with a person one on one is immediate and does not require mediation. This is communication in its purest form.

The purpose of a medium is to assist in the conveying of a message. When using more than one type of medium, we refer to it as *multimedia*, whether or not it is computer-based. At one time, media mainly applied to newspapers as a way to disseminate news and information to the masses. Now, media encompasses many forms of communication.

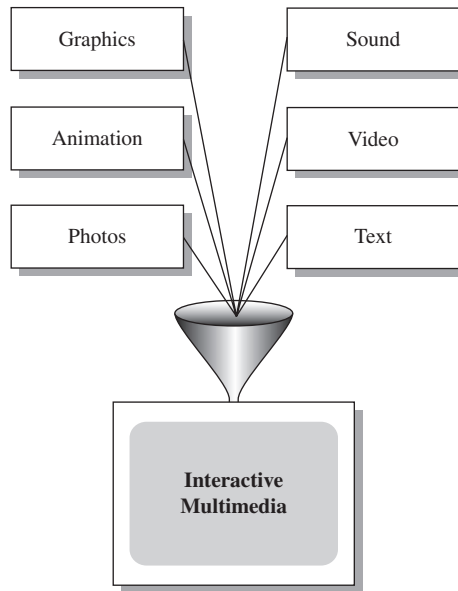


FIGURE 1-1 • Disparate multimedia elements funneling into one unit

The kinds of media elements and how they are used play a significant role in multimedia environments. Consider a web site without any graphics, color, or images. How about a music video without sound? There is clearly something lacking. A combination of media adds richness and provides a complete sensory experience.

As shown in Figure 1-1, multimedia is a synergistic process whereby various media elements work together to make a stronger, more cohesive whole. Take it one step further—get a person involved by providing interactivity with a multimedia program, and there will be even greater potential to increase the educational and entertainment value. Adding user choices with the help of computer code leads to the *interactive* in *interactive multimedia* and generates an engaging, multifaceted experience.

A Concise History of Multimedia

Before we delve into the components and types of multimedia, let's take a look at where the term *multimedia* originates.

Multimedia once meant a slide projector and a tape recorder being played simultaneously. For instance, 50 years ago, photographic images in slide form

were projected on a screen or wall while audio attempted to synchronize with the sequence or played as “background” music.

In 1967, pop artist Andy Warhol organized “multimedia” events called the *Exploding Plastic Inevitable*, where he showed films combined with live performances that were illuminated with flashing, colored lights to create a multisensory atmosphere. The technology necessary for joining individual media did not exist at that time. Computers were not accessible to the general public and those that did exist were large, complex, costly, and primarily geared toward scientists and researchers.

Today, the term *multimedia* is associated almost exclusively with the computer, and the components that make up a multimedia program are digital. Various media are brought together to perform in unison on the computer as a single entity, and they are programmed or scripted using authoring software or programming languages. Diverse forms of communication are combined with multimedia to allow for a myriad of outcomes.

Early Multimedia Computing

Up to the 1980s, mainframe computers were the norm as opposed to desktop varieties. These housed vast amounts of data and were primarily used by the military and scientific communities.

In 1975, IBM released the first portable computer with a fixed monitor, keyboard, and data storage. However, it had drawbacks: It required text input, weighed 55 pounds, and cost \$20,000, so it was hardly accessible to the masses. In the early 1980s, IBM introduced desktop computers, or personal computers (PCs). The base model had no built-in storage and a text-based screen where input was limited to typing on a keyboard.

As the PC developed, so did its multimedia capabilities. This allowed for regular and widespread use of multimedia and the creation of media elements. At this time, people began using computers for many home and office purposes.

In 1983, Apple Computer, Inc., announced its first desktop computer, which demonstrated an innovative graphical user interface (GUI). It was called the Lisa, and was considered user-friendly because it included a mouse to point and click on interface/screen desktop elements. Other PCs, such as the IBM, did not have these capabilities at the time.

The Lisa was ultimately not successful, so in 1984, Apple released the Macintosh. This was the first commercially successful computer with a GUI that was capable of designing for desktop publishing. This early Mac paved the way for the creation of graphics and page layout design with What You See Is What You

Get (WYSIWYG) technology. This allowed the users to view on their screen an approximate representation of what they would have in their printout, so it was possible to make edits and not need to guess what the final output would look like.

Table 1-1 shows the timeline from the early days of PCs to the current multimedia computers.

TIP For more information about the history of computers, go to <http://oldcomputers.net/> and www.computerhope.com/history/index.htm.

You might be wondering where the original concept of multimedia derived from. In the early 1900s, Vannevar Bush, an American computer scientist who

TABLE 1-1 Timeline of Early Days of PCs That Led to Multimedia Computers

Year	Technology and Functionality
1975–1979	First portable computers and game systems; text input only
1980–1987	First personal computers for word processing, spreadsheets, games, simple slide shows; basic interactivity; CD-ROM specification for releasing multimedia titles; better monitors with higher quality color graphics; increased storage
1988–1992	Faster processors and more memory; sophisticated GUIs; interactive environments grow; beginning of the World Wide Web (the Web) with HTML
1993–2000	CD-quality audio and wide use of CDs and DVDs for data storage; 3D computer animation and virtual reality; enhanced presentation software; sophisticated authoring environments; cross-platform developments; the Web becomes interactive with GUIs; widespread Internet and web access
2001–2011	Extensive Internet use with broadband Ethernet capabilities; all-in-one handheld devices for email, Internet, phone, music, video, and photos; game systems and smart phones with Wi-Fi and 3G access; vast search capabilities (such as Google); real-time videoconferencing and live news broadcasts; video on demand (Netflix, Hulu); TV recording devices; social networking; rich multimedia presentations; high-definition TV with Blu-ray technology; downloadable music (iTunes, Pandora)

developed patented devices, came up with inventive ideas about ways to link information. He saw the potential of storing information with built-in connections to other data. Bush called his notion *associative indexing*, which would link information in a way that is more meaningful to the user, rather than the more traditional numerical and alphabetical classifications. He developed the Memex System in 1945, and although it was never implemented, it would have allowed the operator to input notes and drawings using an early method of photocopying. Data was interconnected and could be stored for later recall. His theory led to the development of interlinked hypertext methods, similar to those that are used today.

Douglas Engelbart was another computing pioneer who was way ahead of his time. He is credited with inventing office automation devices such as the mouse, multiple window screens, electronic mail, and videoconferencing during the 1960s. Engelbart was trying to find ways to create a synergy between the user and the computer with an emphasis on human–computer interaction. He worked on collaborative hypermedia systems, which paved the way for current interactive multimedia approaches.

TIP *Learn more by going to The History of Computing Project, at www.thocp.net, which has a vast amount of information about computers. For an interactive timeline of the Internet, go to <http://historyoftheinternet.org/>.*

Hypermedia and Hypertext

Ted Nelson is a key figure in the evolution of multimedia. As an information technology pioneer who developed the *hypertext* system in the 1960s, Nelson researched the capability of browsing and searching information using a multidirectional, linked approach. He coined the term *hypermedia*, which is nonsequential reading and writing. This coincided with a method he created called Project Xanadu, which was intended to deal with a nonhierarchical approach to storing, presenting, and manipulating data. It demonstrated a form of text that branched and allowed choices to the reader, so users could explore subjects from many different perspectives.

Nelson's explorations opened doors to the multimedia revolution, which ultimately led to the widespread use of the Hypertext Markup Language. HTML is the fundamental web site programming language, or *markup language*, necessary for web pages to be viewed on the Internet.

TIP More information on Nelson's hypertext Xanadu project can be found at <http://xanadu.com/xuTheModel/index.html>.

The first practical use of hypermedia using hypertext was with a software program called HyperCard, which was introduced by Apple Computer in 1987, as shown in Figure 1-2. It was touted as an easy-to-use “software construction kit,” and anyone could be both the creator and user of multimedia. It included buttons, text fields, and menus, and used a metaphor of *cards* (like individual web pages) that made up *stacks* (like entire web sites). The programming language that was used with HyperCard was called HyperTalk, and it was appealing to the masses due to its ease of use. HyperCard was used as a presentation program, like PowerPoint, as well as for designing games and learning tools. This paved the way for more sophisticated software programs that allowed the amateur to create and develop multimedia projects.

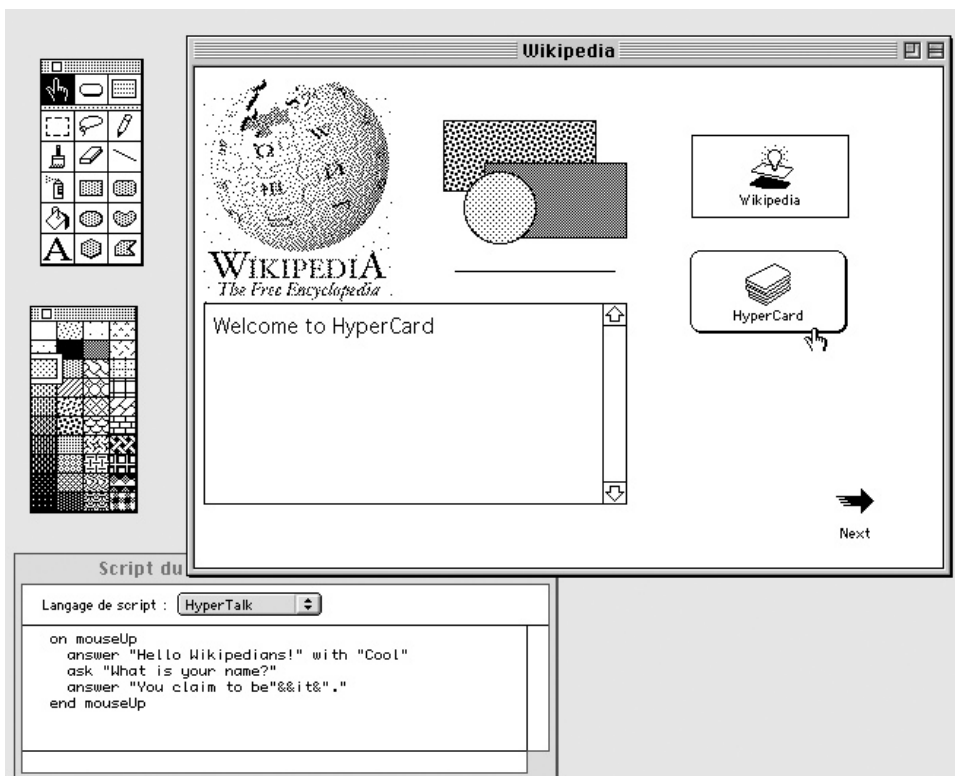


FIGURE 1-2 • Early hypermedia application with HyperCard software

In the early 1990s, there was a surge of multimedia programming, referred to as *edutainment*, that focused on interactive educational projects and books designed for children. CD titles were being produced at a rapid pace, but they were not tested well enough either for significance of the content or technological feasibility. This trend never turned into the revolution that was promised, as it was riddled with hardware and software compatibility problems. It also faced consumer resistance due to cost and unfamiliarity with the use and benefits of such products.

Combining Content from Various Media

The components that make up a multimedia production can be used in various combinations, as in the example in Figure 1-3.

As previously explained, there needs to be at least two kinds of media used in a single program or web site to qualify under the definition of multimedia. Here are some media options:

- Images, including graphics (lines, boxes, circles, rectangles, arrows, borders, and so on), photographs, illustrations, diagrams, cartoons, and color
- Text and typography
- Audio, including sound effects, music, and voice-overs



FIGURE 1-3 • Individual multimedia elements

- Animation, 2D and 3D
- Video
- Interface elements such as backgrounds, scenes, and metaphors
- Navigational devices such as buttons and menus

Linear vs. Interactive Multimedia

As illustrated in Figure 1-4, two important distinctions can be made with respect to how multimedia programs are used. One form of multimedia is called *linear* because it plays out in one continuous narrative sequence. Another type of multimedia is called *nonlinear* because information is not laid out in a chronological manner, but with many potential directions.

Nonlinear programs are inherently interactive and require active audience participation. The Web is a primary example of this type of multimedia, considering the endless pathways the embedded links provide. Let's explore this a bit further.

Linear Multimedia

Despite the apparent oxymoron, some multimedia programs are linear and designed for sequential viewing and reading of information. They begin at a

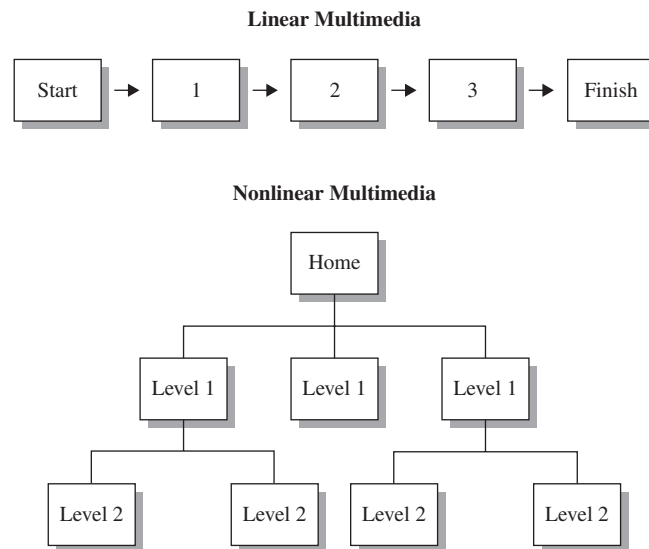


FIGURE 1-4 • Linear vs. nonlinear multimedia

predefined starting point and conclude at a logical ending location. Linear presentations may be automated so that each screen advances at a timed interval.

The linear approach is intended strictly for display purposes and is typically a passive “receiving” experience by the viewer, with no expectation of participating. It eliminates the need to take action (by pressing buttons or keys or touching a screen), and the developer, as opposed to the program user, is in control.

An example of linear multimedia is a PowerPoint presentation given by a town official during a meeting. The presentation is prepared, organized, and controlled by the presenter in a logical sequence. It is intended to present information in a straightforward manner for the purposes of education and discussion. Productions such as these can be as simple as text with bullet points, or multimedia elements—such as photographs, videos, and animation—may be embedded in the presentation. The presenter will press a button or key to begin, as you would do with a video, and play it for an audience to watch and learn without active involvement.

Another example of a simple linear presentation with one primary type of media is a slide show of vacation photographs that are displayed in one direction, with a distinct beginning and end. Additional media elements could be included that would bring it to the level of multimedia, such as active web links to the areas where the person traveled, videos shot on location, and music from the native culture playing in the background.

A linear presentation may also be designed with some minimal control options for either the presenter or another user, by employing computer-programming techniques. If the program is set up to be interactive, it would need to have navigational devices on the screen to click or touch, such as arrows, or a key press option on the keyboard, in order to move forward to the next screen.

Linear presentations are used in place of nonlinear ones when there is no requirement for interactivity. For instance, movies are presented in a linear format, which allows for greater submersion in the experience. You can absorb the information without the distraction of needing to make decisions about what to learn or where to go next. Someone is delivering the content to the audience in the order that it was intended with a predictable conclusion. This method provides a rich experience, yet it eliminates choices and relinquishes control to the presenter.

When the goal is to simply be entertained, gain knowledge about a subject, or become familiar with others’ viewpoints, a linear multimedia presentation is preferential. A person or group would be more apt to concentrate on the content of the topic being presented without the possibility of diversions. Interactivity,

on the other hand, forces users to make decisions and move through the content at their own pace. Both linear and nonlinear multimedia have their benefits and drawbacks.

Nonlinear Interactive Multimedia

Nonlinear, nonsequential multimedia implies that a person will in some way interact with a computer program. By doing so, they control the experience and dictate their unique journey to their final destination.

Interactivity results when there is some kind of *interface*, or connection between a user and a medium. A range of options or pathways is available to the user by way of menu selections or buttons that will lead to different categories and ultimately provide new information. This results in variable outcomes, which depend on the choices made by the user. The program has predetermined informational hierarchies established by the developer, but the user is free to explore, due to the elimination of path restrictions and time constraints. In this vein, acquiring knowledge by pursuing a random order of routes is encouraged.

An example of interactive multimedia is an educational museum kiosk with a touchscreen that allows visitors to learn more about an exhibit, as shown in Figure 1-5. They can explore historical information by reading text on the subject, viewing images and diagrams, watching videos, and listening to sound recordings.



FIGURE 1-5 • Peabody Essex Museum's multimedia program



FIGURE 1-6 • A multimedia program for the 56th Presidential Inauguration

Such a program supplements other physical displays to allow for further educational opportunities.

Another example of linear vs. nonlinear multimedia is viewing a video. By its very nature, video is a type of single, independent medium that is typically played and viewed from point A to point B. If presented to an audience, such as in a theater, it is linear, sequential, and noninteractive. There is no viewer participation other than sitting back and watching. The content is presented in a straightforward manner, and it is completely in the hands of the video producer and the person who is controlling the display device.

However, if a video is viewed on a DVD player or streamed via the Internet on a computer or TV, as shown in the example in Figure 1-6, there are many ways to interact with it and control the experience. The video can be paused, rewind, or advanced; different scenes can be selected at random; closed-captioning can be displayed; audio can be adjusted; and the list goes on. This is undeniably a much more lively way to view a movie, even though the video medium itself is inherently designed for passive observation.

Kinds of Multimedia

The following are some examples of different kinds of multimedia programs:

- Educational children's spelling program for use in schools in conjunction with handwriting on the board or on paper

- Retail clothing store with a computer-based interactive customer guide for choosing products and services
- Online hospital training program for a nursing staff that can be completed at work or home
- Informational kiosk at a historical museum with a multimedia program on the social and political issues of the 1970s
- In-store sales and marketing demonstration to persuade customers to purchase office supplies
- Video game based on medieval knights with interactive role-playing options
- Military combat simulations using 3D virtual reality software to prepare soldiers for live warfare conflict (as seen in Figure 1-7)
- Smart phone mini-application to determine the tax and shipping costs for online purchases
- Language learning programs to help prepare for travel



FIGURE 1-7 • Uses of simulation programs in the army

- Live TV broadcast of a singing and dancing competition where the audience can participate by selecting who they prefer with a handheld voting device, and where viewers at home can cast votes via the Web in real time
- Handheld global positioning system (GPS) device for mapping routes while driving, biking, or hiking

As you can see, there are a variety of options when designing for multimedia, ranging from entertainment to business, children to adult, and home use to public kiosks.

Let's Get Technical

Fundamentally, multimedia is a mixture of digital or computer-based images, text, audio, video, and animation that can take many forms. Here, we will cover the basic technical concepts that are essential to understanding multimedia and how it works.

The media elements used in multimedia projects need to be digital (computer-ready) or *digitized* (converted into a digital format) to be used on a computer. The word *digital* stems from the term *binary digits* or *bits*, which is a combination of the two words. These binary or double digits pertain to the value of zeros (0s) and ones (1s) that make up all computer data.

Inside every computer are electronic components that are triggered either by preset commands (what your operating system tells your computer to do) or by input commands (what you are telling your computer to do when you click something or type on the keyboard). The presence of a 0 indicates when the electrical switch is off, and 1 means it is on.

Bits are also related to units of memory, whereby information is stored in a computer. Computing memory has many bits, which are organized into groups of eight, called *bytes* (a byte is 8 consecutive bits). Units include kilobytes (1KB = 1,024 bytes), megabytes (1MB = 1,024 kilobytes), and so on. For instance, a single text character is 1 byte, so the letter *A* is represented in computer storage (or memory) as the following eight binary digits: 01000001. Table 1-2 shows the approximate file size required for various multimedia elements.

TIP For more about data information, see www2.sims.berkeley.edu/research/projects/how-much-info/datapowers.html. For a conversion calculator, go to <http://users.nlamerica.com/kevin/Bitsbytes.htm>.

TABLE 1-2 Bits and Bytes for Some Multimedia Elements

Media Element	File Size Approximation
Typed word	10 bytes or 80 bits
Typed page	2KB or 2,000 bytes
Low-quality image	100KB or 100,000 bytes
Thirty seconds of broadcast-quality video	5MB or 5,000KB

So, the pictures, text, and sounds used in multimedia are essentially just a bunch of numerical digits. Depending on the combination of electronic switches and quantity of 0s and 1s, the results are unlimited as long as there is enough memory to handle all the multimedia components.

When referring to *memory* in relation to computers, two types are available: active memory, called *random-access memory* (RAM), and memory needed for the software that starts up the computer, called *read-only memory* (ROM). Computers also have internal storage, which is required to save programs and files on the hard drive. Computers are manufactured with memory chips installed, and more can be added to accommodate an increase in software and data requirements.



Still Struggling

RAM is called *random access* because it is readily available and becomes activated as the computer needs it. RAM is the main memory of the computer, and it is needed to run software programs efficiently.

As demand for more memory increases, the greater the need for more RAM, which can be expanded by installing computer chips in the computer. You can do this yourself, but it is recommended that a professional install memory to avoid damage to your motherboard (the primary electronic panel or circuit board inside the computer).

The amount of RAM needed depends on what you use the computer for. If it is mostly for word processing and Internet access, then a minimal amount is needed, and the native RAM is more than adequate. If it is for graphics and video, where multiple programs are open at the same time, then you might need to increase your RAM. If you do not have a sufficient amount of RAM, the programs

(continued)

may not function or could freeze, or files could become corrupted or not open correctly.

The major difference between the data storage on a computer hard drive and RAM storage is that the former is considered more permanent and the latter is only temporary. Anything in RAM will get lost when the computer shuts down. Hard drive memory remains stored in the computer until it is deleted by placing it in the trash (or the recycle bin) and then emptying it. It is easier to understand this concept if you equate it with the desktop metaphor of the filing cabinet (for memory stored in the hard drive) and the desktop workspace (for the active memory).

Analog-to-Digital Evolution

As previously mentioned, media elements must either be converted to a digital format or derive from a digital source in order to be used on the computer. Visual images—such as photos, drawings, and paintings—must be digitized, either by scanning with a flatbed scanner or photographing with a digital camera. Photographic images can also be acquired digitally in their original form by using a digital camera from the start. Either way, they will end up in a computer-friendly format that can be included in a multimedia presentation. Video and audio are similar in that they need to be converted using analog-to-digital technology or captured using a digital video camera in its native format.

The term *analog* generally refers to traditional, physical media, such as video and cassette tapes. This technology was used before the advent of computers that transmitted continuous TV and radio signals resulting in a linear representation. Videotapes were originally developed as a means of recording and playing back analog signals transmitted wirelessly or by cable. Later, they were designed for the home market to record live action for family movies. These days, most video is shot using a portable digital video camera so that the need to use an analog-to-digital converter is eliminated. This process saves steps and is also preferred when producing multimedia, as the screen dimensions and file size requirements are typically small and do not require high-end equipment.

A photograph that derives from a film negative and is printed on light-sensitive paper in a darkroom (or commercially printed) is also an analog source. Music recorded onto vinyl records and movies produced on celluloid filmstrips are other examples.

The analog-to-digital evolution is still occurring as we speak, but much of what is used for multimedia today is digital to begin with. This makes the development of a project easier and quicker, and ultimately cheaper to produce. The arrival of digital cameras in the early 1990s, for instance, allowed photographers to generate average-quality digital images. Over time, lower costs and improvements in technology have spawned numerous brands and models of digital still cameras, and now higher-quality results are commonplace and expected.

In the early days, relatively affordable cameras were very limited. They had a maximum resolution of 72 pixels per inch. The dimensions were limited to 640-by-480 (equal to 6-by-8 inches, or the average dimensions of a 13-inch computer monitor, which was standard at the time), with a 256-color palette, and the image yielded a 900KB file. Average photos taken with a digital camera today are at least 9MB, sporting millions of colors, which is ten times as large with a much higher-quality result.

When scanning or digitizing photographic images for multimedia, the end product and file size are very important. In other words, your goal is to have the highest quality image or sound file possible, but one that is also small enough to play seamlessly on a multimedia CD or the Web.

Another factor in the quality of digital media is that it is dependent on the equipment and technique used to acquire or convert it. A multimedia developer *must* establish in advance what the delivery format will be, as this will determine how the media files will be treated and prepared. More in-depth information on this topic will be discussed later in the book.



Still Struggling

The quality of a photographic image depends on the number of pixels it contains. Simply put, the more pixels that are present in an image, the finer the level of detail and color gradations. Inversely, if the image results in a low quality, the photo will have fewer pixels and the file size will be smaller. Graphics and images will be covered in detail in Chapter 3.

Summary

This chapter covered what multimedia is within a historical context, as well as how and why we use it. You now have a basic understanding of some of the technical concepts centered on multimedia, so you can begin learning about the process of developing it.

By distinguishing between linear presentations and user-controlled interactive environments, you should have an easier time planning your project goals. We also compared older uses of analog media with current digital media to give you a framework for how far we have come and where we are heading with respect to computing and multimedia.

QUIZ

1. **How many bits are in a byte of computer data?**
 - A. 2
 - B. 8
 - C. 100
 - D. 1000
2. **What is the term for presentations that are sequential and typically do not have interactivity?**
 - A. Linear
 - B. Nonlinear
 - C. Hyperlinked
 - D. Nonhierarchical
3. **Who came up with the original concept of multimedia?**
 - A. Ted Nelson
 - B. Douglas Engelbart
 - C. Marshall McLuhan
 - D. Vannevar Bush
4. **In what year was the first Apple computer sporting the innovative GUI released?**
 - A. 1980
 - B. 1975
 - C. 1983
 - D. 1990
5. **What is hypertext?**
 - A. Douglas Engelbart's invention of office automation devices
 - B. An information system that allows for browsing and searching using a multidirectional, linked approach
 - C. A programming language that was used with HyperCard
 - D. The name of Vannevar Bush's associative indexing system
6. **How many bytes make up an average typed page?**
 - A. 100,000 bytes or 10KB
 - B. 8 bits or 1 byte
 - C. 10 bytes or 10,000 bits
 - D. 2KB or 2,000 bytes
7. **Which type of media element is *not* considered digital?**
 - A. Audiocassette tapes
 - B. Web interface buttons
 - C. Computer animation
 - D. Scanned images

8. What does Marshall McLuhan's statement "The medium is the message" mean?

- A. The way something is delivered is more important than what is being said.
- B. When media elements are combined, they result in a more powerful end product.
- C. Linear presentations eliminate the distraction of needing to make decisions.
- D. Text branched out and users could explore subjects from many different perspectives.

9. What determines the file size of a scanned photograph?

- A. The number of colors
- B. The dimensions of the image
- C. The file size or number of bits
- D. All of the above

10. What term refers to traditional, physical media, such as video and cassette tapes?

- A. Analog
- B. Digital
- C. Interactive
- D. User interface