

# Alien Technology Made Familiar

*The latest CBT systems may seem futuristic, but they're already in use at companies such as Northern Telecom. Now is the best time to learn how they fit into your long-term training strategy.*

Imagine that a group of friendly aliens arrived from another galaxy. They manage to communicate with us enough so that we recognize that they are from a highly advanced civilization and have a great deal to teach us. We also learn that they are part of a larger contingent that is on a one-way voyage to Earth.

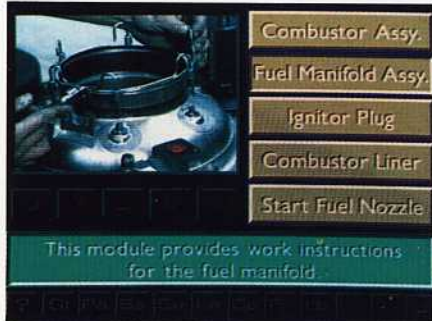
If such beings were to arrive here, we would probably focus our finest resources on the task of fully understanding how to communicate with them. We would probably anticipate quantum leaps in our knowledge base as well.

In terms of the training world, the latest advances in computer-based training technology are the aliens. Some of them are here today; a whole lot more are on the way.

## A major transition

Training technology is on the threshold of a major transition. Computer-based training has long been a side-show. But now it is maturing into something that will become a dominant training methodology in the near future. Personal computers that can

By Jay M. Orlin



*Northern Telecom uses the WITS system (top) to train inspectors on the factory floor. The bottom photo shows a closeup of a screen in an aircraft maintenance training program that uses similar technology.*

capture, compress, and decompress full-motion audio and video are available today. And a wide assortment of equipment can digitally manipulate data. Personal computer manufacturers plan to build much of this capability into every PC they sell by the mid-1990s.

It is not the whiz-bang nature of these new technologies that will make them a significant part of future training strategies. It is the fact that they are the best way to train in many subject areas, especially technical ones.

If you think of CBT as a catchword for the simple, linear, page-turning products of the past, look out. The arriving aliens are fully integrated, all-digital training systems that deliver realistic, real-time training—on-line in the work area or embedded in equipment. They represent true multimedia—the capability to utilize and effectively integrate a full range of media into a single system.

## The time is now

Familiarity with such systems is critical for any human resource person with responsibility for planning or implementing training strategies. Now is the best time to learn what these technologies are and how they fit into a long-term training strategy.

Why is this the time? Because up until now, only bits and pieces of technology were available. They were generally premature in their release. Even the manufacturers didn't fully understand what their products did; integrating different technologies together was next to impossible. Now many products are into their second and third releases. Fully configured systems of this nature are available and are in place. It is no longer a matter of whether this technology will work or whether it can deliver significant productivity gains. It is now a matter of who will be ready to start using it next.

Organizations known for using the most advanced training technologies include airlines, the military, utilities, and firms in the space industry. They became forerunners in the use of new technologies because they had the right combination of need and funding.

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For more information on this topic, see Orlin's article, "Technology, the Future of Training," in the January 1991 issue of *Technical & Skills Training* magazine, published by the American Society for Training and Development. (For ordering information, call ASTD's customer support department at 703/683-8129.)

In the past, the cost of using and maintaining such systems was enormous. There was no realistic way to get into it inexpensively.

But now we are essentially talking about systems that are based on personal computers. It's still not nickel-and-dime stuff, but the prices are easily within reach of many training budgets.

## Video compression and decompression

An example of technology that is new, different, and important to understand is video compression and decompression. Intel, Philips, and

Fractal are three companies working on this. To understand what it is and why it's important, let's look at the following scenario:

Someone from the program development group, or perhaps a supplier, proposes development of training using video compression or video decompression.

"What does it do?" the budget-conscious HR manager asks.

"It allows the compression of full-motion audio and video into digital information that can be stored on and recalled from the hard disk of the computer."

The HR manager immediately re-

members spending a lot of money on laser disks, and wonders, "We already have full-motion audio and video coming through the computer. Do we want to spend training dollars to do the same thing in a different way?"

In all likelihood some very interesting and spirited discussions follow. The proposer struggles to emphasize the value of the new systems. The HR manager tries to avoid spending training dollars on high-tech toys that seem to do the same things the company already can do, slightly differently.

The HR manager has to make a decision.

He or she might decide to continue spending on the existing systems, which are based on older technologies. That could amount to spending training dollars on products that become obsolete before return on investment is achieved.

A better decision might be to campaign for the organizational support necessary for an investment in advanced training technology. For many HR managers, this choice would pay for itself in the long run. The new technology is an investment in the future of training—it enables HR departments to move ahead into increasingly sophisticated methods of training delivery.

## Northern Telecom's WITS and MISTS

Northern Telecom made a conscious decision three years ago to be a pioneer in the use of advanced training technology. Acting as a beta-site tester for Integrated Training Systems of San Diego, NT provided subject matter expertise for the development of two systems:

■ WITS is the Wafer Inspection Training System, used on the factory floor to train inspectors.

■ MISTS is the Microscope Instruction and Support Training System, which trains operators in the proper use and maintenance of microscopes.

The initiative made Northern Telecom the first company to use a commercially available DVI-based technical training system. DVI, or digital video interactive, is a technology that allows full-motion video to play on a properly equipped computer.

### WITS

WITS, the program that trains inspectors on the factory floor, was de-

## A Glossary of Multimedia Terms

**algorithm:** a series of formulated steps that performs an action by input; for example, drawing a circle or placing a particular pattern on the screen.

**analog:** information technology that uses a continuous scale, incompatible with computers; data are stored and retrieved as a continuous signal rather than in bits; traditional VCR and audiocassette tapes are examples.

**data objects:** pieces of data that contain certain characteristics as well as functions that can act on those characteristics when called.

**digital:** information technology that uses a format that is compatible with computers; information is stored and retrieved as bits.

**discovery learning:** a training philosophy that is predicated on having all information easily and readily available, allowing trainees to navigate through an instructional system as they wish.

**DVI:** Intel Corporation's digital video interactive technology, which compresses and decompresses sound and video in real-time on a PC.

**fully integrated:** describes a system in which all components are connected, compatible, interchangeable, and centrally scheduled and executed.

**hard-coded:** describes a pre-determined sequence of statements that is not changeable by the user while he or she is running a program.

**multimedia:** using more than one medium, i.e., sound and text; often refers to the use of many media options, centrally controlled and coordinated, especially by a computer.

**object-oriented:** describes a programming scheme that creates data objects with their own functionalities and attributes; it allows messages to be sent and activates them.

**platform:** usually refers to the basic computer used in a system; also refers to connected hardware.

**robust:** describes a system that has been designed and tested to withstand extensive use and rough handling in industrial or other demanding settings.

**screen calls:** actions executed by a computer program, based on instructional design, that place specific elements on the screen.

**video compression:** a process that reduces the number of digital bits required to store information; the data can be compressed either with no loss of information, or with some loss but with enough information retained to represent the image.

**video decompression:** a process that restores previously compressed information into the format from which it was compressed, with either some or no loss of information.

**video stream:** usually refers to a sequence of video being replayed by computer command.

signed to meet a host of challenging demands:

- It had to be a robust system, available on a 24-hour-a-day basis.
- It had to have realistic, superior-quality images. The actual job of the inspectors entails the use of microscopes, so images used in the training program have to be highly detailed.
- It had to have a large, easily accessible visual data base, designed so that an operator can capture images online and add them to the data base.
- The user interface had to be simple and user-friendly. Trainees had to have complete freedom in support of a "discovery learning" philosophy.
- The courseware had to be interesting and easy to modify.
- Testing and certification had to be objective and rigorous enough to support a skill-based pay system.
- The system had to give training designers the ability to develop programs on the fly.

The developers of WITS met those demands through the use of all-digital multimedia and object-oriented programming.

Using a fully integrated all-digital platform allows the data to be easily manipulated between system components. The implications are enormous for both development and delivery. Developers and trainees use the same technique to capture images—they activate a digital video camera. The developer, of course, is involved in extensive image capture. The operator uses the capability only occasionally to save an image for later review with an engineer.

The point is that the images have been stored as digitized information in the computer. They can be retrieved as needed. They could just as easily be taken from a VCR, as still or motion video, and stored in the computer. Voice narration and music can be stored and retrieved in the same way: sound is input into the computer, digitized, and stored for later processing. The other components of the program are also digital: text, graphics, screen designs, instructional commands, and animation.

All of the information is stored and ready to go. What really makes it come to life is the expert use of object-oriented programming.

Object-oriented programming uses objects instead of traditional hard-coding. This means that what the

trainee sees on the screen is temporary; the learner requests a unique configuration of information, based on his or her needs at the moment. The computer fetches it from the data base and places it on the screen. Any text, graphic overlays, images, audio, or video in the data base can be used alone or in combination.

Hard-coded programs must be entirely rewritten when changes are needed. With an object-oriented scheme, designers can make changes in moments, simply by replacing the contents of the object's component. Placing new digital images into a program is a matter of capturing and labeling content data.

WITS trains operators to perform a critical microscope inspection accurately. The operator inspects semiconductor wafers during each level of manufacturing and determines whether the photo patterns on them are correct. The trainee must perform nine inspections in 30 seconds and make correct judgments about pattern, color, and defects. The training traditionally took three to six months. With WITS, the decrease in training time was an amazing 85 percent.

## **MISTS**

MISTS is the Microscope Instruction and Support Training System. Its purpose is to teach the proper use and maintenance of microscopes. Microscopes are fundamental tools in the microelectronics industry, but most people who use them get little or no formal training. Optical engineers and microscope repair technicians verify that only a small percentage of microscopes are used correctly.

MISTS uses full-motion video to simulate such activities as focusing an image. It uses animation to illustrate light paths and the working of the human eye. The all-digital object-oriented approach allows individual video segments or individually selected video clips from a single video stream to be used for any of several different screen calls.

This is where video compression technology comes in. Until a couple years ago, storing full-motion video on a computer was too impractical to consider. It would have required disk drives of enormous capacity. Instead, all full-motion video was created and stored on analog media.

Film and VCR tape are examples of

analog media. They contain all the information the viewer will see and hear in the same format in which it was captured. A video camera or editing machine produces analog tape. As tape runs through a VCR, machine heads read its signals and send them to be processed and displayed on a screen.

A digital still- or motion-video camera, on the other hand, records images by breaking them down and storing them as bits and bytes on a computer disk. Any part of the data can be randomly and directly retrieved from a hard disk or a floppy disk, unlike the information on a videocassette, which must be viewed in the order in which it was recorded.

Video compression and decompression uses algorithms to reduce the amount of data that needs to be stored. To compress full-motion video, the system analyzes it and determines what is different from one frame to the next. It then saves only the elements from each frame that are different from those in the previous frame. If the only motion in a segment of video were a person blinking his or her eye, the algorithm would pick that up, save only the blinking eye, and retrieve it when it was needed in the decompression.

That is one method of compression and decompression. There are others, but the point to understand is that this is the type of technology that will be standard equipment on new PCs in a few years.

Combined with clever, object-oriented programming, such technology provides some real opportunities for courseware developers. Of course, video uses a considerable amount of disk storage space even when it is compressed by a ratio of 150:1, so the problem of storage is not eliminated. But the ability to get multiple use from any part of a video segment goes a long way toward minimizing the storage problems.

## **Training flexibility**

Convenient trainee access to information is one of the complexities involved in designing adult learning. This is particularly true for technical training, because the data bases can be voluminous. For example, before WITS, the "visual database" for the inspector training program included 40 to 50 carousels of 35mm slides. If one particular carousel was being

used and a trainee had a question involving a slide on another carousel, it was an awkward procedure to locate and display the image in question.

With WITS, the image that is needed is immediately available and can be displayed at any time. A trainee can even choose to view many images simultaneously.

Integrity of information is another important issue. Many training managers find it next to impossible to keep their training programs up to date. It is particularly difficult in industries in which conditions and technology change quickly.

Training programs that are easy to modify, such as WITS, can solve the problem. If new criteria have been established, or a process change causes something to look different, new information can be added and a

new image replaces an obsolete one. So trainees see the most up-to-date example of what is being taught. The replaced image is not deleted from the data base, but is preserved through a version control scheme.

In addition to their training purposes, the data bases are also used as reference tools. Of course, that makes a high level of integrity even more crucial. And employees who complete the training find that they have received an added benefit: knowledge of how to use the reference data base.

The systems are built with multi-language capability. The use of two languages has already been demonstrated at Northern Telecom. It is possible to have several more available on one system. A trainee can switch languages in midframe; the program will continue in the language selected.

Testing and certification present another opportunity. Companies are maturing in the implementation of their quality strategies. As more firms recognize the value of a trained, certified workforce, certification of job skills becomes more of an issue. And many companies are implementing skill-based pay systems that require impartial testing.

In WITS, certification test questions are drawn at random from the entire data base. They are more complex than the questions asked in individual modules, because they require the trainee to demonstrate a synthesis of all the learning.

A trainee can access the certification test whenever he or she feels ready and can take individual questions one at a time. Once a trainee calls for a certification question, she or he must complete it. The system logs in the score. But the trainee then has the option to review further rather than going immediately to another question.

Detailed records of the training and testing may be kept with the new systems. This can be helpful in many ways. For example, the records can explain what actually happened if a trainee disputes a score. The records can also be useful in protecting the company against accusations of bias in testing practices.

### **Tremendous payback**

High-quality multimedia training is well suited to engaging trainees' attention. In our daily lives we are continually exposed to media that are sophisticated, high-quality, and imaginative. Television, computer kiosks, amusement centers, and computer games are a few examples.

On the other hand, screens that are heavily laden with text and rudimentary graphics just don't capture our attention. It's a lot like watching a television that gets only the channel that lists program times and civic meeting dates.

The latest advances in CBT have the potential to deliver tremendous payback for training dollars. They train effectively, can be built and modified quickly, can be available on a 24-hour basis, and eliminate many problems associated with certification.

In short, the future of training is here; it is woven into the advancing media. The time to become conversant with such technologies is now. ■

## **Adult Learning and New CBT Technology**

Adult learning principles have long been accepted maxims in training. Among other things, they advocate providing only training that is relevant to learners and allowing them some control over the learning process. Trainees in a self-discovery mode tend to be more relaxed, more motivated, and therefore more effective learners.

Much new training technology has been designed with self-discovery as the underlying principle. The technology allows learners to move around at will within a training program. It is as if they were handed a book and invited to go through it by reading the parts they found interesting and useful. This is called free play.

In the past, some CBT programs had limited branching capabilities. Using them was like reading a book in which you couldn't turn to the first page until you had been exposed to the copyright page for at least 45 seconds. That is what is meant by limited trainee choice.

Another component for successful training is realism. The more realistic the training scenario, the greater the transfer of learning to the job.

The WITS system for training

the inspectors at Northern Telecom is a good example. Images viewed during training were captured through the microscope at the same power the employees use on the job. So trainees learn from a data base that consists of the same images and image quality they will see at work.

Feedback is an important part of adult learning. With systems such as WITS, each module has built-in quizzes to help reinforce learning and provide feedback to trainees on how they are doing. The quizzes access visual data on a random basis, so a trainee never sees the same set of questions twice. This also replicates real life, in which work must be processed as it comes. Success on the quizzes requires answering correctly in an allotted time frame. The timing is real-world based; again, it transfers directly to the job.

Certification test questions are more complex than those on the regular quizzes. A trainee may ask for certification questions at any time. That freedom gives learners more control over their own learning, supporting the basic principles of adult learning. For many people, that sense of control somewhat decreases the anxiety of taking tests.