CHAPTER 3

VISUAL PRINCIPLES

OUTLINE

- The Roles of Visuals in Instruction
- Visual Literacy
- Styles of Visual Design
- Processes of Visual Design
- Visual Problem-Solving Tools
- Digital Images
Since the earliest days of schooling, education scholars have lamented teachers' overreliance on words as communication vehicles. Pictures can clarify complex ideas, make them easier to remember, and provoke emotional responses. In many schools, student media portfolios often include such items as illustrated books, videos, or audiovisual presentations.

Students vary in their abilities to interpret visuals and to create their own visual messages; the goal of visual literacy education is to enhance these abilities. You can improve your own ability to create instructionally effective visuals by following some basic visual design principles and processes and applying them to everyday design tasks, such as creating bulletin boards and designing computer screens.
KNOWLEDGE OBJECTIVES

1. Describe the roles that visuals play in instruction.
2. Define visual literacy in your own words.
3. Identify two general strategies that you may use to teach visual literacy.
4. Describe the factors that influence students’ decoding of visuals.
5. Describe the factors that influence students’ encoding of visuals.
6. State in your own words the goals that good visual design aims to achieve.
7. Regarding the visual design process, characterize the qualities that a designer would look for in the individual visual and verbal elements of the design, including elements that add appeal.
8. Describe the factors that a designer would manipulate in establishing an underlying pattern to the design.
9. Describe the factors that a designer would manipulate in arranging the visual and verbal elements to achieve clear communication, reduce effort in interpreting, increase active engagement, and focus viewer attention.
10. List various roles that color can play in enhancing the impact of visual displays.

LEXICON

referent
iconic
visual literacy
sans serif
optical spacing
alignment
rule of thirds
complementary colors
analogous colors
proximity
directional
figure-ground contrast
storyboarding
digital camera
scanner
charge-coupled device (CCD)
photo CD

Because so much learning involves visual imagery, the design and use of visuals in instruction is worthy of separate consideration. Most of the media discussed in this text—transparencies, slides, video programs, computer courseware, multimedia—have a visual component. The rapidly increasing visual capabilities of computers and digital telecommunications can only heighten the importance of visuals in education. Unfortunately, in the past teachers and materials designers have too often used this valuable visual capability primarily to show pictures of... WORDS! (See Figure 3.1.) The overemphasis on words has contributed to the failure of formal education to reach its ideal of universal success. We know that some students learn more readily through visual imagery, and even those who are verbal learners need visual supports to grasp certain types of concepts.

This chapter examines the functions and characteristics of visuals and visual literacy; it presents guidelines for designing and using visuals effectively. We suggest specific applications for teacher-made materials such as bulletin board displays and computer screens.

FIGURE 3.1
Too often, visual media are used to show only verbal messages.

Parts of a Letter
- Return Address
- Inside Address
- Salutation
- Body
- Closing
- Signature

Significant contributions to this chapter were made by Elizabeth Boling, MFA, and Dennis Pett, EdD, both of Indiana University.
THE ROLES OF VISUALS IN INSTRUCTION

Attempts to make broad generalizations about the role of visuals in learning invariably fail to yield simple answers. For example, a major synthesis of research studies comparing visual-based lessons (those using photographs, overhead transparencies, video, and the like) with conventional instruction indicated a small overall superiority in achievement for students who experienced the visual treatment (Cohen, Ebeling, & Kulik, 1981). However, on closer examination it was found that the degree of superiority depended on many factors, including the subject matter and the utilization practices of the teacher. As discussed in Chapter 2, individual students vary in terms of their visual “intelligence” and in the way they process and use visual information.

One role that visuals definitely play is to provide a concrete referent for ideas. Words don’t look or sound (usually) like the thing they stand for, but visuals are iconic—that is, they have some resemblance to the thing they represent (see Dale’s Cone of Experience in Chapter 1). As such, they serve as a more easily remembered link to the original idea (Figure 3.2).

FIGURE 3.2
A color photograph can be a highly iconic visual, capturing much of the reality of the original referent.

Visuals can also motivate learners by attracting their attention, holding their attention, and generating emotional responses.

Visuals can simplify information that is difficult to understand (Figure 3.3). Diagrams can make it easy to store and retrieve such information. They can also serve as an organizing function by illustrating the relationships among elements, as in a flow chart or timeline.

Finally, visuals provide a redundant channel; that is, when accompanying spoken or written verbal information they present that information in a different modality, giving some learners a chance to comprehend visually what they might miss verbally.

VISUAL LITERACY

Consider the sorts of visuals that are used every day for important communication purposes, such as the emergency information cards in airplanes (see Figure 3.8) or highway signs that warn of dangerous curves or obstructions. They work only to the extent that you are “literate” in the conventions of that medium. Whereas the term literacy once was used only to refer to reading and writing of verbal information, today we use the term visual literacy to refer to the learned ability to interpret visual messages accurately and to create such messages. Research on visual literacy examines the influence of the visual processing system on the acquisition of knowledge, skills, and attitudes. Interest in visual literacy has grown to the point that it has become a professional interest area. The International Visual Literacy Association, Inc. (IVLA), which conducts formal meetings and publishes its own periodical, is an organization established for professionals involved in visual literacy.

The critical role of visuals in education was recognized forcefully a century ago by John Dewey (1897),
probably the most influential American philosopher of education:

I believe much of the time and attention now given to the preparation and presentation of lessons might be more wisely and profitably expended in training the student's power of imagery and in seeing to it that he is continually forming definite, vivid, and growing images of the various subjects with which he comes in contact in his experience. (p. 80)

Visual literacy can be developed through two major approaches:

- **Input strategies.** Helping learners to *decode*, or "read," visuals proficiently by practicing visual analysis skills (e.g., through picture analysis and discussion of films and video programs).
- **Output strategies.** Helping learners to *encode*, or "write," visuals—to express themselves and communicate with others (e.g., through planning and producing photo and video presentations). These input and output strategies are shown in Figures 3.4 through 3.7.

### Decoding: Interpreting Visuals

Seeing a visual does not automatically ensure that one will learn from it. Learners must be guided toward correct decoding of visuals (Figure 3.8). One aspect of visual literacy, then, is the skill of interpreting and creating meaning from surrounding stimuli.

**Developmental Effects.** Many variables affect how a learner decodes a visual. Prior to the age of 12, children tend to interpret visuals section by section rather than as a whole. In reporting what they
FIGURE 3.8
Well-designed visuals communicate clearly across boundaries of language and culture.

Source: Copyright SafeAir. Reproduced by permission.

see in a picture, they are likely to single out specific elements within the scene. Students who are older, however, tend to summarize the whole scene and report a conclusion about the meaning of the picture (Figure 3.9).

Hence, abstract symbols or a series of still pictures whose relationship is not clearly spelled out may fail to communicate as intended with younger viewers (Figure 3.10). On the other hand, highly realistic visuals may distract younger children. However, as Dwyer (1978, p. 33) notes, "As a child gets older, he becomes more capable of attending selectively to those features of an instructional presentation that have the greatest potential for enhancing his learning of desired information."

Cultural Effects. In teaching, we must keep in mind that the act of decoding visuals may be affected by the viewer's cultural background. Different cultural groups may perceive visual materials in different ways. For example, let's say your instruction includes visuals depicting scenes typical of the home life and street life of inner-city children. It is almost certain that students who live in such an area will decode these visuals differently than will students whose cultural (and socioeconomic) backgrounds do not include firsthand knowledge of inner-city living. Similarly, scenes depicting life in the Old West might be interpreted quite differently by a Native American child than they would be by an African American, Caucasian, or Mexican American child (Figure 3.11).

Visual Preferences. In selecting visuals, teachers have to make appropriate choices between the sorts of visuals that are preferred and those that are most effective. People do not necessarily learn best from the kinds of pictures they prefer to look at. For instance, research on picture preferences indicates that children in upper elementary grades tend to prefer color to black and white and to choose photographs over drawings; younger children tend to prefer simple illustrations, whereas older children tend to prefer moderately complex illustrations (Myatt & Carter, 1979).

Most learners prefer colored visuals over black-and-white visuals. However, there is no significant difference in the amount of learning except when color is related to the content to be learned (e.g., when workers

FIGURE 3.9
What story do you think this picture is telling? Do you think a 5-year-old would see the same story?

FIGURE 3.10
An active posture, as in the drawing on the left, communicates movement more reliably than arbitrary graphic conventions such as speed lines, as in the drawing on the right.
must learn to assemble electrical components with different-colored wires, the presence of color is essential. Most learners also prefer photographs over line drawings, even though in many situations line drawings may communicate better (e.g., drawings can eliminate distracting pictorial elements and highlight the important details). Even though many learners prefer very realistic visuals over abstract representations, teachers must strike a balance between the two to achieve their instructional purposes. Even though young learners prefer simple visuals and older students prefer more complex visuals, simpler visuals are usually more effective, whatever the age group.

Regardless of their different starting points and differences in bias, students develop their visual abilities by using them. They can practice by viewing and critiquing visual displays, such as magazine ads, and by thinking critically about and discussing television programs. This chapter begins to explore some of these possibilities.

**Encoding: Creating Visuals**

Another route to visual literacy is through student creation of visual presentations. Just as writing can spur reading, producing media can be a highly effective way of understanding media.

Most older students have access to a camera. For example, you could encourage students to present reports to the class by carefully selecting sets of 35mm slides, which can help them to develop their aesthetic talents. The video camcorder is another convenient tool for students to practice creating and presenting ideas and events pictorially (Figure 3.12). Or, students can scan photos or drawings into a computer-generated presentation using software such as PowerPoint.

One skill nearly always included in visual education curricula is that of sequencing. Reading specialists have long known that the ability to sequence—that is, to arrange ideas in logical order—is an extremely important factor in verbal literacy, especially in the ability to communicate in writing (see the following "Media File").

Children who have grown up constantly exposed to movies and television may expect the visuals they encounter in school to be similarly packaged and sequenced. They may need practice in arranging visuals into logical sequence, which is a learned skill, like the verbal sequencing in reading and writing. For this reason, many visual education programs, especially for primary school children, emphasize creative activities that call for arranging and making visuals.
That Incomparable Moravian

One day in the late 1640s in Massachusetts, Cotton Mather, ever zealous to make Puritan New England the cultural center of the New World, noted in his journal his disappointment that a certain "incomparable Moravian" was not, after all, to become an American by accepting the presidency of Harvard College.

That brave old man, Johannes Amos Comenius, the fame of whose worth has been trumpeted as far as more than three languages could carry it, was indeed agreed to come over to New England, and illuminate their College and Country, in the quality of a President, which was now become vacant. But the solicitation of the Swedish Ambassador diverting him another way, that incomparable Moravian became not an American.⁹

Who was this Johannes Amos Comenius? Why had his fame as an educator spread all the way from Europe to Mother's Massachusetts Bay Colony?

Comenius was an educational reformer born in 1592 in Moravia (now part of the Czech Republic). He became a clergyman of the United Brethren, an evangelical Protestant reform sect known popularly today as the Moravian church. At the time of his consideration for the presidency of Harvard, he was living in exile in Sweden. Indeed, the religious persecutions of the Thirty Years' War and its aftermath had forced Comenius to live most of his life away from his native Moravia.

Despite this and the deprivations of war, Comenius achieved fame throughout Europe as a reformer and writer of innovative textbooks and other educational works. His Janua Linguarum Reserata ("The Gate of Language Unlocked") was a Latin language textbook that taught a basic vocabulary of eight thousand carefully selected words and the principles of Latin grammar. The instructional strategy of the Janua consisted of Latin sentences about a variety of topics, forming a kind of encyclopedia of basic human knowledge of that time. Comenius also argued that the teaching of languages should be divided into stages parallel to four human developmental stages. For this insight Piaget acknowledged Comenius as a forerunner of genetic psychology.⁷ The Janua became one of the

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great pedagogical best-sellers of all time, and it influenced, wittingly or unwittingly, virtually all later scholars of language instruction.

Comenius was also one of the earliest [and certainly the most renowned] champions of what we call visual literacy and visual education. The last fourteen years of his life were spent in Amsterdam, from where he oversaw the publication in 1657 of the work for which he is today best known and on which he had been working for years: Orbis Sensualium Pictus ("The Visible World Pictured").

Orbis Sensualium Pictus was the first illustrated textbook specifically designed for use by children in an instructional setting. (It was not the first children's picture book. The English printer Caxton, for example, had produced an illustrated edition of Aesop's Fables as early as 1484.) The design and illustrations of Comenius's text were expressly intended to enhance learning. The 150 woodcut drawings were learning and teaching devices, not mere decorations. The text embodied the application of educational theories espoused by the author over a period of forty years. It is interesting to note, for example, that Comenius chose Aristotle's observation "Nihil est in intellectu, quod non prius fuit in sensu" ("There is nothing in the mind which was not first in the senses") to adorn his title page. The primacy of this principle has been supported increasingly by modern psychological research.

Orbis Sensualium Pictus is truly remarkable for having incorporated, more than three hundred years ago, so many educational concepts that seem thoroughly modern. Underlying Comenius's use of visuals was a theory of perception based on the idea that we learn through our senses and that this learning imprints a mental image that leads to understanding. A real object is preferable for this process, but visuals may be used in the learning environment as substitutes for the real thing.

The design and illustrations of Orbis Sensualium Pictus, the author tells us in his preface, were intended "to entice witty children to it, that they may not conceal a torment to be in the school, but daintily fare. For it is apparent, that children [even from their infancy almost] are delighted with pictures, and willingly please their eyes with these sights." His pedagogical aim was that children "may be furnished with the knowledge of the prime things that are in the world, by sport and merry pastime."

The idea that learning should be a "merry pastime" rather than a burdensome chore is startlingly modern. Indeed, centuries were to pass before this basic educational philosophy became what it is today—the common wisdom. Apoll called "that incomparable Moravian" in his own time, Johannes Amos Comenius may still be called so in ours.

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\[ 
\begin{array}{ll}
\text{The Fisherman 1.} & \text{Piscator 1.} \\
\text{catcheth fish,} & \text{captat pisces,} \\
\text{with an Hoop, 2.} & \text{with an Hoop,} \\
\text{which hanged by a line} & \text{which hanged} \\
\text{on the angling rod,} & \text{on the angling rod,} \\
\text{and on which} & \text{and on which} \\
\text{the bait is hanged;} & \text{the bait is hanged;} \\
\text{3. with a} & \text{3. with a} \\
\text{Cleck-Net,} & \text{Cleck-Net,} \\
\text{which hanging} & \text{which hanging} \\
\text{on a Pole, 4.} & \text{on a Pole,} \\
\text{is put into the water;} & \text{is put into the water;} \\
\text{5. in a Boat,} & \text{5. in a Boat,} \\
\text{with a Trammel-Net} & \text{with a Trammel-Net} \\
\text{6. with a Weel,} & \text{6. with a Weel,} \\
\text{which is laid in} & \text{which is laid in} \\
\text{the water by Night.} & \text{the water by Night.}
\end{array} 
\]
Elements

Designing a visual display begins by gathering or producing the individual pictorial and text elements that you expect to use in the display. This assumes, of course, that you have already determined students’ needs and interests regarding the topic and decided what objective you might achieve through the visual you are planning—be it a bulletin board, an overhead transparency, printed handouts, or computer screen display.

In selecting or producing the pictorial and text elements, you will want to make your choices based on achieving the visual design goals—ensuring legibility, helping the viewer to quickly see your message, getting the viewer actively engaged with your message, and focusing attention on key points. We have grouped the following design suggestions according to the various elements or components of the display: the visual elements (choosing the type of visual), the verbal elements (lettering style and location), and the elements that add appeal (surprise, texture, interaction).

Visual Elements. The type of visual selected for a particular situation depends on the learning task. Visual symbols, one classification of learning resources in Dale’s Cone of Experience (discussed in “Flashback” on p. 14), can be subdivided into three categories: realistic, analogic, and organizational (Houghton & Willows, 1987).

Realistic visuals show the actual object under study. For example, the color photograph of a covered wagon in Figure 3.13 is a realistic visual. Using realistic colors can heighten the degree of realism; this is one of the major instructional purposes that color serves. No representation, of course, is totally realistic. The real object or event will always have aspects that cannot be captured pictorially, even in a three-dimensional color motion picture. The various visual forms themselves range in representation from highly realistic to highly abstract.

One might be inclined to conclude that effective communication is always best served by the most realistic visual available. After all, the more realistic a visual is, the closer it is to the original. This, however, is not necessarily so. There is ample research to show that under certain circumstances, realism can actually interfere with communication and learning. For example, the ability to sort out the relevant from the irrelevant in a pictorial representation grows with age and experience. So, for younger children and for older learners who are encountering an idea for the first time, the wealth of detail found in a realistic visual may increase the likelihood that the learner will be distracted by irrelevant elements of the visual.

As Dwyer (1978, p. 33) notes in his review of visual research, “The arbitrary addition of stimuli in visuals makes it difficult for learners to identify the essential learning cues from among the more realistic background stimuli.” Dwyer concludes that rather than being a simple yes-or-no issue, the amount of realism desired has a curvilinear relationship to learning. That is, either too much or too little realism may affect achievement adversely (Figure 3.14).

Analogic visuals convey a concept or topic by showing something else and implying a similarity. Teaching about electricity flow by showing water flowing in series and parallel pipes is an example of
FIGURE 3.14
Visually tend to become less useful in instruction as they approach the extremes of very abstract or very realistic.

FIGURE 3.15
The solar system is often used as a visual analogy to explain the composition of an atom.

FIGURE 3.16
An organizational chart, such as this one representing a section of this chapter, can help show relationships among concepts.

Using analogic visuals. An analogy for white blood cells fighting off infection might be an army attacking a stronghold. Later in this chapter, we use the color wheel as an analogy to help visualize the relationships among the colors of the visible spectrum. Such visuals help learners interpret new information in light of prior knowledge and thereby facilitate learning (Figure 3.15).

Organizational visuals include flowcharts, graphs, maps, schematics, and classification charts. (See Chapter 4 for details on types of charts and graphs.) These graphic organizers can show relationships among the main points or concepts in textual material. This type of visual (such as the one in Figure 3.16) helps communicate the organization of the content.

Verbal Elements. Most displays incorporate some type of verbal information in addition to visuals. In evaluating a display for its instructional potential or in preparing your own display, you need to consider the lettering as carefully as you consider the pictorial elements, for it can communicate powerfully, too. At a minimum, you have to be sure that the lettering is legible in terms of size and spacing and of a style that is consistent with your intended message.

Letter Style. The style of the lettering should be consistent and should harmonize with the other elements of the visual. For straightforward informational or instructional purposes, a plain (i.e., not decorative) lettering style is recommended. You may
together, they will tend to blur at a distance; if they are too far apart, they will seem disjointed (i.e., not part of the same unit). For a happy medium, the vertical space between the lines should be slightly less than the average height of the lowercase letters. To achieve this, use a ruler to draw lines lightly on your blank layout. Separate baselines by about one and a half times the height of the lowercase letters. Lettering on these lines will then result in text with the correct spacing (Figure 3.20).

**Elements That Add Appeal.** Your visual has no chance of having an effect unless it captures and holds the viewer’s attention. Let’s look at three devices for making displays more appealing: surprise, texture, and interaction.

**Surprise.** What grabs attention? The unexpected, primarily. Think of an unusual metaphor, an incongruous combination of word and picture, an abrupt infusion of color, a dramatic change of size. People pay attention as long as they are getting novel stimuli or new information. They tune out when the message becomes monotonous.

**Texture.** Most visuals are two dimensional. However, you can add a third dimension by using texture or actual materials. Texture is a characteristic of three-dimensional objects and materials. It can convey a clearer idea of the subject to the viewer by involving the sense of touch—for example, touching samples of different cereal grains. Or texture can simply invite involvement—for example, using cotton balls to represent clouds or showing book jackets to entice students to read a new book. Company products can be incorporated into a display. Components of equipment can be shown with drawings and captions.

**Interaction.** The R of the ASSURE model applies to all forms of media. Viewers can be asked to respond to visual displays by manipulating materials on the display, perhaps to answer questions raised in the display. Students can move answer cards to math facts into the correct position. Answers to geography questions can be hidden under movable flaps. The teacher or learners can move dials on a weather display to indicate the forecast for the day or the actual weather outside the classroom. One example of an interactive format is shown in Figure 3.21.

**Pattern**

Having made tentative decisions about what elements to include in your visual display, you are ready to consider its overall “look.” The idea is to establish an underlying pattern—to decide how the viewer’s eye will flow across your display. The major factors that affect the overall look are alignment of elements, shape, balance, style, color scheme, and color appeal.

**Alignment.** When you position the primary elements within a display so that they have a clear visual relationship to each other, viewers expend little effort making sense out of what they are seeing and are free to concentrate on understanding the message being conveyed. The most effective way to establish such visual relationships is to use alignment. Viewers will

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**FIGURE 3.19**

Optical spacing means estimating approximately equal amounts of white space between letters.

```
GOOD
MINE
LABWORK
*Optical spacing*
```

**FIGURE 3.20**

Lines of text should not be too cramped or too widely separated.

<table>
<thead>
<tr>
<th>Text is difficult to read when lines are too close together.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Text seems disconnected when lines are too separated.</td>
</tr>
<tr>
<td>Text is most legible when separation is 1½ times average letter height.</td>
</tr>
</tbody>
</table>
perceive elements to be aligned when the edges of those elements are aligned on the same imaginary horizontal or vertical line, as shown in Figure 3.22. These imaginary lines should be parallel to the edges of the display. For an irregularly shaped element, surround it mentally with a rectangle and align that rectangle, as shown in Figure 3.23.

**Shape.** Another way to arrange the visual and verbal elements is to put them into a shape that is already familiar to the viewer. Your aim should be to use a pattern that attracts and focuses attention as effortlessly as possible. A simple geometric figure, such as a circle, triangle, or rectangle, provides a convenient framework because its shape is predictable to most viewers (Figure 3.24). Shapes that approximate certain letters of the alphabet have the same virtue. The letters Z, L, T, and U are frequently used as underlying patterns in display layouts (Figure 3.25). Of course, the words used in the layout, as well as the pictures, form part of the shape.
Another principle that can guide the placement of visual elements is the rule of thirds. That is, elements arranged along any of the one-third dividing lines take on importance and liveliness. The most dominant and dynamic position is at any of the intersections of the horizontal and vertical one-third dividing lines, especially the upper left intersection (Figure 3.26). The most stable and least interesting point on the grid is dead center. Items placed in the corners or at the edges tend to be ignored or to make the arrangement unbalanced.

**Balance.** A psychological sense of equilibrium, or balance, is achieved when the "weight" of the elements in a display is equally distributed on each side of an
axis, either horizontally or vertically or both. When the design is repeated on both sides, the balance is symmetrical, or formal.

In most cases, though, for visuals that will catch the eye and serve an informational purpose you should aim to achieve an asymmetrical, or informal, balance. With asymmetrical balance there is rough equivalence of weight, but with different elements on each side (e.g., one large open square on one side, three small dark circles on the other). Informal balance is preferred because it is more dynamic and more interesting than formal balance (Figure 3.27). In general, try to avoid
**FIGURE 3.27**
The analogy of a balance scale, shown in the bottom row, represents the three different types of balance.

<table>
<thead>
<tr>
<th>formal balance</th>
<th>informal balance</th>
<th>imbalance</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Balance Scale" /></td>
<td><img src="image2" alt="Balance Scale" /></td>
<td><img src="image3" alt="Balance Scale" /></td>
</tr>
</tbody>
</table>

*imbalance*—using a distinctly disproportionate weight distribution—because it tends to be jarring.

**Style.** Different audiences and different settings call for different design styles. Think about the simple, uncluttered, primary-color “look” of the *Barney and Friends* television show compared with the complex imagery, busy scenes, and realistic color of an adult action drama. Likewise, you would not use the same stylistic treatment for a first-grade bulletin board (see, for example, Figure 3.21) as you would for a slide set made to show at a teachers’ professional development conference (Figure 3.28). Your choice of lettering and type of pictures should be consistent with each other and with the preferences of the audience.

**Color Scheme.** When choosing a color scheme for a display, consider the harmoniousness of the colors. Viewers are more likely to linger over and to remember a display having pleasant color harmony than they would a display done with clashing colors. The color wheel is a visual analogy to help us understand the relationships among the colors of the visible spectrum (Figure 3.29).

- Any two colors that lie directly opposite each other on the color wheel are called *complementary colors*—for example, red and green or yellow and violet. (The latter combination is one of the most popular ones for colored overhead transparencies—yellow-orange lettering on a blue-violet background.) Complementary colors often harmonize well in terms of an overall color scheme (Figure 3.30). However, try not to directly juxtapose two complementary colors (e.g., placing green letters on a red background). There are two reasons for this. First, if the colors are of equal value, or darkness, the letters will not have good figure–ground contrast.

Second, when saturated (intense) complementary colors are placed directly next to each other the eye cannot focus on both at the same time, so you get an unpleasant vibrating effect.

- Colors that lie next to each other on the color wheel are called *analogous colors*—for example, blue-green, blue, and blue-violet. Analogous colors may also form pleasing combinations when used together in a display.

When thinking about a color scheme for a display or a computer screen, it may be helpful to think in terms of a background color, a color for the images or text...
FIGURE 3.29
The traditional color wheel helps one visualize complementary colors.

FIGURE 3.30
Complementary colors, such as violet and yellow, can make pleasing combinations.

appearing against that background, and a color for highlights. Colors that work well together are shown in Table 3.1.

Please view these suggestions about color schemes as general guidelines, not as absolute rules, because in any situation there are many factors that will have an impact on whether particular colors will work well together. Keep in mind that these generalizations also assume normal color vision on the part of viewers. We know that 8 percent of all men and less than 1 percent of all women are color blind. Most color-blind people confuse reds with greens and see mainly in shades of blue and yellow. That is, for color-blind viewers, red lettering on a green background might be difficult to distinguish. You can alleviate this problem by making sure that the colors vary in darkness, for example, by using dark red letters on a light green background.

Color Appeal. Artists have long appreciated that blue, green, and violet are considered “cool” colors, whereas red and orange are considered “warm” colors. Research has shown that this is a learned
TABLE 3.1
Effective combinations of colors for background and images for displays and computer screens

<table>
<thead>
<tr>
<th>BACKGROUND</th>
<th>FOREGROUND IMAGES AND TEXT</th>
<th>HIGHLIGHTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>white</td>
<td>dark blue</td>
<td>red, orange</td>
</tr>
<tr>
<td>light gray</td>
<td>blue, green, black</td>
<td>red</td>
</tr>
<tr>
<td>blue</td>
<td>light yellow, white</td>
<td>yellow, red</td>
</tr>
<tr>
<td>light blue</td>
<td>dark blue, dark green</td>
<td>red-orange</td>
</tr>
<tr>
<td>light yellow</td>
<td>violet, brown</td>
<td>red</td>
</tr>
</tbody>
</table>


FIGURE 3.31
In this bulletin board display, warm colors fit with the friendly motif.

phenomenon. When choosing colors for instructional materials, consider the emotional response you are seeking—an active, dynamic, warm feeling or a more contemplative, thoughtful, cool feeling. Also, saturated reds and orange appear to approach the viewer, whereas cool colors tend to recede. Take advantage of this effect by highlighting important cues in red or orange, helping them leap out at the viewer the way a red STOP sign stands out even in a cluttered urban landscape. By the same reasoning, use cool colors for backgrounds (Figures 3.31 and 3.32).

Response to warm and cool colors seems to be related to age. In general, children seem to prefer warm colors (particularly red, pink, yellow, and orange). Children also prefer brighter colors and combinations of intense colors more than do adults. With maturity tends to come a changing preference toward cooler colors and subtler combinations.

There is also a cultural basis to color response. These responses are often deep seated and unconscious. For example, in North America certain colors are associated with certain holidays: red for Christmas and Valentine’s Day, green for St. Patrick’s Day, yellow and purple for Easter, orange and black for Halloween. Such symbolism can vary dramatically across cultures. For example, in Western countries black is the color of mourning, whereas in China and Japan white is the color of mourning.

Arrangement

Proximity. Once you have established the overall shape of your display, you will want to arrange the items within that pattern. Viewers assume that elements close to each other are related and those that are far apart are unrelated. You can use this principle of proximity by putting related elements close together and moving unrelated elements apart. Figure 3.33 shows how confusing it can be when this rule is broken. If a display includes verbal labels for the picture elements, connect the related words and pictures clearly (Figure 3.34).
**Directionals.** Viewers scan a display, with their attention moving from one part to another. The underlying pattern of the elements of the display will be the main determinant of the eye movement pattern. But if you want viewers to “read” the display in a particular sequence or focus on some particular element, you can use various other devices—directionals—to direct attention. An arrow (as in Figure 3.32) is an obvious device for directing the viewer’s attention. For verbal material, you may emphasize key words by bold type, and use “bullets” to indicate items in a list (as shown in Figure 3.1).

Colored elements—whether words or images—in a monochrome display will also draw the eye. Notice how the “hot” arrows in Figure 3.32 stand out from the cool background. Throughout this book we use colored text on “monochrome” pages as a way to call attention to topical headings and special features. Further, a color
repeated in different parts of a display tends to show a relationship between those parts. For example, if only two symbols in a display are shown in cherry red, they will appear to be related to each other, and the viewer’s gaze will go back and forth between them. The more extreme the color is (e.g., red or blue, at the opposite ends of the color spectrum), the more likely it will attract attention.

**Figure-Ground Contrast.** Important elements, especially wording, should stand out in good contrast to the background. The simple rule of **figure-ground contrast** is that dark figures show up best on light grounds and light figures show up best on dark grounds (Figure 3.35).

Different color combinations provide different figure-ground contrasts. When lettering or graphic symbols
are the “figures,” they will show up more clearly on certain backgrounds. As indicated in Figure 3.36, black on yellow is the most legible combination (Birren, 1963). It’s not accidental that this combination has long been used to communicate important road information to drivers. Obviously, a combination of dark figures on a dark background will be even less legible than the combinations shown.

**Consistency.** If you are planning a series of displays, such as a set of overhead transparencies, a multipage handout, or a series of computer screens, you should be consistent in your arrangement of the elements. As viewers go through the series of images they begin unconsciously to form a set of rules about where information will appear in your display. The more often the arrangement conforms to these rules (or exhibits *consistency*) the more viewers trust the rules. Every time the arrangement breaks the rules, viewers have to expend mental energy deciding whether this is a deliberate exception or whether they need to revise the rules. You enhance consistency when you place similar elements in similar locations, use the same text treatment for headlines, and use the same color scheme throughout the series of displays (Figure 3.37).

**VISUAL PLANNING TOOLS**

This chapter emphasizes the design decisions that you must make, not the technical steps involved in the production processes. For those encountering the visual design process for the first time, don’t expect the process to be quick or easy; especially at the beginning. These skills grow with practice, and with practice you will find yourself thinking visually more often as you grapple with instructional problems.
**Storyboard**

If you are designing a series of visuals—such as for several related overhead transparencies, a slide set, a video sequence, or a series of computer screens—**storyboarding** is a handy method of planning. This technique, borrowed from film and video production, allows you to creatively arrange and rearrange a whole sequence of thumbnail sketches. In storyboard, you place on a card or piece of paper a sketch or some other simple representation of the visual you plan to use along with the narration and production notes that link the visuals to the narration. After developing a series of such cards, place them in rough sequence on a flat surface or on a storyboard holder.

Index cards are commonly used for storyboarding because they are durable, inexpensive, and available in a variety of colors and sizes. You also may use small pieces of paper. Self-sticking removable notes (such as Post-It™ notes) have become popular because they will stick to almost anything—cardboard, desks, walls, chalkboards, bulletin boards, and so on.

Divide the individual storyboard cards into areas to accommodate the visual, the narration, and the production notes (Figure 3.38). The exact format of the storyboard card should fit your needs and purposes. Design a card that facilitates your work if the existing or recommended format is not suitable. You can make a simple sketch or write a short description of the desired visual on the card, or use Polaroid pictures or visuals cut from magazines.

You may streamline your storyboarding process by using computer software designed for this purpose, such as **Storyboard Artist**. Such software allows you to draw pictures with the mouse, import graphics from files, and manipulate images (enlarging, reducing, and so on). You may couple these images with text and store them as cards, arranging them in different sequences on the computer screen according to your needs. (The storyboarding process is discussed at greater length in Appendix A.)

**Types of Letters**

A wide variety of lettering techniques for visuals exists. The simplest is freehand lettering with markers and felt-tip pens, which come in an array of colors and sizes.

You also may cut letters from construction paper or other materials. Precut letters are available in stationery and office supply stores. The letters are easy to use because most come with an adhesive backing; however, they are rather expensive.

Some media centers and graphic production units in business and industry use mechanical lettering devices such as the Kroy 88 (however, desktop publishing is rapidly taking their place). With such devices, the style and size of the letters are determined by interchangeable large plastic wheels. The letters are “printed” on strips of clear plastic or colored film. Once the backing has been removed, the letters will adhere to most surfaces.
Assemble the Elements

- Consider the relatively low resolution of computer screens (compared to print) and keep individual elements clean and simple.
- Remember to include features that allow learners control over the pace of the programs.
- Rewrite text to fit the smaller space available on screen; avoid breaking sentences across screens.

Profiles in Freedom

Harriet Tubman

Title is 22 point Helvetica bold in white on black for strong contrast.

Navigation buttons use standard symbols and text labels for clarity.

Images are scanned using a consistent palette and sized or cropped to similar dimensions.

Text fields use serif typeface in a minimum size of 12 points for legibility; line length is 2/3 screen or less with wide margins for readability.

Click Main Menu for more profiles.

On-screen instructions are written in active voice and avoid "cute" or overly familiar tone.

Choose Background and Underlying Pattern

- Use subdued color for large areas to avoid distraction.
- Establish areas of the screen where types of information appear consistently throughout the program.

Arrange the Elements

- Place navigation elements so learners don't have to cross content areas too often in order to control the program.
- Remember to align elements and consider their proximity to related elements.

Check and Revise

- Make a technical review once the elements are assembled, since their interrelationships are an important part of your design.
- Observe viewers of program to assess the effectiveness of your design.

Title area is at top of screen where viewer begins to scan the display.

Graphics area is equivalent in size to the text area since the illustrations play an important role in appealing to the viewers.

Text field and illustration are aligned along the bottom edge.

Graphical rule added to separate navigation buttons from content areas more clearly.

On-screen instruction is grouped with navigation.

Navigation buttons are aligned with each other and the edge of the graphic.

Text and illustration are enclosed in light brown tone to enhance grouping.

Illustration was aligned with navigation buttons; alignment with the text links it to the text more clearly.

Illustration caption is moved out of the text field into closer proximity with the image it describes.
also may use an available desktop publishing system to prepare lettering in various styles and sizes. The lettering ranges from a fraction of an inch in height for overhead transparencies to over a foot high for banners.

**Drawing, Sketching, and Cartooning**

As described in Chapter 4, drawings, sketches, and cartoons are nonprojected visuals that can enhance learning. There are many sources of these in magazines, textbooks, and advertisements. One often overlooked source is you. You don’t have to be an artist to draw. There are some basic guidelines and many how-to books that can help you communicate effectively using these graphic media.

With a little practice, you may be surprised by how well you can draw. Simple drawings can enhance chalkboard presentations, class handouts, bulletin boards, and overhead transparencies. For ideas on getting started, see “How to... Sketch” (p. 88) and the suggested readings at the end of this chapter.

**DIGITAL IMAGES**

As computer technologies advance, creating visual images has moved into the digital world. Students use digital cameras to create originals and may transfer images into digital formats by using scanners.

These technologies provide students with the tools to create visual images, such as photographs, and integrate them into other computer-based materials by incorporating them into desktop published documents, hypermedia projects, or World Wide Web pages.

**Digital Cameras**

Digital cameras work like regular cameras when taking pictures. But, rather than using traditional film that needs to be developed, these cameras create digital files that you then upload to your computer.

Students may import digital pictures into their documents as they are or enhance or change them by using special software. Students can quickly make their documents more exciting by using pictures as part of their message.

**Scanners**

Scanners work with computers to transfer existing visual images, such as drawings or photographs, into digitized computer graphic files. As with digital photographs, students may quickly incorporate scanned images into a word processing file or enhance or change them using software.

**FIGURE 3.39**

Scanning images is a simple task.

Scanners come in two forms, flatbed and hand-held. The flatbed scanner looks like the top of a photocopier machine, and is connected to the computer with special cables. The user lifts the lid of the scanner and places the image face down on the glass surface. Special software on the computer operates the scanner. Inside the scanner is a lens or mirror system to focus the light reflected from the original into a charge-coupled device (CCD). This device translates the output into a digital form acceptable to the computer (Figure 3.39).

Hand-held scanners use the same basic process as flatbed scanners, but a person must manually roll the scanner over the image so that the light source and sensing mechanism can capture the image. The image is converted into hundreds of digitally recorded dots per inch.

Hand-held scanners are considerably less expensive than flatbed types. They can be viable devices for use in schools where budgets are tight. However, hand-held scanners have their limitations. The image must be small in order to capture it. Anything larger than 5 to 6 inches wide will be difficult to scan. Further, if the scanner is moved across the image at an angle, the lines of the scanned image might appear crooked or jagged.

**Photo CDs**

An alternative for digital images that is less expensive and that uses equipment that might already be in schools is the photo CD. Students may use a regular camera and film to take photographs. Then, when having the film developed, instead of getting glossy prints, they can have their photographs stored on a CD-ROM. One CD can store 100 to 150 images. A unique feature of this technology is that additional pictures can be added to the CD at a later date.
HOW TO... Sketch

Faces
Use an oval and add a minimum of lines to indicate features and expressions.
1. Start with a circle or oval.
2. Add ears in the middle on each side.
3. Draw a nose between the ears.
4. Place the eyes near the top of the nose.
5. Draw the mouth halfway between the nose and chin.
6. Add hair and other features.

Body
Begin with stick figures, which can show action. With practice, add detail to your characters.

1. Determine the head size and draw.
2. Draw a straight line down from that head which is an additional 3 heads long. This is the torso.
3. Just below the head draw a horizontal line about 2 head lengths long. This is the shoulder line.
4. Draw a horizontal line about 1½ head lengths long at end of torso (slightly wider for female figure). This is the hip area.
5. Draw vertical lines down from hip "joints" 4 head lengths long. Leg length comprises half of entire body length. Knees would fall about halfway or 2 head lengths down.
6. Draw vertical lines down from shoulder points to below the hips. These are arms. Add "mitten" hands at the ends. Elbows fall midway on these lines.
7. Superimpose simple triangular feet on the legs at the bottom.
## VISUAL DESIGN CHECKLIST

**KEY WORDS:**

**Material being evaluated**

Evaluator ___________________________  Date ___________________________

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**Arrangement**

| Proximity                        |           |            |      |          |
| Directionals                     |           |            |      |          |
| Figure-ground contrast           |           |            |      |          |
| Consistency                      |           |            |      |          |

**Verbal Elements**

| Lettering style                  |           |            |      |          |
| Letter size and spacing          |           |            |      |          |

**Appeal**

| Surprise                         |           |            |      |          |
| Texture                          |           |            |      |          |
| Interaction                      |           |            |      |          |
Visual Literacy and Writing

Analyze Learners

General Characteristics
The sixth-grade class at St. Matthew School has 33 students who come from diverse cultural and language backgrounds; in this school in Brooklyn, New York, 85 percent of the students are Hispanic, 10 percent are African American, and 5 percent are Asian American. According to standardized tests, almost all the students in this class are achieving well below grade level in reading.

Entry Competencies
Because the teacher is focusing on reading and writing skills, she administers a standardized rating scale to evaluate compositional ability. Her students are writing at about 50 percent competency for content and mechanics compared with other sixth-grade populations in the United States.

The teacher has discovered that her students have difficulty organizing their writing because they lack a sense of sentence and paragraph structure. She also realizes that they have difficulty retaining information when it is presented in a way that is disconnected from their experience.

State Objectives
The main objective for this unit is as follows: Given themes developed by student pairs, sixth-grade students will be able to compose visual essays in sequential and descriptive styles that exhibit composition skills appropriate to their grade level.

A supporting objective includes the following: In pairs, students will exhibit active listening skills so that they will successfully reach consensus, be able to express themselves orally, and make oral presentations of their photo essay storyboards using coherent standard English.

Select Methods, Media, and Materials
This teacher prefers to follow the whole-language approach, integrating listening, speaking, reading, and writing activities together in one unit. She decides to use a visual literacy approach implemented through cooperative learning pairs and discovery methods to provide concrete experiences that might help fill gaps in the students’ mental schema. She wants to improve both language ability and motivation by providing meaningful connections between the students’ real-world experiences and their language activities in school. This means that the students, rather than the teacher, would be the main performers.

First the teacher prepares materials for a schematic mapping activity the whole class will do. She visually models the process of building a map of ideas by using the overhead projector in the front of the room.

Next, she organizes student pairs to create photo essays. There is a logistical hurdle: getting enough cameras to allow all students to have hands-on experiences taking pictures. Fortunately, the library media specialist is able to help her obtain 20 cameras from the district media center.

Finally, she decides the students need to learn to use the computer program, Inspiration, to help them develop storyboards to organize their photo essays. Each student will write an essay based on her or his pair’s photo story.

Utilize Media and Materials
The two-week unit begins with the teacher conducting a large-group brainstorming session, using the overhead projector, to develop schematic maps. They start with the general theme of “Brooklyn’s Amazing History” and break that down into subtopics, such as “The Role of the Subway.” These subtopics constitute the content for the photo shooting that follows.

Students, working in pairs, use the computer program, Inspiration, brainstorming their ideas to develop storyboards of their photo stories.

Require Learner Participation
Following these planning sessions, the pairs of students go out into their neighborhoods to shoot the photographs they had visualized in their schematic maps.

When the finished photos are available, the pairs use storyboarding techniques to organize their pictures and prepare captions. Each pair presents their storyboard to the rest of the class. The unit culminates with each student writing an essay on the photo story created by the pair.

This procedure is repeated once, for a total of four weeks of planning, photographing, storyboarding, and writing.

Evaluate and Revise
The teacher analyzes the essays, again using a standardized rating scale. The typical score for each of the essays is in the 70 percent range. The structure of the essays is improved compared with those written earlier, although there are still obvious deficiencies in spelling and grammar.

She also uses simple rating forms for class members to give feedback on each oral presentation; she notes that students make fewer negative and more positive comments about the second attempts.

The teacher also keeps an informal journal of instances of nonstandard English use in students’ everyday classroom speaking. She notices that a number of students are improving their ability to speak standard English.

In class discussion after completing the two projects, students agree that they prefer this approach to conventional writing approaches.

This "Blueprint" is adapted from an actual case report by Richard Sinatra, Jeffrey S. Beaudry, Josephine Sathi-Bemake, and E. Francine Guastello, "Combining Visual Literacy, Text Understanding, and Writing for Culturally Diverse Students," Journal of Reading (May 1990), 612-617.

A computer template for a Blueprint is found in "Classroom Link."
A photo CD can be read by a CD-ROM player connected to the computer. Students may then incorporate into their documents the images displayed on the screen. It is an inexpensive way to capture a large number of images in a small space.

**Caution When Editing Images**

It is important to recognize the need for caution when digitally editing or changing images since there arises the possibility of misrepresentation. With the advanced capabilities of computer tools, a computer user could alter an image in a way that might distort reality and present a false message to the reader or that might violate a copyright holder’s rights in regard to the original image (see Copyright Guidelines, Appendix C).

**INTEGRATION ACTIVITIES**

1. Plan a set of learning activities to improve the visual literacy skills of learners you now work with or might work with in the future.
2. Critique a bulletin board or other display using the “Visual Design Checklist” in this chapter. Attach a description of audience, objectives, and the features of the display that help achieve the goals of visual design.
3. Design a series of computer screens related to an instructional purpose exemplifying the principles in “How to... Design Computer Screens.” Attach a description of audience, objectives, and features that help achieve the goals of visual design.
4. Critique either a display or a computer lesson using the criteria described in “Visual Design Checklist” and “How To... Design Computer Screens.”

**REFERENCES**


**SUGGESTED READINGS**


Danzer, Gerald A. 1992. Excerpt from “Tuning In,” a curriculum development project, the camera’s eye; imagery and technology. *Social Studies* 83 (3): 134.


