Yue-Ling Wong

Digital Art

Its Art and Science

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CHAPTER

1

GENERAL LEARNING OBJECTIVES

In this chapter, you will learn:

- The role of digital in digital art.
- The role of art in digital art.
- How technology is used as a tool in digital art.
- How technology is used as a medium in digital art.
- How the digital art process, from creation to display, differs from that of traditional media.
- Technological properties that distinguish digital media from traditional media.
- Other characteristics that distinguish digital art from traditional art.
- To critique digital art in the studio art course environment.
- Effects of memory size, storage size, and CPU speed on digital media production processes.
- The distinction between the need for computer memory (RAM) and hard disk space.
- To assess memory and storage needs.
- To use folders to organize digital art files.
- The distinction between opening and importing files.
- To determine the proper media for file storage and backup.

See *Digital Media Primer*, Chapter 1, on analog vs. digital, continuous vs. discrete, and infinite vs. finite concepts. These pertain to the important role of the terms discrete and numbers in digital technology. You will see their significance in later chapters in this module.

Two other important terms for digital media are sampling and quantizing. These explain resolution and bit depth across different media, including digital images, audio, and video. See *Digital Media Primer*, Chapter 1.

1.1 WHAT IS DIGITAL ART?

Nowadays, we associate the word *digital* with computers in general. Computers rely on digital technology (a discrete system that uses numbers to represent information). The words *discrete* and *numbers* are crucial to understanding the science behind digital art: its capabilities and limitations. It's true that you will not encounter these terms directly when using digital-media software application programs. However, keeping these two words in mind is important, because their characteristics help form many other terms you will encounter in working with digital art.

Unlike *digital,* which has a clear scientific definition, defining *art* is more problematic. In its simplest and broadest definition, art is a product of human creativity. It may be governed by commonly held principles and aesthetics across different media, but each medium has properties that set it apart from the others. The properties that make the digital medium unique, however, are ***interactivity***, wide ***accessibility***, ***manipulability***, and ***volatility.*** The display of the electronic versions of digital art relies on a computer environment. Being digital does not eliminate or invalidate any of its underlying principles and aesthetics.

Interactivity

Interactivity loosely refers to the relationship between the viewer and the art. It plays a role in the communication between the viewer and the artwork. Generally speaking, any medium has this kind of interaction. A painting or a sculpture can provoke thought and influence the viewer's visual, emotional, or intellectual path within the work. Because different thoughts can be evoked for different viewers, each viewer's experience can be unique. Because different viewers follow different paths while looking at the painting or sculpture, their experience also can be nonlinear. However, in traditional media, the visual and physical content of the art remain unchanged during this interaction.

For digital media, interactivity has a more specific meaning. It allows a direct input from viewers, which may change their communication with the art. The direct input is usually a physical action, like mouse clicking, pressing a key on a keyboard, or even body movement captured by an electronic sensor. The action results in changes to the visual or auditory content of the work. Interactivity can provide nonlinearity when the viewer input changes the order of the experience. In some digital artwork, viewers' input becomes part of the work's content; the content evolves with the viewers' input.

Interactivity of digital media is achieved by computer programming. Many of the digital artworks on the Web are programmed using Java or Flash ActionScript. *Digital Media Primer* in this book series covers fundamentals of Flash ActionScript programming. JavaScript is also a common programming language for the Web. Chapter 10 of this book covers the fundamentals and examples for adding interactivity to Web documents using JavaScript.

Wide Accessibility

With the exception of site-specific installations, most digital-media works can be reproduced and distributed to a larger audience than traditional media. The Web is a popular outlet for displaying digital art due to its wide accessibility. Web technologies also support the use of multimedia and the kind of interactivity particularly appropriate to digital art.

Manipulability

Digital technologies make extensive manipulation and alteration of file content possible. Digital media also allow the artist to mix many different components—image, video, and audio—into a single work. The layering, transparency, and blending controls of digital-imaging tools present artists with new possibilities in composing and collage. The artist can adjust the level of seamlessness or juxtaposition in combining different visual components to create the intended reality. Some digital artworks exhibit distinctive digital qualities. However, digital content can be created to have the same visual qualities as traditional media, so that the digital manipulation is not apparent to the viewer.

Volatility of Digital Art

Selected URLs of Digital Art
A selected list of URLs of digital artworks.

The volatility of digital technologies makes the preservation of digital art different from that of traditional art. In the traditional model, rarity increases economic value, and the archival quality of the materials determines the work's preservation for generations. Because of the mass reproduction capability of digital media, most digital art can reach a broader audience with greater ease, and in this sense, it is of less economic value. However, the presentation of the electronic format of digital art relies on many rapidly changing environments, such as computer hardware, software, and operating systems. Such digital art may be short-lived if the required technological environment is not preserved. One initiative aimed at preserving digital art is developing emulators that can run works created on older computer systems.

Emulators are not a new concept in the computer world. Software emulators have been used to simulate a virtual computer environment; for example, to run software written for one platform on a totally different operating system, like running Linux under Windows or Windows under Mac OS.

1.1.1 Digital Art as Fine Art and as Design

AIGA (American Institute of Graphic Arts) is the professional association for design. Visit their Web site at http://www.aiga.org/

Fine art often refers to the visual arts which include painting, drawing, printmaking, sculpture, and some performance art—not including art forms such as music, dance, literature, and poetry.* ***Graphic design*** is an area where digital technologies are frequently used. They are also valuable for three dimensional (3-D) design. In the AIGA's graphic design career guide, it explains that graphic design is "a creative process that combines art and technology to communicate ideas." In addition, graphic designers work with a variety of media, such as "drawn, painted, photographed, or computer-generated images (pictures), but they also design the letterforms that make up various typefaces found in movie credits and TV ads; in books, magazines, and menus; and even on computer screens. Designers create, choose, and organize these elements—typography, images, and the so-called 'white space' around them—to communicate a message."† Works of graphic design include logos, posters, medical illustrations, print layout, packages, signs, and web design. Figures 1.1 through 1.9 show examples of different types of graphic-design works.

Figure 1.1 Logo design for *Stories From the Field* (Courtesy of Stella Priscilla Poco—http://www.xstellax.com)

Figure 1.2 Logo design for *Paint Your Heart Out Tampa* (Courtesy of Stella Priscilla Poco—http://www.xstellax.com)

*http://www.bbc.co.uk/dna/h2g2/classic/A779448

†http://www.aiga.org/content.cfm/guide-whatisgraphicdesign

Figure 1.3 *Function and Form Typography Series* poster design (Courtesy of Barry Harmon—http://aigadesignjobs.org/bharmon)

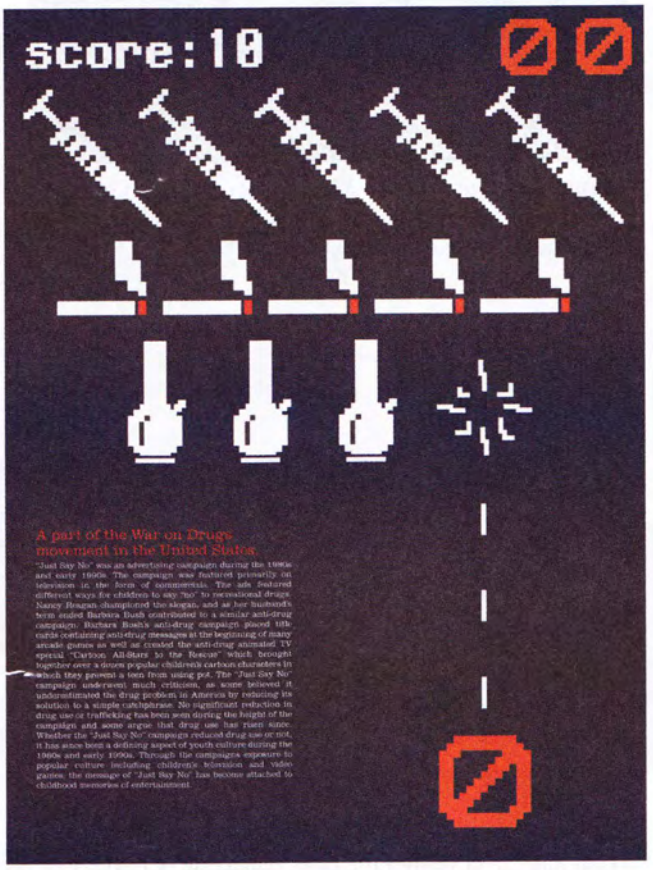


Figure 1.4 *Just Say No* poster design (Courtesy of Barry Harmon—http://aigadesignjobs.org/bharmon)

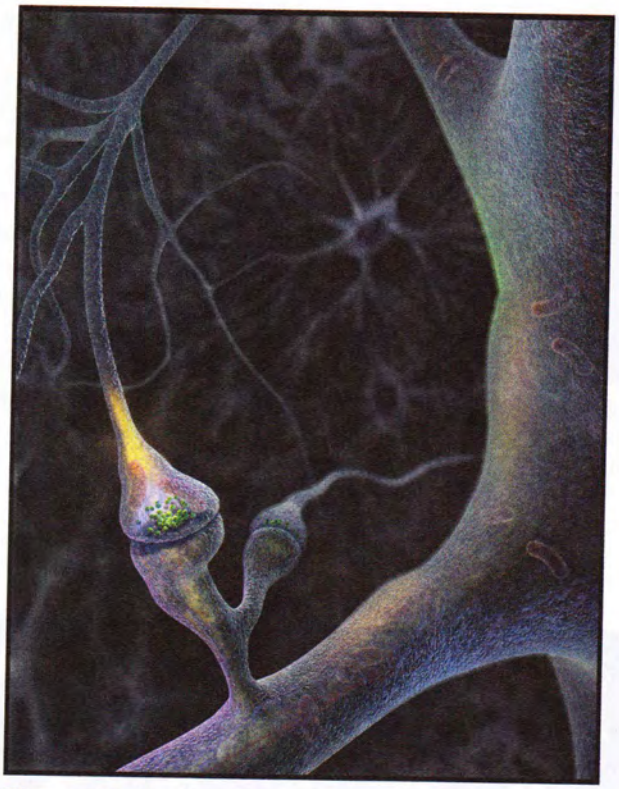


Figure 1.5 *The Synapse Revealed*, created by Graham Johnson of www.fivth.com for the Howard Hughes Medical Institute Bulletin ©2004

Figure 1.6 Layout and cover design for *Bark* magazine (Courtesy of Stella Priscilla Poco—http://www.xstellax.com)

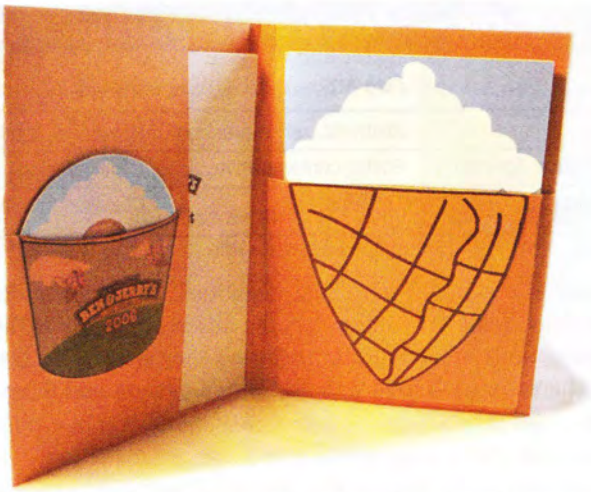


Figure 1.7 Annual report layout and package design for Ben & Jerry's Ice Cream Company (Courtesy of Stella Priscilla Poco—http://www.xstellax.com)

Figure 1.8 Postcard promotional campaign design for new Pantone colors (Courtesy of Stella Priscilla Poco—http://www.xstellax.com)

Figure 1.9 *Garnier Fructis* Web design (Courtesy of Liza Pagano—http://www.thegraphicdetail.com)

TABLE 1.1 Different Aspects of Fine Art and Design

	Fine Art	Design
Intention	Aesthetic, self-expression	Functional, utility
Communication Approach	Poetic, contemplative	Clear, effective, immediate
Origin of Idea	The artist	Clients, employers

Fine art and graphic design differ by their intentions, communication approaches, and the origin of their ideas. Table 1.1 summarizes the different aspects of fine art and graphic design. These distinctions are important, because they determine how the works are judged. Digital technologies are used in both art and design, and these distinctions also apply to digital art.

Intention

The main difference between fine art and design is the primary intention of the products. Fine art is created for its own aesthetic purpose and self-expression. Design, on the other hand, is created for a practical function. Graphic designers still use artistic skills—fundamental art elements and organizational principles—in their works. For example, Graham Johnson's medical illustration (Figure 1.5) was built on a pencil composition based on the scientific information. Sketches were worked up before the image was modeled on the computer. The rendered image of the 3-D model then was touched up in Adobe Photoshop (for aesthetics); for example, to increase depth by enhancing highlights and shadows.

Communication Approach

Because of their different intentions, fine art and design differ in the ways they communicate their ideas to the audience. Fine art often has a poetic quality, provokes thoughts, and prompts contemplation. Graphic design usually strives for clear, immediate, and effective communication of the idea to the audience.

Origin of the Idea

The ideas and purposes of a designer's projects often come from clients or employers. In contrast, the fine artist generates the work's idea and intention.

1.1.2 Digital Technologies as a Tool and as a Medium in Digital Art

The digital component plays two different roles in digital art: as a tool and as a medium. Whether the technology is used as a tool or a medium depends on the extent to which its different properties—interactivity, accessibility, and manipulability—are exploited.

Digital Technology as a Tool

The ease with which digital media can be manipulated makes their technology a very good tool for creativity. In particular, the capability to "undo" enhances the artist's creative freedom to experiment. When used as a tool, strong motives are often the manipulability, wide accessibility, and rapid reproduction capability of digital technology. Sometimes, digital technology is used to aid art creation in traditional media; that is, the final product is not in

digital format, and the use of the technology is not apparent. For example, the composition for an oil painting can be experimented using digital images before transferring to the canvas. Digital imaging and digital video are the common media that are used as a tool for this purpose.

Digital Technology as a Medium

When digital technology is used as a medium, its intrinsic characteristics (especially interactivity) are exploited to a greater extent. Such artworks exhibit some common distinctive aspects, although not all characteristics must exist within a single work.

1. Physical interaction.

Viewers often have to perform some kind of action (especially to interact with the computer) either through the mouse, keyboard, or other devices to experience the entire piece. Just being a spectator will not initiate much communication with this type of artwork.

For example, in Camille Utterback's *Untitled 6* (Figure 1.10), the viewer makes marks through the bodily movement. The following is an excerpt about this piece.[‡]

> "*Untitled 6* is the sixth piece in Utterback's *External Measures Series*. The series began with Utterback's attempts to create interactive paintings and has evolved as she

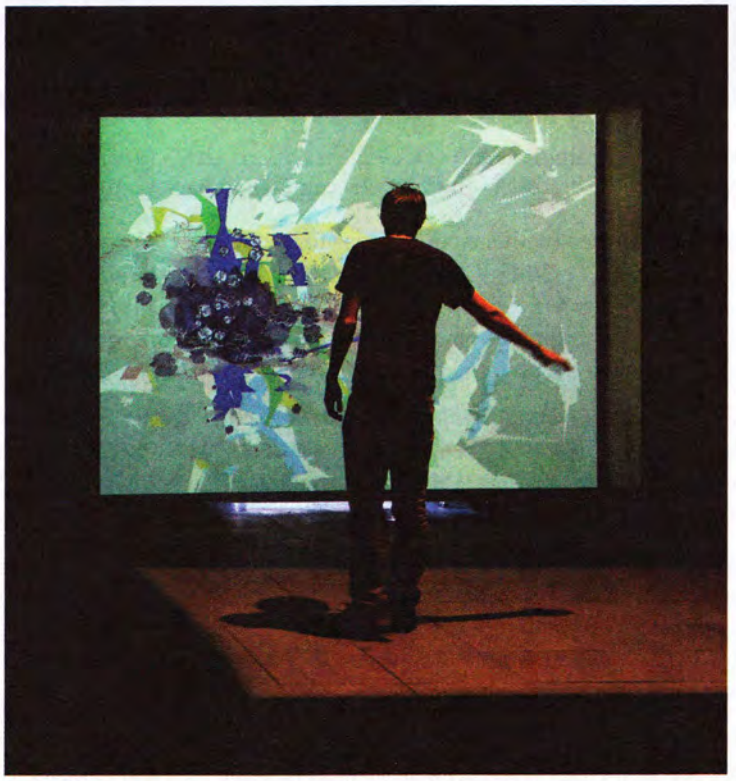
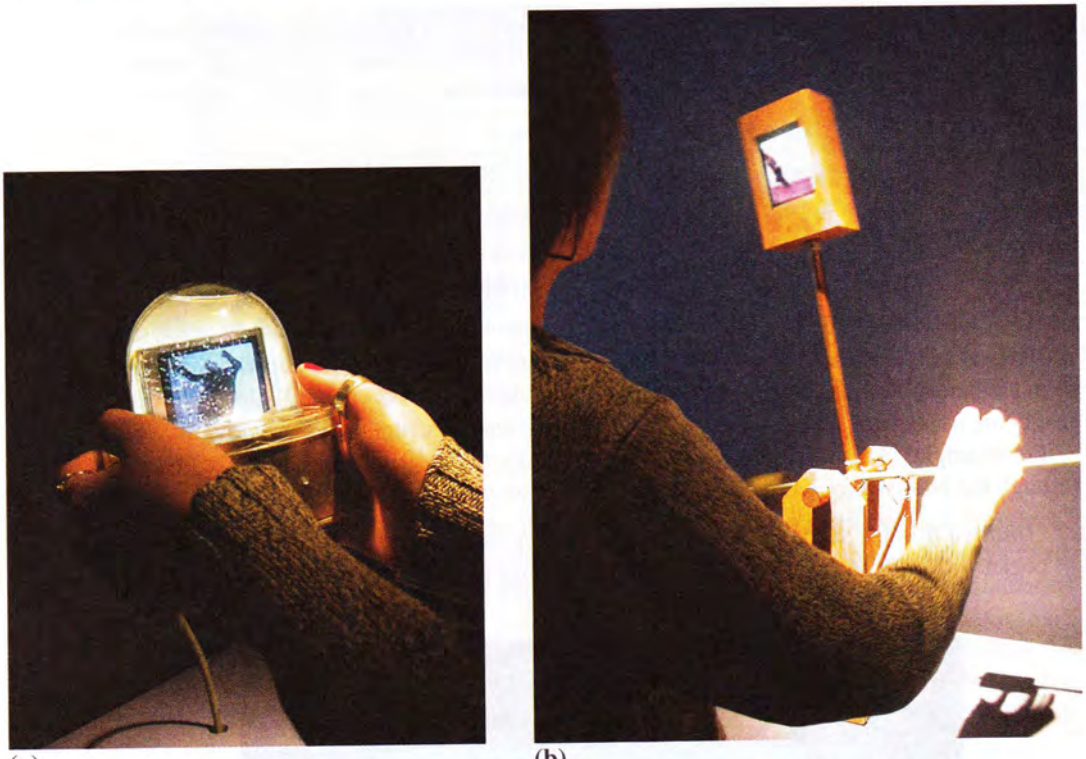


Figure 1.10 An installation still of Camille Utterback's *Untitled 6,* 2005 (Photographed by Peter Harris © 2007) (Courtesy of Camille Utterback—http://www.camilleutterback.com)

[‡]http://www.camilleutterback.com



(a) (b)

Figure 1.11 Installation stills of Camille Utterback's *Potent Objects*, 2003 (a) *Shaken* (b) *Balance* (Courtesy of Camille Utterback—http://www.camilleutterback.com)

> continues to experiment with the possibilities for hinging digital aesthetic systems to human movement. . . . While Utterback's work is computer generated and detects movement in the space via a video camera, it shares a lineage with analog works like mobiles and kinetic sculptures, where artists create a framework for various possibilities to occur through the physical relationships between parts of the sculpture."

In Camille Utterback's *Potent Objects* (Figure 1.11), the viewer can hold and move a physical device. The live-action character displayed on the device reacts to the viewer's interaction with the device. Figure 1.11 shows installation stills of two objects: *Shaken* and *Balance'*. Here is an excerpt describing the work.[§]

> "Through the use of double entendres and plays on words, *Potent Objects* examines the tropes of interactivity as metaphors for human emotion. Each object is based on a word that refers to both a physical gesture and an emotional state. Some objects will try to 'learn' about certain emotions or interactive behaviors by capturing and incorporating users' actions into the object's own repertoire of 'emotion'."

2. Use of multimedia.

See Chapter 4 for detailed description about *Spacequatica* and *Drum Machine*.

Image, video, audio, and even text may be used to make up a whole piece, and they can be shown asynchronously. For example, The Sancho Plan's audiovisual works, *Spacequatica* (Figure 1.12) and *Drum Machine*, combine sound, music, and animation.

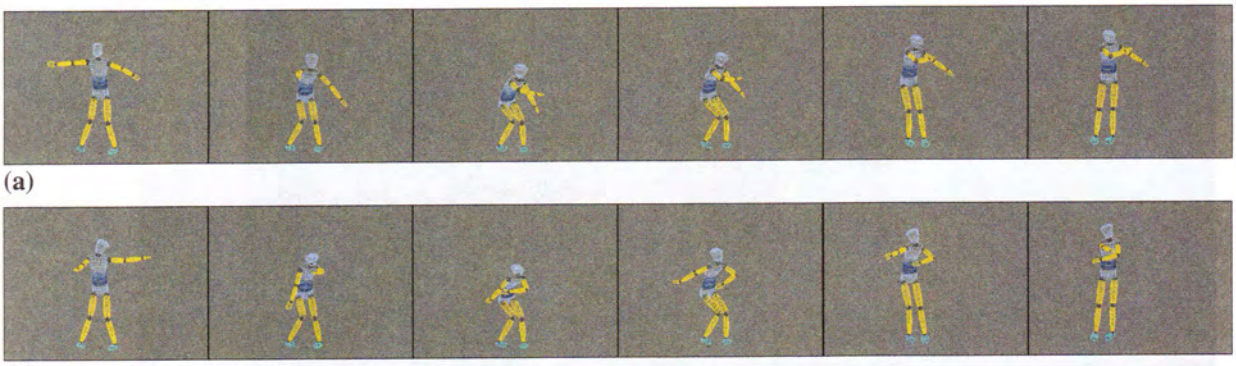
[§]http://www.camilleutterback.com/potentobjects.html

Figure 1.12 The Sancho Plan's *Spacequatica* (Courtesy of The Sancho Plan—www.thesanchoplan.com)

3. Nonsequential experience.

Digital technology allows navigation of the work based on the choice of the viewer. This creates new possibilities for nonlinear experience of the work. Directing the viewer's eye around the canvas is not a new concept in visual art composition, but digital technology can direct viewers' experience by moving their attention *across* and *within* components or "pages". For example, hypertext documents allow nonlinear navigation. The viewer does not need to follow a specific order to view the documents. The order of viewing depends on the viewer's choices.

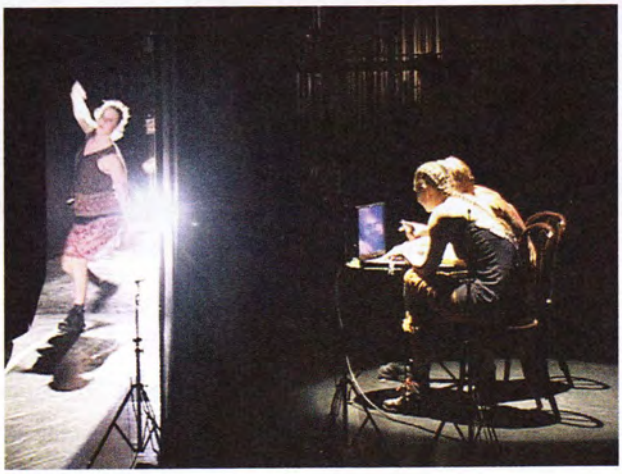
With digital technology, an originally linear sequence can be reconstructed into new sequences. The viewer can make choices to control how the different elements are recombined into a new sequence. For example, in the author's *Mannequin*, the body movement of a motion-captured dance sequence is segregated into two parts: upper and lower body. This severs the timing relationships between the upper and lower body (Figure 1.13). The motion of the two body parts then can be recombined by allowing each part to have different speeds and direction of playback, which also can be reversed. The new sequence depends on the viewer's choices. The work was created for a dance performance in which two such mannequins were controlled by two dancers behind a projection screen (Figure 1.14a). Two dancers in front of the screen were trying to mimic the movement of the mannequins (Figure 1.14b). Despite the rehearsal, the new motion was different and unpredictable in each show. The piece explores the idea of control in addition to the experimentation of nonlinear recombination of body movement.



(a)

(b)

Figure 1.13 (a) Frames of the original dance applied onto a 3-D mannequin character (b) The movements of the upper body and the lower body are recombined with different timing (controlled by the user) to create new movement



(a)

(b)

Figure 1.14 Stills of *Mannequin* in the dance performance *Fibonacci and Phi*, Alban Elved Dance Company, 2003

4. Viewer involvement.

Viewer involvement is not limited to the moment of the viewer's physical presence. The involvement also can be captured and becomes part of the content of the work. The viewers can leave marks that influence how the piece will communicate with future viewers. For instance, viewers can input words, and images or videos can capture their actions in time.

In Marek Walczak and Martin Wattenberg's *Apartment* found at http://turbulence.org/Works/apartment/, viewers can enter a sentence to create rooms. The apartments are grouped visually based on their linguistic relationships. Here is an excerpt from the artists' Web site about the work.

> "Viewers are confronted with a blinking cursor. As they type, rooms begin to take shape in the form of a two-dimensional plan, similar to a blueprint. The architecture is based on a semantic analysis of the viewer's words, reorganizing them to reflect the underlying themes they express. The apartments are then clustered into buildings and cities according to their linguistic relationships.
>
> Each apartment is translated into a navigable three-dimensional dwelling, so contrasting between abstract plans/texts and experiential images/sounds.
>
> ... establishing an equivalence between language and space, *Apartment* connects the written word with different forms of spatial configurations."

In *Life SpaciesII* (Figure 1.15) of Christa Sommerer and Laurent Mignonneau, new creatures are created through e-mails from people all over the world. The characteristics of the creature and the food (text characters) it seeks to eat are based on the e-mail content that creates it. Here is an excerpt from the artists about the concept of this project.**

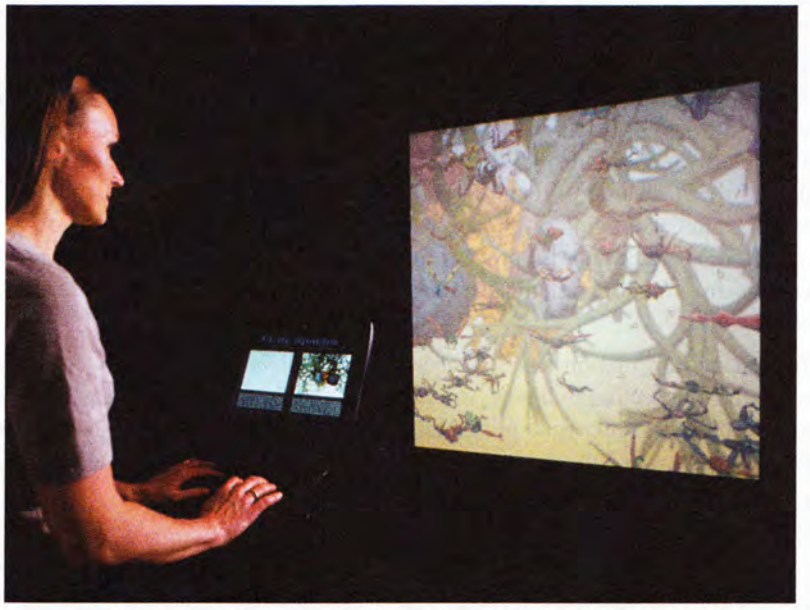


Figure 1.15 An installation still of *Life SpaciesII* (© 1999, by Christa Sommerer and Laurent Mignonneau, developed at ATR MIC Labs Japan, collection of the NTT-ICC Japan)

**http://www.interface.ufg.ac.at/christa-laurent/WORKS/CONCEPTS/LifeIIConcept.html

"Through the 'Life SpaciesII' web page, people all over the world interact with the system; by simply typing and sending an email message to the 'Life SpaciesII' web site at http://www.ntticc.co.jp/~lifespacies, one can create one's own artificial creature.

We developed a special text-to-form coding system that enables us to use written text as genetic code and translate it into visual creatures. In a way similar to the genetic code in nature, letters, syntax and sequencing of the text is used to code certain parameters in the creature's design functions. Form, shape, color, texture and the number of bodies and limbs are influenced by the text parameters. As there is a great variation in the texts sent by different people, the creatures themselves also vary greatly in their appearance.

As soon as a message is sent, the produced creature starts to live and move around in the 'Life SpaciesII' environment. Depending on the complexity of the written text message the creatures body design and its ability to move is determined. Some creatures might move very fast whereas others might be slower. Creatures also look for food and aim to eat text characters that can be interactively released by the visitors: creatures always eat the same characters as contained in their genetic code. For example 'John' creature will only eat 'J', 'o', 'h' and 'n.' Since other creatures might want to eat the same characters as well, competition among creatures for certain types of food will occur. Creatures also might starve and die if they do not succeed to catch enough text characters. On the other hand if a creature has eaten enough food (=text characters) it will look for a mating partner and bear a child. Offspring creatures will then carry the genetic code of the parent creatures and live and interact with the other creatures in 'Life SpaciesII.'"

INFORMATION VISUALIZATION AND DIGITAL ART

Information visualization deals with transforming large amounts of data into a visual form that enables the viewer to understand and make sense of the data. With computer technology, the visualization process often allows dynamic updates of the data and user interaction with the visual display of the data. Like the art creation, the process of transforming information into a visual form requires communicating information to the viewer and an understanding of human perception.

In addition, it is a thoughtful process for choosing or creating symbols or metaphors for the data. Information visualization has its aesthetic and utility purposes. To quote Edward R. Tufte:[††]

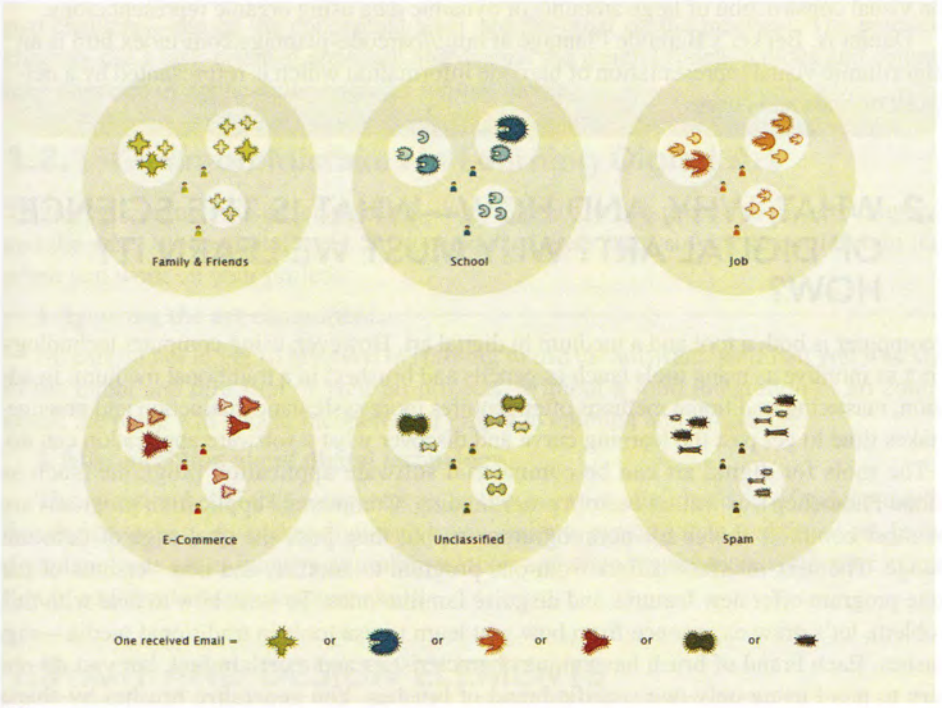
> "To envision information—and what bright and splendid visions can result—is to work at the intersection of image, word, number, art, . . . and the standards of quality are those derived from visual principles that tell us how to put the right mark in the right place."

Information visualization has served as an inspiration, a basis, and premise for many digital art projects.[‡‡] Carolin Horn's *Anymails* at http://carohorn.de/anymails/ (Figure 1.16a) was developed during the artist's MFA thesis entitled "Natural Metaphor For Information Visualization." It uses microorganism-like creatures (Figure 1.16b) to represent different types of e-mails (Figure 1.16c) in her e-mail inbox. The size and

[††]Edward R. Tufte, *Envisioning Information*, Graphic Press, 1990.

[‡‡]More examples of information visualization works can be found at: http://rhizome.org/art/?tag=informationvisualization

(a)



(b)

Figure 1.16 Screenshots of Carolin Horn's *Anymails*—http://carohorn.de/anymails/ (Courtesy of Carolin Horn)

Figure 1.17 A screenshot of Ben Fry's Genome Valence project—http://benfry.com/genomevalence/

opacity of the microbe represent its age. The amount of hair and the speed of the microbe's motion are used to represent the status of an e-mail (read, replied, and unread).

Ben Fry's *Genome Valence* project at http://benfry.com/genomevalence/ is a visual representation for genome searches that deal with large amounts of data. The information is represented as points, arcs and a ribbon of text (of nucleic acid symbols, A, C, G, and T) in space (Figure 1.17). The project evolved from the artist's Masters thesis which focused on visual construction of large amounts of dynamic data using organic representations.

Daniel A. Becker's Barcode Plantage at http://barcode-plantage.com/index.htm is an algorithmic visual representation of barcode information which is rerpresented by a network of lines and curves.

1.2 WHAT, WHY, AND HOW—WHAT IS THE SCIENCE OF DIGITAL ART? WHY MUST WE LEARN IT? HOW?

Your skill level is reflected in the craftsmanship and professionalism of your art. Skills can be acquired by studying artworks, continuous experimentation, and practice on your own.

A computer is both a tool and a medium in digital art. However, using computer technology is not as intuitive as using tools (such as pencils and brushes) in a traditional medium. In addition, mastering traditional methods often requires more systematic instruction and practice. It takes time to get past the learning curve and discover what a software application can do.

The tools for digital art can be commercial software application programs (such as Adobe Photoshop), as well as custom programming. Commercial application programs are the most common choice for nonprogrammers, but they pose the challenge of constant change. The user-interface differs from one program to another, and new versions of the same program offer new features and disguise familiar ones. To learn how to deal with this problem, let's draw experience from how you learn to use tools in traditional media—say, brushes. Each brand of brush has unique characteristics and a certain feel, but you do not learn to paint using only one specific brand of brushes. You generalize brushes by shape and material to associate their qualities with functions and visual effects—that is, the tasks.

Digital art cannot be separated from the fundamental elements and aesthetics of art and design. This textbook approaches the teaching and learning of digital art using both art

and science perspectives. Both are integrated. A good understanding of art principles and skills helps you to make digital art *art*. Understanding the underlying scientific concepts of the digital tools and human perception helps you make educated decisions to create the intended effects—your artistic vision will not be compromised by the tools' default settings or arbitrary choices.

Art Perspective

This book approaches digital media from the fundamentals of art and design that can be applied across different types of media. An overview of the basic art elements and art and design organizational principles will appear in Chapter 2 and will be referred to over and over in chapters on each different medium—image, video, audio, and Web. They serve as the foundation for discussion and extrapolation to digital art.

Science Perspective

In integrating the science component, this book aims to help students (1) acquire skills that are transferable to new situations and (2) adapt to changing software applications. It is not the intention of this book to provide software training. This book is not intended to be a user reference, going over what each menu item does in an application program. Instead, it emphasizes concepts and tasks which can serve as guides to search for procedural information.

Application programs of the same media type have very much the same functionalities. They usually have an online Help index and let you perform keyword searches to navigate their content. Of course, you need a general idea of how an application program works in order for the content of the Help menu to make sense. You have to know the keywords it uses for the functionalities you seek. For each imaging, audio, and video topic, there are two chapters—one on the conceptual level and the other on the practical. The practicum chapters use a task-oriented approach and discuss the general functionalities and common user-interface of application programs for that media.

1.2.1 Common Mistakes in Learning Digital Art

There two common misunderstandings about digital art: one related to the art component and the other to the digital tools. Be conscious of these traps so you do not fall into them when you work on your projects.

1. Ignoring the art component.

Be careful not to get so involved in learning to use the software itself that you lose sight of the intent and direction of your art projects. Without a solid integration of art components, the piece will appear incoherent or empty in emotion and substance.

2. Misconception about digital technology.

The common belief that computers make things easier often leads to a fatal assumption that digital technology makes digital art much easier to produce than traditional art. In fact, digital tools are not as intuitive as traditional tools and often require more systematic instruction in addition to basic computer skills.

1.3 ART AND DESIGN ELEMENTS

Line, **shape**, **value**, **color**, **texture**, and **space** are the basic visual elements for art and design across media. It cannot be emphasized enough that using digital technologies is by no means divorced from traditional aesthetics.

Because visual concepts are so interrelated and their visual results somewhat overlap, trying to break down the subject of composition into individual principles is problematic. Different artists and authors may have slightly different lists and groupings of these principles.

The basic elements often are integrated to create more complex visual statements in art and design according to their fundamental principles. The term ***composition*** is used to describe the structure of a work or arrangement of these elements according to certain organizing principles, which include ***variety and harmony***, ***balance***, ***repetition and rhythm***, ***emphasis and focus***, and ***perspective***. Chapter 2 will present an overview of both basic elements and organizational principles for art and design.

1.4 CRITIQUING DIGITAL ART

Class critique is an important component of studio art courses in which every student should participate. Critique is a sharing and learning experience. If peers do not understand the subject matter or emotion the work intends to communicate, their responses may provide clues to identify the weaknesses and the possible solution.

The way to critique digital art (especially digital images) does not differ very much from the methods used to critique traditional media, because many of the visual, aesthetic, and organizational principles still hold. Time-based media (such as video and animation) and interactive media add extra dimensions that become additional aspects for the critique. For example, images can change with time, and more than one medium (sound and images) can be used to convey the whole experience. In interactive works, the navigation structure introduces a design principle foreign to traditional media.

Here are some general suggestions for stepwise critique in studio art courses. Later chapters on specific media will discuss more specific criteria.

1. Describe what you see and/or hear.

The first step in critique is a straightforward, factual description of the sight and sound. Do not jump to make any interpretation or association yet. Watch for any adjectives in your description of what you see and/or hear.

You may be reluctant to stick with simple factual description (because it seems trivial and silly) when everyone can see the image or hear the sound. But what is obvious to you may not be picked up by others. An image theoretically contains an infinite amount of information—not every bit is the artist's intention, and not every bit makes sense to the viewer. It is not uncommon to identify an unintentional emphasis while the intentional aspects are ignored. Going through this step of describing what you see helps other students to see too.

2. Describe what you see in terms of the art and design elements and principles.

In the next step of critique, refer to the basic elements and art and design principles as a guideline for discussion. As objectively as you can, discuss the visual components in terms of line, shape, value, color, texture, and space. Also, discuss the composition in terms of variety and harmony, balance, repetition and rhythm, emphasis and focus, and perspective.

Referring to the basic elements and principles keeps you conscious of them. Think of it as training. The discussion will not be limited to them, but they will establish a model and starting point from which the discussion can be expanded.

3. Discuss the subject matter.

Based on what you see, what do you think the work is about? What does it mean? What do you think it is trying to communicate? Does everyone agree? Do other students' responses change your initial thoughts about the piece?

Note that the subject matter that is being discussed so far is the viewer's interpretation only. In the studio art class environment, the student artist may keep silent until the critique

of the piece is over. This way, other students will not be influenced by the original intent, and the artist can get more direct and unbiased responses. The work ultimately stands on its own.

4. Discuss the execution of techniques.

How is the piece executed? How skillful is the technical craftsmanship? Craftsmanship includes the care in execution and neatness. Neatness is not a requirement for a good art. However, if it is unintentional, it may divert attention, and the work also may look sloppy, amateurish, and accidental.

5. Student artist responses.

At the end of the critique, student artists can respond to their peers' reactions and talk about the original intent, intended subject matter, and any unsolved problems in the piece. Other students are encouraged to respond, initiating a communal discussion, because the class now has new information about the piece.

1.5 DIGITAL CANVAS

In traditional visual art, the work you are creating is truly WYSIWYG (what you see is what you get) throughout the process. An oil painting, for example, has the same dimension in the exhibition as when it is being developed in your studio. The pigment stays on the canvas. The color may look a little different under different lighting or at different times of day. But you still have a pretty good idea of how the color will look in a show.

On the other hand, digital art is created or prepared on computers. It is probably seen on only one computer display during the creation process, but the finished work will probably be shown on another display system—for example, a projector or a different monitor—or output to another medium—for example, an inkjet print or video. If the finished digital artwork is going to be shown in a controlled environment (such as a gallery) where a specific computer monitor is set up to display your work, you need only to set up that one system to match your vision for your work. If your work is intended for the audience to install and view on their own computers, then you will have little control over how your work is displayed. You will be uncertain whether it will look exactly the way you intended.

When a digital artwork is transferred from your computer to another medium or even another computer display, physical dimension and color may change. These elements are important to the work's essence. To make the exhibiting artwork match what you see on your computer, you have to understand what may cause changes, how you can preserve the color from your computer to another display medium, and how to predict the destined physical dimension of the artwork.

The discussion on color management can be found in Chapter 2.

The skills needed to control and predict these changes require understanding of technical concepts—one of the most important of which is ***resolution***. Resolution has been explained and discussed in the *Digital Media Primer*. Later, in Chapter 2 on digital imaging, we will revisit this topic using pegboards as an analogy to explain resolution from the creative-process point of view—from capturing to displaying on screen to printing—and to clarify ppi and different uses of dpi.

Digital technologies influence the art process from creation to exhibition, and different technologies present different considerations. The types of consideration that influence the ***creation*** process can be divided into two areas: ***delivery*** and ***display***. As with traditional media, you have to determine the delivery and intended display method before you begin creation.

Creation

During the creation process, the computer monitor is your working canvas. However, unlike traditional media, its dimension does not necessarily reflect the displaying dimension and the actual colors of the final product. The monitor display is measured in pixels, while a physical artwork is measured in inches or centimeters. In addition, color may differ slightly from one display medium—computer monitor or print—to another.

Delivery

Delivery in the digital realm refers to how viewers receive the files. Examples of delivery methods include CD-ROM, DVD, print, and the Web. The delivery method influences the file format. While creating digital media, you often work with a file format that is not the same as the final delivery format. For example, you composite and layer images of higher resolution in Photoshop in its native format—the Photoshop file or PSD. To make the image available on a Web page, you would have to resize it and save it as a Web-image format, such as JPEG, GIF, or PNG.

Display

The intended display method is another important factor in the creation process. It influences such file settings as image resolution. Therefore, you should determine the method by which you intend to display your digital artwork before you start creating it. Display methods include print, computer monitor, projector, and television set. The computer-monitor display can be a specific monitor in a controlled situation (like a gallery). It can be on anyone's monitor if the work is going to be accessed on the Web. In the first case, you have a certain control by adjusting display settings like color and resolution before the exhibition. If possible, try to find out the resolution of the exhibiting computer monitor before you finish your project. In the second case, you have no control over the viewer's monitor settings. It may be adjusted too brightly or dimly. It may have a resolution different from the one you intended; your work may be sized too large or too small. When you cannot control the viewer's monitor settings, you should use the most common, current monitor resolution, which at the time of this writing is 1024 × 768 pixels. Many existing laptops and desktops support higher resolution, such as 1280 × 800 pixels.

1.6 MEMORY AND STORAGE

Digital art files often are large. Compared to word-processing tasks, handling these files—image, video, and audio—demands much more memory and processor speed. The files also require more disk space for storage, especially because (like traditional art) their creation commonly involves a long process of experimentation and the evolution of ideas. Computers offer the advantage of keeping an archive of the process. Many different versions of a digital artwork can be produced before reaching the finished work, which will probably be large in itself. You must consider the capacity of different media—whether CDs, DVDs, or online.

The high requirements for both memory and disk space commonly are expressed in megabyte units, although currently, personal computer disk space is in gigabytes, and many servers are installed with gigabytes of memory. Because the units are the same, the terms ***memory*** (RAM) and ***disk space*** often are mixed up. However, they serve different

functions. To be able to assess your equipment needs, you must be able to distinguish these terms and the problems caused when they are insufficient.

1.6.1 Memory

What is RAM, and does increasing RAM always make a computer faster? Before answering these questions, you need to understand what RAM does. A processor consists of a main memory device and a ***central processing unit (CPU)***. ***Random access memory (RAM)*** is one of the most important and best-known forms of main memory. Both data and instructions are stored in a main memory unit. For example, when you open your image file (data) with the image-editing program (instructions), they are stored in the RAM.

You may have been told that insufficient memory causes slow processing of a file, but why? Does adding more RAM *always* boost the speed? Not always. With a very large image file and several different programs running simultaneously, your computer may run out of memory. The operating system then creates extra virtual memory by using its hard disk space to create a ***swap file***—moving the data and instructions back and forth between the RAM and the swap file on the hard disk. Because the hard disk is slower than the RAM, such swapping can cause noticeable delay. In this situation, adding more RAM can boost the speed by eliminating the need for swapping. However, if the slowness is not caused by the swapping, increasing the RAM will not help the computer performance.

The speed of the CPU also determines the performance of a computer. For example, the CPUs in older computers are slower. Increasing the RAM will not make an older and slower computer perform like a newer faster computer.

1.6.2 Storage Media

The most common categories of storage media today are magnetic disks (such as hard disks) and optical disks (such as CDs and DVDs.) Recently, removable hard disks and memory keys have become more popular as portable media for transferring files.

New computers come installed with DVD/CD writers and DVD-authoring software. CD-R (compact disc-recordable) and CD-RW (compact disc-rewritable) devices are very common storage and backup media. The storage capacity ranges from 650 to 700 MB. The disk space of files erased from a rewritable disk can be recovered and rewritten. Depending on the recording option set in the CD-recording software, a CD-R can be recorded multiple times (multi-session). In this case, you still can add files to the CD-R. However, the disk space of previously recorded files on a CD-R cannot be recovered.

DVDs offer higher storage capacity. Currently, there are DVD-R, DVD-RW, DVD+R, DVD+RW discs. Writing to any of them requires the appropriate hardware and software. Check the user guide of your DVD writer to see which types of disc it supports. Many CD-recording software applications also can record files on DVD discs, but producing DVD movies with menu navigation requires DVD-authoring software, such as Adobe EncoreDVD, Apple DVD Studio Pro, Sony DVD Architect, and Ulead DVD Workshop. At the time of this writing, the capacity of most DVD-R, DVD-RW, DVD+R, and DVD+RW discs you see in the store is 4.7 GB—the equivalent of almost seven 700-MB CDs. The single-sided, double-layered, or dual-layered DVD disc available in stores has an 8.5-GB capacity.

If you are distributing your work on CDs or DVDs to a larger audience, CD-ROMs (compact disc-read-only memory) and DVD-ROMs (digital versatile disc-read-only

memory) offer a cheaper solution per disc. However, you must send them to a company that has the equipment for mastering and pressing. While these companies also may offer silk screening and packaging services which give the product a more professional look and feel, disc mastering is costly. Therefore, the CD-ROM or DVD-ROM is an economical choice only if your work is, produced in large quantities. Moreover, since CD-ROM and DVD-ROM storage is permanent (read-only memory), it cannot be updated without replacing the entire disc. If the presentation of your digital artwork relies on specific versions of certain applications on the audience's computers, then you should consider the following options.

- Press a small number of CD-ROMs or DVD-ROMs, just enough for your immediate needs, because the computers of future audiences—say, after a year—no longer may support the required player.
- Include the installer of the specific player on your disc, which usually requires obtaining a license agreement with the company who owns the application.
- Consider other media. For example, websites are very good for showing work that is updated frequently.

Writing data to CD-R, CD-RW, DVD-R, DVD-RW, DVD+R, and DVD+RW requires a continuous flow. The computer system must be fast enough to sustain the continuous data transfer to the CD-R, DVD-R, or DVD+R drive, otherwise errors may occur. The data to be transferred must be on the local hard drive not on a remote network drive. Any network slowdown during the writing will disrupt the continuous flow of data and cause failure, ruining the disc. Before writing, copy all of the data to be transferred to the disc onto the local hard drive. Close all other applications to minimize the possibility of slowing down your computer system during the actual writing.

Choosing storage media

Price and speed are important factors in choosing storage media. Table 1.2 indicates the relative speeds of some different storage media.

TABLE 1.2 Relative Speeds of Different Storage Media

Relative Speed	Media		Capacity
↑	Hard Drive	• Fixed • Removable	• Most common: 100 MB to 500 GB • Also, in Tera bytes (TB), where 1 TB = 1000 GB
	Removable Flash Memory	• Compact Flash • Memory Key	• 16 MB to 64 GB
	Optical Disc	• DVD-R • DVD+R • DVD-RW • DVD+RW	• 4.7 GB • 8.5 GB
		• CD-R • CD-RW	• 650 MB • 700 MB

When distributing your artwork, your media's compatibility with your target audience's computer system is crucial. Most CD-ROM drives can play CD-R discs, but not all can play CD-RWs. Some DVD-ROM drives on computers only can play DVD-R discs, some only DVD+R, and some both. Older generations of set-top DVD players do not support any of these DVD discs. The newer ones can play them, and some can play movies on DVD-R discs but not DVD+R.

1.7 COMPUTER SKILLS FOR WORKING WITH FILES

This section discusses two basic computer skills that commonly are overlooked: (1) **file and folder organization**, and (2) **file opening and importing**. They do not seem to have any direct relation with digital art creation. However, poor file handling can cause many frustrations later on and waste time.

1.7.1 Organizing Files and Folders

Whether you are creating digital art or writing a term paper on a computer, you have to open files. Knowing where you saved them so that you can find and reopen them easily for future editing or backing them up to a CD will spare you a lot of time and frustration.

Files can be organized using folders. Think of your computer hard drive as a filing cabinet. A ***folder***, also called a directory, can contain files and other folders. A path designates the location of each file and folder.

For digital-art projects, you often have to create many files. Organize them logically, and do not save them all in one folder or on your computer desktop. There are many ways to organize your files, depending on the nature of your project and (sometimes) personal preferences.

Saving file on the desktop is often a personal preference. Putting too many files on the desktop will clutter the desktop, making it hard to locate a file or folder. In addition, the desktop is a special folder. The file path is not a simple, obvious path. You need to be able to identify the file path for a Web project.

One way to categorize your digital art project files is by their intended use—for example, raw working files and final products. Let's look at a Web project. You may have images that you edited in Photoshop and saved as Photoshop files. However, when you complete the editing and want to place them on a Web page, you must save them in a Web format, such as a .jpg file. The Photoshop files (which are working files) cannot be used directly on the Web page. The .jpg file (which is not suitable for further editing but is suitable for the Web) is a final product. You only have to upload the files of the final product to the Web site. Thus, separating the raw working files from the final product helps you to easily locate the files that suit your intention—for example, to upload final files or to rework originals.

If your project uses more than one type of media, you can categorize your files further by type—image, audio, video, or text. You can organize by intended use and by media types at the same time.

For Windows systems, the hard drive, by default is assigned a letter C. It is found under My Computer. More drives can be assigned letters higher than C. Say you create a folder called `artproject` directly in the C drive. Then you create another folder called `images` inside this `artproject` folder. When you save a file—say, a .jpg image called `background.jpg`—in this `images` folder, its path is

```
C:\artproject\images\background.jpg
```

For Mac OS X, the hard drive by default is represented by the Macintosh HD icon on the desktop (Figure 1.18).

Figure 1.18 Macintosh HD icon on the desktop

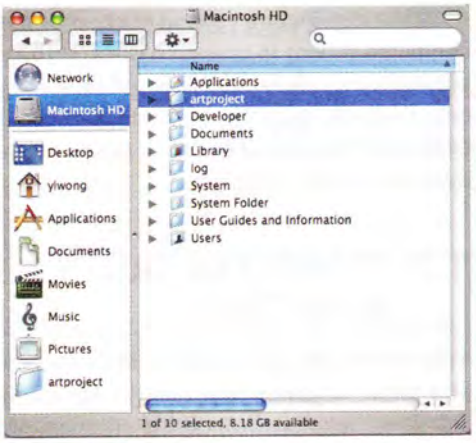


Figure 1.19 The content in Macintosh HD is listed when you open Macintosh HD

Say you create a folder called `artproject` inside Machintosh HD (Figure 1.19). You also create another folder called `images` inside this `artproject` folder. Suppose you have saved a .jpg file called `background.jpg` in this `images` folder. To find this .jpg file later, you will go to Macintosh HD, open the `artproject` folder, and open the `images` folder. Although you may not see the file path by default, the file actually has a file path. When you use the Terminal (in Macintosh HD > Applications > Utilities) to navigate the files and folders on the computer, file paths are used. The file path for this `background.jpg` is

```
/artproject/images/background.jpg
```

Shortcuts and Aliases

Shortcuts in Windows and ***aliases*** on the Macintosh are types of files that behave like pointers to a document, folder, or application program. Double-clicking on a shortcut or alias opens the original application, folder, or document wherever it is located. These shortcuts and aliases provide a convenient way for you to open a document, folder, or application program immediately, without having to navigate to its actual folder location. However, if you do not understand how shortcuts and aliases work, they may cause confusion in some situations. For example, when you open or import files in an application program, you will have to navigate in the open-file window to the folder where the file is located; selecting the shortcut or alias may not work. In addition, deleting a shortcut or alias does *not* delete the file or folder to which it is linked—nor does backing up a shortcut or alias back up the linked file or folder.

No matter the medium—traditional or digital—you have to be familiar with the basic working of your tools to realize the art you envision. The more knowledge you have about them, the less frustration you will experience during the creative process. You must become very familiar with creating, organizing, and navigating the folders and files on your computer as well as develop basic computer skills such copying, deleting, and renaming files and folders. Mastering these very basic computer skills will help you learn to use digital tools to create digital art.

1.7.2 Opening Files versus Importing Files

Some digital media application programs, such as digital video-editing programs and multimedia authoring programs, use a model of a ***project***, which embeds or links to the media files (***imported files***) that are used to create the work. A project is not a folder but a file saved in the application program's native format. When you save your work, you save the *project file*, and the next time you want to continue you have to *open* the *project file*. Some programs, such as Adobe Premiere Pro and Encore DVD, call its file a project file. For example, there are Open Project and New Project commands under the File menu in these programs. Other programs, such as Adobe Flash and Adobe Director, use the project model but do not use the term *project* to describe the file. In working with these files, you import (instead of open) other media files to include them.

If you want to use other media files in your digital work, you often must *import* them first into the *project*. Some application programs let you open non-project files to view the media file in the view-only mode. Some will not let you open non-project files. In either case, if you do not understand the difference between importing and opening files, you will have hard time working on your piece—thinking that the program does not let you open your *project* files or not let you use other media files.

Figures 1.20 through 1.22 use Adobe Premiere Pro as an example application to illustrate the difference between importing a file and opening a *project* file. Figure 1.20 shows the Open Project and Import commands found under the File menu. When the Open Project command is selected, the Open Project window (Figure 1.21a) comes up. As shown in Figure 1.21a, only the Premiere Pro Project file is listed in the window, and there is only one choice in the dropdown list of file type. This means only the Premiere Pro Project file is accepted.

The *project* model often is found in digital video and multimedia authoring programs where many other media files are used to produce the final product. The project model is not common in digital image applications, such as Adobe Photoshop and Illustrator. The file Import command in these programs is not the same as in those applications that use the *project* model.

Video-editing applications are discussed in *Digital Media Primer*, Chapter 7. The purpose of discussing the Adobe Premiere Pro workspace here is to demonstrate the distinction between *importing* a file and *opening* a *project* file.

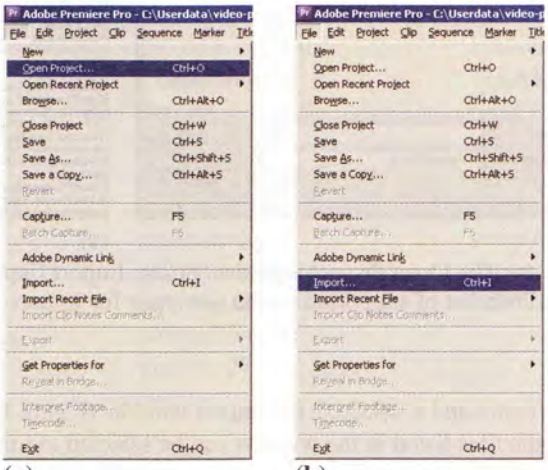
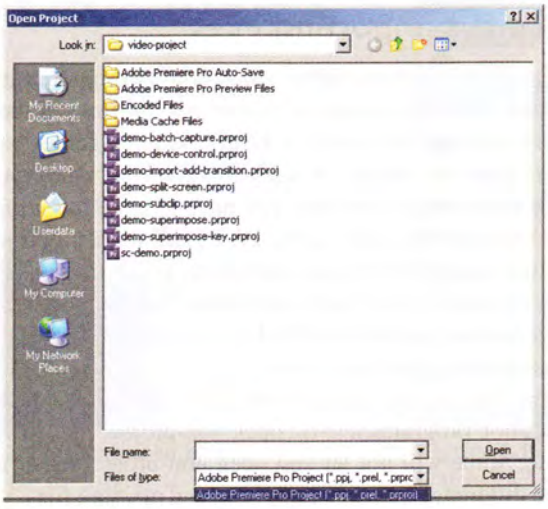
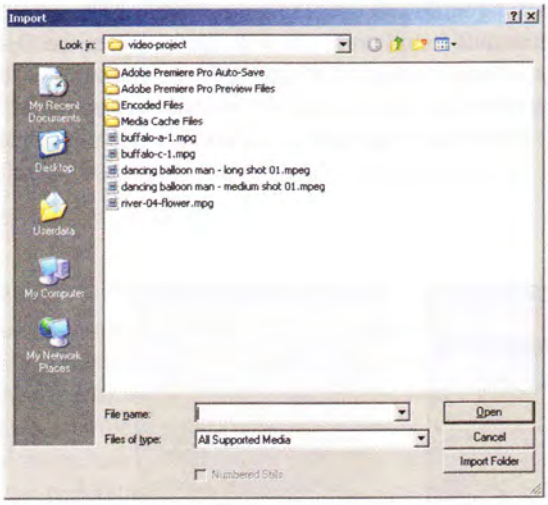


Figure 1.20 Screenshots of the File menu of Adobe Premiere Pro (a) The Open Project command (highlighted) (b) The Import command (highlighted)



(a)



(b)

(c)

Figure 1.21 (a) The Open Project window (b) The Import file window (c) The dropdown list of supported media file types for import

When the Import command is selected, the Import window (Figure 1.21b) comes up. All of the supported media files listed in the window can be selected to import. The dropdown list of file type (Figure 1.21c) has many choices of accepted file type. Figure 1.22 shows the Adobe Premiere Pro workspace, and the red rectangle points out the list of imported media files. The imported files can be placed on the timeline for sequencing. In this example, the project is a single Adobe Premiere Pro file that contains references to the imported media files and video sequences. It also stores information about sequences and media, such as transitions and audio mixing. The list of imported files is only part of the project file.

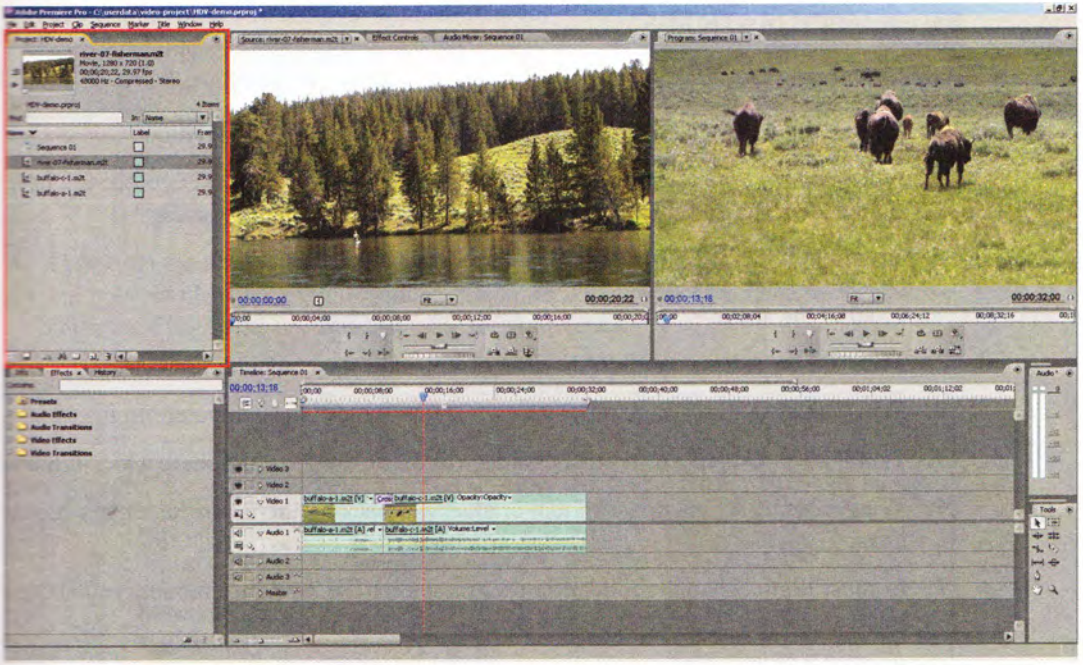


Figure 1.22 A screen capture of Adobe Premiere Pro CS3 workspace; the red rectangle marks the window where lists the imported media assets; these imported media files are ready to place on the timeline for sequencing

TERMS

accessibility, 4
aliases, 26
balance, 20
central processing unit (CPU), 23
composition, 20
creation, 21
delivery and display, 21
disk space, 22
emphasis and focus, 20
file and folder organization, 25
file opening and importing, 25
fine art, 6
folder, 25
graphic design, 6
imported files, 27
interactivity, 4
manipulability, 4
memory, 22
perspective, 20
project, 27
random access memory (RAM), 23
repetition, 20
resolution, 21
rhythm, 20
shortcuts, 26
swap file, 23
variety and harmony, 20
volatility, 4

LEARNING AIDS

The following learning aid can be found at the book's companion Web site.

Selected URLs of Digital Art
A selected list of URLs of digital artworks.