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Future Trends in HRD, Instructional Technology

VISUAL LEARNING

By Diane E. Kirrane

How is society—and work and training—influenced by an increasingly visual culture? What and how do we interpret and learn from images?

In 1992 the annual Federal Office Systems Exposition in Washington, D.C., added a training track: visual applications. The new track covered technologies that are changing what we see in offices, labs and factories, training rooms, homes, and movie theaters. These technologies for image processing and computer graphics are a mixed blessing. They offer captivating—and potentially destructive—possibilities.

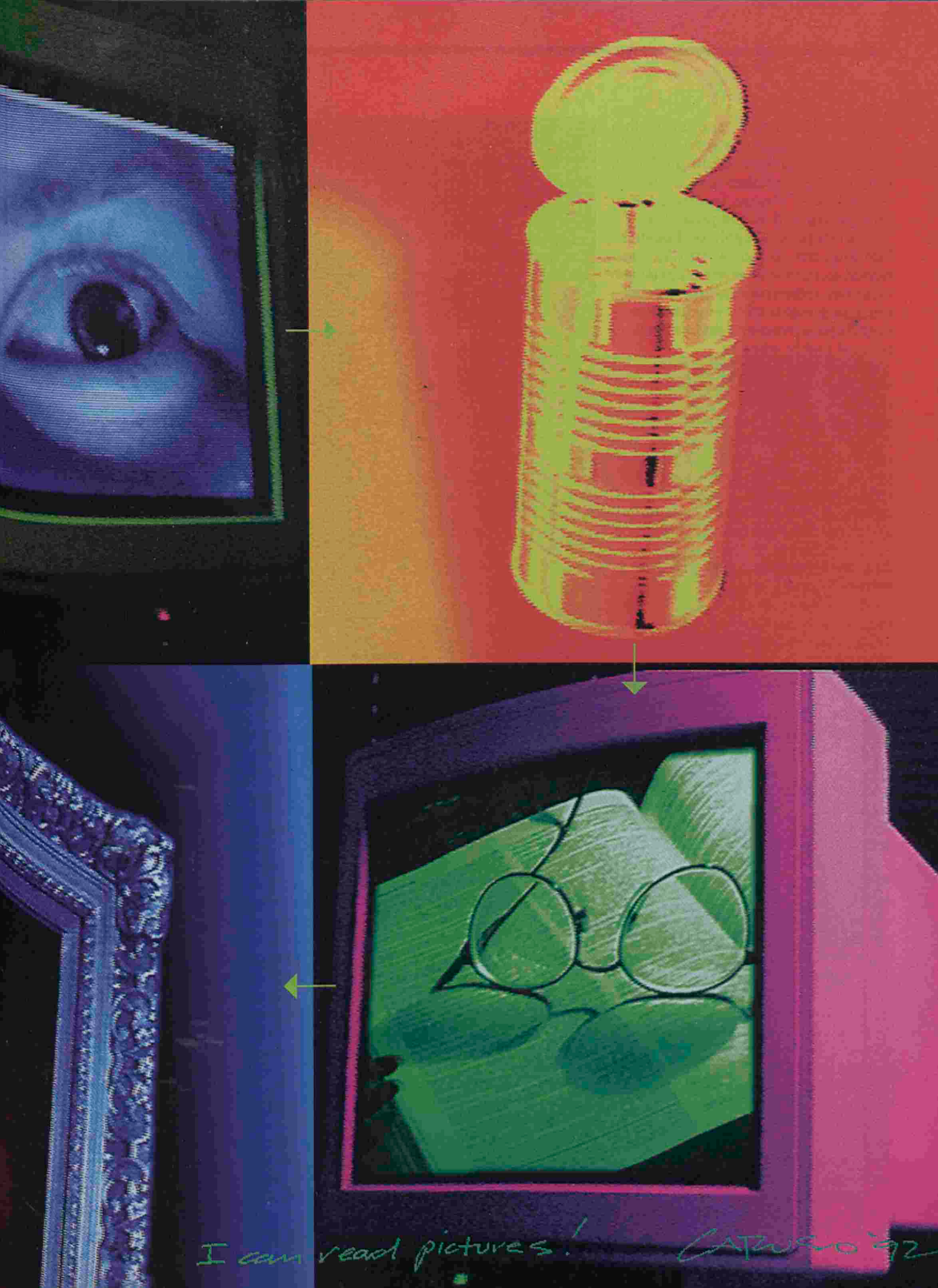
We're on the threshold of another round of computer-based change in the workplace. Just as the processing of numbers and words spread—moving from specialized companies to specialized departments within organizations to nearly everyone's workstation—the manipulation of images is gradually becoming decentralized. Well-trained for it or not, many office workers already work with desktop publishing that involves image manipulation. That's just the beginning.

As these technologies' costs come down and their applications are better publicized, their movement into the workplace will accelerate.

Because people have used images for the recording and communication of information since the cave-painting era, the new technologies may seem to be nothing more than an update of ancient practices. But the potential for "visual culture" to displace "print culture" is an idea with implications as profound as the shift from oral culture to print culture.

Oral culture's still around, of course: people lecture, gossip, and recount family folktales. But, it isn't what it once was. Shoshanna Zuboff, in *In the Age of the Smart Machine*

Illustration by John Caruso


I can read pictures!
CATSUKO '92

(Basic Books, 1988) paraphrases the conclusions of the historian, M.T. Clanchy: "To the modern mind, the evanescence of the spoken word seems more plastic, quixotic, and undependable than the printed word. To members of a highly oral culture, however, the spoken word was connected to the incontrovertible realities of bodily experience, while the written word was a thin, substanceless scratching whose two-dimensionality seemed highly arbitrary."

The extent to which print culture will be displaced by a rising tide of images remains to be seen. But, many changes are visible now.

Surely, image-related technologies often can and do serve useful purposes. To help ensure that images enlighten rather than dazzle and overwhelm us, we need to think about—and train for—working with them.

Are we losing our typographic minds?

Neil Postman, chair of the department of communication arts at New York University, writes in *Amusing Ourselves to Death,* (Viking Penguin, 1985) and *Technopoly: The Surrender of Culture to Technology* (Knopf, 1992) that we are in danger of losing our "typographic minds." In other words, we are becoming less involved with print media and more involved with images—photos in magazines, videotapes, movies, and so on—and that those images are altering how we think and learn.

Deep concern about this often emanates from people on the high side of the 40-years-of-age line. But whichever side of that line you're on, training sessions already include a large percentage of learners who don't remember a time when there was no television. Other learners lack interest or skill in reading. And increasingly, training design, development, and implementation must appeal to learners of all ages who routinely view spectacular effects on television and in movies.

Commenting on the movie "JFK," Boston-based syndicated columnist Ellen Goodman wrote last January 4 that there's "a fuss made by a generation that reads and writes for the minds of a generation that watches and rewinds.

Defining Visual Literacy

The International Visual Literacy Association provides three explanations of what is meant by visual literacy.

visual literacy 1. a group of vision competencies a human being can develop by seeing and at the same time having and integrating other sensory experiences; 2. the learned ability to interpret the communication of visual symbols (images), and to create messages using visual symbols; 3. the ability to translate visual images into verbal language and vice versa; 4. the ability to search for and evaluate visual information in visual media.

visual literacy visual thinking; visual aesthetics; creative exploration; visual linguistics; self-concept development; phototherapy; visual communication; visual symbology; visual expression; visual anthropology; visual learning; visual education; artistic expression; visual awareness; visual understanding; visual creativity; visual analysis; visual evaluation; visual message encoding; visual message decoding.

"Visual literacy refers to a group of vision competencies a human being can develop by seeing and at the same time having and integrating other sensory experiences. The development of these competencies is fundamental to normal human learning. When developed, they enable a visually literate person to discriminate and interpret...visual actions, objects, and/or symbols, natural or [artificial]....

"Through the creative use of these competencies, [we are] able to communicate with others. Through the appreciative use of these competencies [we are] able to comprehend and enjoy the masterworks of visual communication."

(The last definition is from John L. Debes.)

From the International Visual Literacy Association, Virginia Polytechnic University, Educational Technologies—LRC, Old Security Building, Blacksburg, VA 24061-0232.

"Those of us who are print people—writers and readers—are losing ground to the visual people—producers and viewers. The younger generation gets its information and infotainment from television and movies. Less information. More infotainment. The franchise over reality is changing hands."

To Postman, it's more than a fuss; it's war. The printed word, he says, emphasizes logic, sequence, history, exposition, objectivity, detachment, and discipline. But television emphasizes (among other things) images, simultaneity, immediate gratification, and quick emotional response. And television conditions American children before they enter school.

Once children start school, Postman believes, "a sort of psychic battle takes place, and there are many casualties—children who can't learn to read or won't, children who cannot organize [even] a simple paragraph, children who cannot attend to lectures or oral explanations for more than a few minutes," says Postman. "They are failures, but not because they are stupid. They are failures because there is a media war going on, and they are on the wrong side—at least for the moment.

"In time, the type of student who is currently a failure may be considered a success. The type who is now successful may be regarded as a handicapped learner—slow to respond, far too detached, lacking in emotion, inadequate in creating mental pictures of reality. Consider [that] the unreal knowledge acquired through the written word [as opposed to direct bodily experience] eventually became the pre-eminent form of knowledge valued by schools. There is no reason to suppose that such a form of knowledge must always remain so highly valued."

Postman also discusses the centuries-long truce in the classroom between "orality" and the printed word. Orality, he says, stresses group learning, cooperation, and a sense of social responsibility, while print

stresses individualized learning, competition, and personal autonomy. Now the computer will, he believes, emphasize private learning and individual problem solving.

Jane Healy of Cleveland State University and author of *Endangered Minds: Why Our Children Don't Think* (Simon & Schuster, 1990) agrees that television programs attract and hold attention by rendering "visual jolts," and also accustom us to ignoring language. But she's more upbeat about computer-based learning. She finds that computer programs may offer a helpful blend of print and visuals and that different programs can provide a mix of individual and group learning.

Training for visual literacy

Stuart Ewen, a sociologist at the City University of New York Graduate Center and chair of the department of communications at Hunter College, writes in *All Consuming Images: The Politics of Style in Contemporary Culture,* (Basic Books, 1989) that "we are educated from infancy to *look;* we are not encouraged to see and interpret simultaneously. Our eyes imbibe images with little critical resistance."

That needs to change. Training for visual literacy should begin at least by school age and continue in college or on the job.

Dennis Muren is senior visual-effects supervisor at George Lucas's Industrial Light & Magic, the outfit that created the images of fierce fires in "Backdraft," the watery creature of "The Abyss," and the quicksilver villain of "Terminator 2."

According to *Time* (April 13, 1992), Muren wants "kids to come up learning" how to create computer graphics. His associate, animator Mark Dippe, describes the computer as a design and communication tool that can simulate a surgical procedure in three dimensions as well as entertain. Another visual effects pro, Steve Williams, likens the computer to a pencil: not everyone learns to draw as a profession, but nearly everyone has enough experience to understand what a pencil can do.

Robert Wood, the Henry Luce Professor of Democratic Institutions and the Social Order, at Wesleyan University in Middletown, Connecticut, discussed curriculum reform for "training competent Americans." He proposes including these elements: economics courses, science courses for nonscience majors, study of human behavior in organizations, and study of communications—especially visual communications.

He says that increasing numbers of people now are engaged in getting information and forming judgments by visual means. But even in colleges where students acquire a command of the written word, most are no good at dealing with oral and visual communication.

Wood notes that, except for the relatively few students who study film or television techniques in depth, people rarely are sophisticated in their critiques of visual presentations. Simple exposure to film and television doesn't provide the

Words and Images

Consider the following items about the relationship between words and images in current American culture:

- American youths each watch tens of thousands of television commercials a year, and learn to recognize countless brand name packages and symbols (such as "Joe Camel," the cigarette symbol) while they're still preschoolers. Shows such as "Sesame Street" follow a format that mimics commercials. As a result, children may learn to count and so on, but they also learn to expect a quick payoff from learning; in a way, they are trained to be bored by or impatient with more complex learning tasks. The typical American sees at least a couple million television commercials by age 65, in addition to magazine ads, billboards, and other visual enticements.
- In commercials, entertainment shows, and even some news programs, the number of shifts in image ("shots") per minute is increasing. The average shot now lasts less than 4 seconds. Research indicates that viewers' attention drifts otherwise.
- More people who are able to read choose not to read unless it's required. Sales of newspapers and books are down.
- Libraries, whose name is derived from the Latin for "book," have become information centers that offer several media, including videotapes or discs. Meanwhile, as part of what Princeton University's Alvin Kernan calls the "Gutenberg devolution," 15 library schools have been closed. That includes those of Columbia University, the University of Chicago, the University of Southern California, and Vanderbilt University.
- Scholastic Aptitude Test scores for verbal skills have declined. And employers can no longer be sure that college graduates are versed in traditional forms of rhetoric. Management development programs frequently must cover basic rhetoric and logic.
- The Pentagon created the Defense Intelligence Network's "Global Update" because written reports weren't being read. CIA Director Robert M. Gates has recommended forming a similar but more exclusive network for the agency. After all, White House officials kept citing the Cable News Network as their source of information during the recent Gulf War.
- *The Washington Post* reported on February 6, 1992, on a worldwide survey of 175,000 students (9-year-olds in 14 countries and 13-year-olds in 20 countries). The survey found that American students watch more television than most other students, and suggested that the more time students spend watching television, the less time they spend doing homework or reading. One of the survey's analysts said that more television viewing seems to correspond with less success in science, and questioned what this means for U.S. economic competitiveness.
- *Time* (October 21, 1991) reports that more than a half-million Texas students will be introduced to science via a videodisc series rather than a text.

capacity to criticize the "terrible importance of what images convey." As an example of what people need to know, Wood cites the challenge of evaluating what happens in a 30-second political commercial.

Another field of study that could contribute to meeting that challenge is advertising. In the 1980 update of his 1957 book, *The Hidden Persuaders* (Pocket Books/Simon and Schuster), Vance Packard describes how advertisers use printed and spoken words to appeal to our thinking, "left-brain" hemisphere, but aim images at our emotional, "right-brain" hemisphere.

Packard traces advertising research, from early studies on color for product packages to later advanced research into how to motivate—and manipulate—people through images. Only a few people take up advertising as a life's work. But we'd all do well to learn the basics about how advertisements work on us.

In *The New Learning & Telecommunications Technologies* (Charles C. Thomas, 1990), Ibrahim M. Hefzallah identifies two basic competencies for visual literacy: competency in critical analysis of visuals and competency in communicating through visual media.

For critical analysis, he says, "an educated person...should be...capable of interpreting [a] picture to reveal its intended message whether it is explicit or implied...Even when the image looks like a real event being captured, a critical viewer understands that there is a marked difference between reality seen and reality photographed...composing the image to magnify or reduce certain aspects of what is seen in reality."

"Therefore, images, even when they look like what they represent, are interpretations of the image-maker of what [he or she] sees and wants to communicate to the viewer. Many times we are confronted with images which through the power of symbolism imply meanings, feelings, and a style of life of the characters shown in the picture."

To communicate well, he continues, an "educated person should be able to identify the elements of communication that can best be communicated visually, and to request technical and professional personnel to produce the most efficient image that will help communicate."

Research on Visual Learning

Sociologists, psychologists, anthropologists, biologists, machine vision specialists, and communications specialists all contribute to current research on how humans process, store, and recall images. Here are recent bulletins from the research front:

A study at the University of Washington (reported by the *Washington Post*, April 6, 1992) indicates that people see colors somewhat differently. When study participants turned knobs to come up with a colored light that matched a red control light, they dialed up different wavelengths.

Time (January 20, 1992) reports on studies that men and women tend to have different visual expertise: as a rule men excel at thinking in three dimensions, while women proved 70 percent better than men at remembering the location of items on a flat surface such as a desktop. Also hormonal fluctuations in men and women affect their visual perception and skills.

In *Illustrating Computer Documentation* (John Wiley & Sons, 1991), William Horton cites several studies and tests of visual learning. For example:

- One study found that technicians made three times as many errors when using narrative instructions as when using flowcharts.
- Another study indicated that people learn about 11 percent audibly and 83 percent visually.
- Memory improves with the formation of mental images because they involve "conjoint retention" of information in different parts of the brain.
- Some pictures and graphics are counterproductive for learning. For example, they may be overly elaborate and distracting. Horton notes that communicators may lack training, or writers and illustrators may not collaborate well.
- People vary in their ability to form and use images. For example, they differ in ability to generate images, to find part of a whole image, or to hold an image in mind.
- Culture and learning styles affect people's reactions to images. For example, colors, hand gestures, and icons such as the skull-and-crossbones to indicate poison do not have universally recognized meanings. Also, learners sometimes literally need to see the big picture—a holistic, contextual image—to prepare them for the details of a close-up view. For example, think about the maps that give an overview and a blowup of a particular region—or an equipment training film that shows an assembled part before displaying it disassembled.

What pictures are good for

In *Silicon Dreams* (St. Martin's Press, 1989), Robert W. Lucky, executive director of research at AT&T Bell Labs in New Jersey, lists what pictures are good for:

- describing spatial relationships
- showing the structure of data
- allowing pattern-matching approaches to problem solving
- getting attention
- describing and identifying people
- invoking aesthetic appreciation.

Lucky believes that describing spatial relationships "may be the most important function of pictures in the information environment. The physical world about us is so much embedded in our mental structures that we tend to think in spatial terms, and in analogy to them."

For instance, although Lucky knew mathematical descriptions of distributed computer processing architectures, he found that the metaphor of processors acting "like a team of oxen" gave him an "immediate mental image of what parallel processing is about in terms of concrete, three-dimensional pictures."

In *Illustrating Computer Documentation* (John Wiley & Sons, 1991), William Horton recommends using images and graphics for representing numerical values, logical relationships, procedures and processes, visual and spatial characteris-

tics, organizational relationships, and temporal relationships.

New tools and techniques

In *Envisioning Information* (Graphics Press, 1990), Edward R. Tufte writes that "even though we navigate daily through a perceptual world of three spatial dimensions and reason occasionally about higher dimensional arenas with mathematical ease, the world portrayed on our information displays is caught up in the two-dimensionality of the endless flatlands of paper and video screen.

"We envision information in order to reason about, communicate, document, and preserve...knowledge.... Escaping this flatland and enriching...data displays are the essential tasks of information design.

"Recent work on computer visualizations, stereo images, holograms, and so on hint at an increasing depth and pace to analytic displays," says Tufte, "perhaps eventually without all the paraphernalia accompanying current methods."

Many of today's imaging technologies do require a great deal of gear: consider the headsets and data gloves or suits for "virtual reality" simulations. These technologies affect skill requirements. For example, a surgeon needs training to operate successfully while looking at the images transmitted by a laparoscope rather than directly at human tissue.

Meanwhile, according to *U.S. News & World Report* ("Seeing the Invisible," January 28, 1991), "beyond visualization of physical phenomena, computer imaging also has promise as a tool for managing abstract data. Actuarial tables, for instance, might be turned into a vast data city over which an insurance analyst could fly in search of patterns."

Business Week (November 12, 1990) called scientific visualization "a whole new way of looking at the world." That issue also reported that Kozo Fujii, a professor at Japan's Institute of Space & Astronautical Science, has developed a way for a computer user to "call up—and change—the calculations underlying the visual images on the screen." Although scientific visualization usually is carried out on dedicated workstations, its capabilities are coming to personal computers.

Computer graphics are already helping with many kinds of problem solving. For instance, Ralphe Wiggins explained in *AI Expert* (May 1992) how he solved a problem involving docking trucks. He said, "The approach to the solution could not have been formulated without a graphics device that helped me visualize the behavior and tradeoffs of the problem."

As imaging technologies advance, there are few standards or uniform agreements about information display. There are exceptions. For example, the American National Standards Institute has developed standards for color on signs (such as red to indicate danger, yellow to indicate caution, and orange to highlight dangerous equipment). But these do not necessarily translate to other contexts. In parts of the Middle East, yellow symbolizes happiness or prosperity. An American may associate yellow with sunshine and, by extension, with bleaching properties.

Research on imaging technologies and human visual information processing is booming. AT&T Bell Labs in New Jersey, the Media Lab at the Massachusetts Institute of Technology, Xerox's Palo Alto Research Center, and the Institute for the Learning Sciences, headquartered at Northwestern University and working in partnership with businesses and government agencies, are among the many places adding to our knowledge about visual learning. ■

WE'D ALL DO WELL TO LEARN THE BASICS ABOUT HOW ADVERTISEMENTS WORK ON US

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