Introduction

VIDEPLACE had its origin in an incident that occurred during METAPLAY. Digital signals from the computer in the gallery were being transmitted to the graphics display in the computer center. Since both machines had a graphics capability, one displayed the waveform being sent, and the other displayed the information being received.

At first, I talked over the telephone with a colleague in the gallery about the displays we each had in front of us. However, after a few minutes of frustrating discussion, I realized that we had a far more powerful means of communication available. Using the two-way video link, we turned the gallery camera on the computer screen there. The computer-center camera was already aimed at the graphics machine. Both of us could now see a composite image juxtaposing the information being sent with that being received (Fig. 3.1). We discussed the two signals and speculated about the source of our transmission errors. As we did this, it was natural to use our hands to point to various features on the composite display. The resulting conversation was exactly the same as it would have been had we been sitting together at a table with a piece of paper between us.

After a while, I realized that I was seeing more than an illusion. As I moved my finger to point to the data my colleague had just sent, the image of my hand briefly overlapped the image of his. He moved his hand. Although I noticed this phenomenon, its significance did not register immediately. When it happened again, however, I was struck with the thought that he was uncomfortable about our images touching. Without saying anything, I subtly tested my hypothesis. Sure enough, as I moved the image of my hand toward his, he repeatedly, but unconsciously, moved his hand to avoid contact. I even felt a phantom sensation when we touched. Although his reactions were exaggerated and even bizarre, he never noticed my actions or his. The inescapable conclusion was that the etiquette of maintaining personal distance and avoiding touching that exists in the real world was operating at that moment in this purely visual experience.

VIDEOTOUCH

We experimented after exhibit hours with what I dubbed VIDEOTOUCH, and confirmed that indeed there was a powerful effect operating. In 1972, I submitted a proposal for a two-way installation titled "VIDEOTOUCH" to the National Endowment for the Arts. The piece was to consist of two environments, each containing a rear-screen video projection of a composite image of two participants. A single participant would
the same self-consciousness about their images that they feel about their bodies. Later experimentation convinced me that people have a proprietary feeling about their image. What happens to it, happens to them. What touches it, they feel. When another person’s image encounters theirs, a new kind of social situation is created.

Over the next two years, the concept of videotouch matured as I realized its broader implications. Whereas we usually think of telecommunication as being between two points, a new premise evolved: Two-way telecommunication between two places creates a third place consisting of the information that is available to all communicating parties simultaneously (Fig. 3.3). When two-way video is used, a shared visual environment that we call videoplace is created.

The idea of a video “place” led me to consider the characteristics of a real place and how they could be reproduced or replaced by alternatives in a video environment. If two people are together, they can see, hear, and touch each other. They can move about the same visual environment, seeing the same objects. They can manipulate objects and hand them to each other. Finally, they can share an activity, such as dinner together.

We can embellish the sense of place by providing a graphic setting furnished with graphic objects and inhabited by graphic creatures. The ultimate consequence is an artificial reality experienced through the participation of one’s video image in the portrayed world. Although it was conceived in the context of two-way communication, videoplace can also be used to stage interactions involving a single participant. By suggesting, but not duplicating, familiar reality, this new graphic

Figure 3.2
The Computer Detects Contact Between the Video Images of Two Participants.

Figure 3.3
The VIDEOPLACE Concept.
experience can highlight assumptions and expectations of which we are never aware, because it does not occur to us that our world could be other than it is.

The computer has complete control over the relationship between the participant's image and the objects in the graphic scene (Fig. 3.4). It can also tell when images and objects make contact, and can coordinate the movement of a graphic object with a participant's actions (Fig 3.5). Thus, the participant's video alter ego is able to lift, push, or throw an object or creature across the screen (Fig. 3.6). One person can lift another's image. He can press down on the image of another person's head and make that person's image shrink under the pressure. A participant in New York could toss a ball to a Californian (Fig. 3.7). The moment an object responds to a participant's touch, both the object and the experience become real.

The world VIDEPLACE simulates need not be a real one. Unlike the real world, VIDEPLACE is not governed by immutable physical laws. Gravity may control your physical body, but it need not confine your image, which can float freely about the screen (PLATE A). You can use special gestures simulating flying, swimming, or climbing to maneuver your image around the displayed world (Fig. 3.8). The consequence of any action is programmable. When you push against a graphic object, the
computer can choose to move the object or to move you. Stamping your feet can cause flowers to grow or volcanoes to erupt.

Although VIDEOPLACE cannot literally duplicate the fullness of the real world, it invents a new model of reality with methods of interacting

Figure 3.7
Three-Way Catch in VIDEOPLACE.

Figure 3.6
Picking Up a Graphic Object.

Figure 3.8
Swimming in VIDEOPLACE.

that are equally compelling. Thus, although some aspects of reality are abridged in VIDEOPLACE, others are enhanced, since many of the constraints and limitations of reality can be overcome. Interactions within the environment are based on a quest to understand the rules that govern this new universe. A person’s expectations can be teased, leading to a startled awareness of previously unquestioned assumptions, much like the experience one has when viewing a Magritte painting.

VIDEOPLACE: The Bicentennial Experience

Starting in July 1974, VIDEOPLACE was proposed as the theme of the United States Bicentennial celebration, updating the Centennial project that had introduced the telephone to the public.

People would enter VIDEOPLACE from installations distributed around the world. Each participant would see her image join a group of other participants’ images to form a single composite image (Fig. 3.9), or she might see part of a much larger graphic space in which she could move around, encountering other people from other locations. The natural greeting was expected to be, “Hello, where are you?”
In addition, Videoplace was to be used to hold panel discussions among participants in different states. I planned dance pieces with dancers thousands of miles apart, the choreography for which existed only on the video screen. Note that such a performance would be pure video; there would be no physical place a person could go to "really" see it. In addition to these more contrived and formal events, the Videoplace was also to provide a facility for ongoing exploration of a new kind of play by serious artists and serious children of all ages.

In July 1974, I traveled to Washington to seek support for the Bicentennial project. High-level administrators at the National Science Foundation (NSF) expressed considerable appreciation for the ideas; however, as I descended to the lower-level offices from which specific projects were funded, I encountered a different reaction. The people in computer science turned up their noses and said, "that sounds like engineering." They cited automata theory as an example of a viable research area. Another person in NSF, who thought the ideas were important, told me point blank but with great sympathy that NSF would never fund Videoplace because the idea was "creative." This was the first of many exposures to that word as a pejorative term. At the Defense

Advanced Research Projects Agency (DARPA), I was told that human-machine interaction "had been done." NASA told me that their satellite was beaming birth-control messages down to India, but there was another satellite that I could use—if I could get it launched.

My last stop in Washington was the one place I was absolutely certain would react enthusiastically—the Japanese Embassy. (I was proposing that Videoplace include an installation in Japan and one in Europe.) The Embassy representative was sure that, if I could get the United States committed, Japan would want to be involved. Other stops on that trip included Bell Laboratories, RCA Laboratories, and IBM. The result of this trip was a clear indication that there would be no ambitious projects inspired by the Bicentennial.

Although Videoplace was not implemented on an international scale, an exhibit introducing the Videoplace concept was shown at the Milwaukee Art Museum in 1975. Two environments with rear-screen video projections were placed 300 feet apart. A person entering either environment saw his own image combined with the image of the people in the other environment. Strangers finding their images together often invented pantomime interactions. Mock battles were staged, backs were scratched, and remote partners danced.

For the next four years, I worked under an arrangement with the University of Wisconsin Space Science and Engineering Center by which I did computer graphics research for them and was provided laboratory and office space to work on Videoplace and to seek funding for it. As a result, I received grants from the National Endowment for the Arts and the Wisconsin Arts Board. I worked on Videoplace nights and weekends for the next four years; by 1976, I had a primitive working prototype with enough real-time perception to demonstrate a few simple visual interactions.

In 1978, I joined the Computer Science Department at the University of Connecticut. I brought the working Videoplace system with me from Wisconsin. At Connecticut, I improved the graphics and composed a number of interactions. In 1983, I left the university; I have been independent since.

In the Videoplace installation, the participant faces a video-projection screen that displays his live image combined with computer graphics. A large sheet of translucent plastic behind the participant is backlight by
fluorescent tubes, producing a high-contrast image that enables the computer to distinguish the participant from the background. The projection screen is about 20 feet away from the participant. The projector is driven by separate red, green, and blue (RGB) signals, instead of by a single composite signal, which means that it displays much sharper colors than those seen on a home television, which uses NTSC encoding (see Glossary). A black-and-white surveillance camera looks at the participant from beneath the projection screen (Fig 3.10).

The VIDEPLACE System

Each participant's video image is digitized and is fed to a series of specialized processors that analyzes the resulting silhouettes. These processors analyze each image in isolation (e.g., posture, rate of movement) and with respect to graphic objects and live images on the screen. (For example, is the participant touching the graphic light switch? Has her image reached a graphic door?)

When the participant's actions are understood by the specialized processors, they are reported to the executive processor that decides what the responses should be. Depending on the participant's behavior, it can move an object, change that object's color, move the participant's image, or make a sound. Another set of specialized processors is then directed to generate visual and auditory responses.

Two or more environments can be linked, with the addition of a little extra hardware. Each participant's image must be analyzed separately and then compared to the other graphic objects and human images on the screen. In addition, each input image requires a separate transformation processor to shrink or rotate it. Two environments demand that more complex decisions be made, but the basic operation of the system is unaffected.

VIDEPLACE Art

Many interactions have been created in the VIDEPLACE framework. Since this is a new medium, it should be explored and its essence sought. Indeed, the goal should be to express the medium itself.

To communicate the wealth of opportunity that interactivity provides, we have always presented VIDEPLACE as a medium within which interactions have been composed in a variety of styles, rather than as a single piece. Although the result may seem disjointed visually, the interactions are connected conceptually. Some of them are studies. Whereas in the past artists did studies for their own consumption, in an interactive art form it is necessary to exhibit studies as well as finished pieces in order to observe how people react to them.

Since there are many interactions and the exhibit is usually unattended, a rationale is needed for switching from one interaction to another. The computer could switch interactions arbitrarily, but this technique would not be in keeping with my notion that nothing should happen in an interactive medium unless it is a response to some action by the participant. Instead, the current interaction continues until the participant leaves. A new interaction is selected when the next person enters. This principle is discoverable, and often one person will step off the screen and reenter over and over to experience a number of interactions. However, it is not necessary or even desirable for every person to see all the interactions. Indeed, as we near 50 compositions, it is becoming impossible. The enlarging repertoire is an intentional statement about the rich potential of the medium.
Interactions

The current interactions are based on a variety of themes and motivations. Some are visually beautiful and provide a link to traditional aesthetics. Other interactions introduce the ingredients of artificial realities one at a time, to see how people relate each one. A final category of interaction involves a real-time dialog between two people in different environments.

CRITTER
One of the most popular interactions traces its origins back to METAPLAY. As I moved the cursor around the screen, I noticed that people reacted to it as though it were alive, batting it away when it approached them. This observation led to the creation of the CRITTER, a playful sprite with an artificial personality.

CRITTER’s general behaviour is to cavort with you, chasing your image around the screen (Fig. 3.11; PLATE 3). If you hold out a hand, CRITTER will float down and land on it. If you stand still, CRITTER’s ambition is to climb up your silhouette until it reaches the top of your head, where it does a jig in celebration. At other moments, CRITTER chases an open hand or dangles from an outstretched finger. After seeing thousands of people try to capture CRITTER with their hands, we made it sense when it is surrounded, search pathetically for an exit, and explode if there is no escape. Happily, reincarnation is instantaneous. The current CRITTER interaction was completed in 1984, but CRITTER’s evolution is resuming to take advantage of new animation techniques we have developed that will, in turn, require high-resolution graphics.

The original CRITTER had already evolved over a period of years. Thousands of hours of work went into its creation and behaviour. John Rinaldi, Bruce Shay, Thomas Gionfriddo, and Katrin Hinrichsen did their masters’ theses on problems surrounding its implementation. Many boards were built to provide the information needed for CRITTER to behave in real time. An elaborate software system was developed to permit rules of behaviour to be described in Conceptual Dependency Notation, a knowledge representation developed by Roger Schank at Yale to understand English. Thus, although CRITTER is not yet intelligent, its implementation employs artificial-intelligence techniques.

Figure 3.11
A CRITTER Sequence.
INDIVIDUAL MEDLEY
The next class of interactions is purely visual. Each is a restricted aesthetic medium that can be composed through body movements. In fact, your body becomes a means of creating art. The goal of these interactions is to communicate the pleasure of aesthetic creation. Since these media are unfamiliar, dwelling as they do on dynamic images controlled by movements of the viewers' bodies, artists trained in traditional static media have no automatic advantage in creating pleasing results.

Each of the INDIVIDUAL MEDLEY interactions captures your eight most recent silhouettes and colors them according to how they overlap on the screen (PLATE E). Each method of assigning color constitutes a distinct interaction and leads to different behavior by the participants. If each new silhouette is placed on top of the others, the result suggests a political poster. If one silhouette is used as a matte, succeeding silhouettes break the person's image into a jigsaw-puzzle pattern.

Each of these interactions has its own idiom. A person's work changes over time as she sees the effect of her actions on the visual patterns. I can often tell how long a participant has been in the environment, whether he will stay in long, and whether it matters how long he stays. Some people do not listen to what their experience is telling them. They move their arms in a jerky manner, rather than synchronizing their movements with the rhythm of the current feedback relationship. Since the visual results are dynamic, a participant creates feedback for himself only as long as he keeps moving. The moment he stops, his past catches up with him. If he does nothing, he sees nothing.

BODY SURFACING
In the BODY SURFACING interactions, the participant's image paints continuously as it moves about the screen. The colors that are applied by the participant's body shade from one to another. The use of shading provides a sense of depth, defining beautiful metallic surfaces (PLATE 9). As these surfaces are defined, colors flow along them in the direction of the participant's movement. This interaction is so peaceful that it suggests an active form of meditation.

REPLAY
Another visual interaction stems from the image-capture capability used in the INDIVIDUAL MEDLEY interactions. When a stationary participant starts moving, the system captures a sequence of 16 silhouettes, and then plays them back. The instant REPLAY is continuous. If you have watched sequences of satellite images repeated several times on television, you may have noticed a lurch when the last image of the sequence is followed by the first image. To avoid this problem, the sequences are played forward, then back, then forward, and so on. The result is smooth continuous motion. No one ever notices that the sequence reverses.

One typical response to this interaction is that a person enters, sees her silhouette mirroring her actions, and assumes that nothing else is going to happen. When her entrance is repeated, she pauses, confused. When she realizes what is happening, she does a doubletake. This action triggers another capture. The doubletake is repeated endlessly. There is something about a single gesture being repeated over and over that makes the gesture seem absurd.

FRACTAL
One day the system started making complex geometric patterns that changed as the participant moved (PLATE H). There was clearly some sort of hardware problem. Rather than fix it, I spent several weeks understanding why a loose wire created a dynamic fractal pattern. The colored silhouettes of the participant were mapped into the patterns in complex ways. Once I understood the process, I realized that this occurrence was just one instance of a whole family of fractal patterns. The simplest of these were incorporated into a special board devoted to the FRACTAL interaction. As movements of the body control elements of the visual FRACTAL patterns, we have also defined pleasing sounds that are controlled by the participant's hands to enhance the experience.

This interaction is not one I would have created on purpose, since abstract geometric patterns are not as involving as your own image. However, when the medium spoke so directly, I thought that it would be ungrateful not to listen.

Minimmedia Family of Interactions
Each member of another family of interactions creates images that suggest a familiar style of art. In the BROADWAY BOOGIE WOOGIE interaction, the participant creates images reminiscent of Mondrian's work. Dynamic rectangular shapes are arranged around the participant's invisible sil-
houette. In a related interaction, the participant’s movements create circles, triangles, rectangles, and polygons that are superimposed over the participant’s body. Each area where the shapes overlap the participant’s image or each other is colored in a way that is also controlled by the person’s movements. The visual results are often stylish high-tech designs.

GAME OF LIFE
The GAME OF LIFE is an interaction featuring audio as well as visual effects. Your image is filled with little cells that divide, move around, and die helter skelter. This animated pattern is a bit of technological culture. The pattern is a simple mathematical game developed by British mathematician John Conway years ago. Every point on the screen looks at its immediately adjacent neighbors to see whether they are dead or alive. If exactly two of them are alive, the cell remains in its current state. If exactly three neighbors are alive, the cell comes to life regardless of its previous state. In all other cases, the cell dies.

This game is known to most technophiles. It is not the Bible or Shakespeare, but it is a bond of shared understanding within this community. Many students were given the GAME OF LIFE as an early programming assignment. A conventional computer can generate a new generation about once per second. Computers are faster than humans at many tasks, but when there are 64,000 points on the screen and the rules described must be applied to every one of them, the typical personal computer is overwhelmed by the sheer number of points. A technical person, knowing this, is knocked out when he sees this algorithm being applied at 60 generations per second. We have had it running at 357 generations per second! However, at that rate, the patterns looked more like a flickering flame than like discrete particles, so we slowed it down.

DIGITAL DRAWING
The next family of interactions give the participant explicit control over a simple medium. In DIGITAL DRAWING, a participant can draw on the video screen using the image of her finger (PLATE 4). This interaction is the automated version of the drawing process that was discovered in METAPLAY in 1970. If several people are in the environment, each is assigned a different color. Early in the evolution of this interaction, we noticed that people waved their hands over their drawings when they wanted to erase them. Since we made this observation, VIDEOPACE has interpreted an open hand as a command to erase the screen. To participants, it is a delightful affirmation of humanity to find that a bit of magic that they wanted was anticipated and made part of this new universe. Participants can erase selectively by "rubbing" two fingers held close together over a part of the image.

DIGITAL DRAWING is an extremely successful interaction. It is somehow liberating to be able to draw on a screen across the room without holding anything. It is a pleasure to be able to erase the screen so totally, so immaculately. That the experience has scale is also important. Drawing on a wall-sized screen is very different from drawing on a piece of paper or a monitor.

FINGER PAINTING
FINGER PAINTING is a variation on the drawing interaction (PLATE F). The image of each finger creates a stream of flowing paint. As in METAPLAY, the participant’s image is not shown on the screen in this interaction. The painted image looks more attractive without the intrusion of the silhouette. However, the participant’s control of the painting process suffers when he cannot see his image.

VIDEOSYNCRASY
VIDEOSYNCRASY is another variation on the drawing theme. Your finger traces an invisible path traveled by pulses of light that have a decaying tail. Particles follow the path, accelerating and decelerating along its length. Since new particles start the path at fixed intervals, there is a tendency to synchronize the current drawing process with the particles that are visible. By timing the act of drawing appropriately, you can create a unified rhythmic pattern. To accomplish this effect, you consciously rock back and forth as you draw, synchronizing your movements with the pattern you have drawn so far.

VIDIOCY
Another playful interaction that provides direct control is VIDIOCY. Each finger can be used to fire a graphic bullet that travels across the screen and explodes when it hits another person (Fig. 3.12). The visual effect is quite comic. We always show this interaction when people ask about military applications.
CAT'S CRADLE

cat's cradle lets you play with graphic string. A graphic curve appears on the screen, attracted by your fingertips in the image (Fig. 3.13). The curve adapts to the movements of the fingers, no matter how fast the fingers appear and disappear. The effect is exactly the same as it would

be were you playing with graphic string—except that there is nothing there. Three or four people will often cooperate to control the curve. More fingers create more complex shapes.

SPLINEMAN

spline man gives you a new graphic body. A graphic curve is loosely fitted to the outline of your silhouette (Fig. 3.14). That curve then becomes your body. As you move, you discover the possible shapes this form can attain. The result is like shadow play. Your new body is essentially a puppet. If two people are in the environment and their images overlap, both of them are wrapped in a single curve. The resulting shape loses its human origins. The effect is much like two children playing under a blanket.

One day, during an exhibit at the Computer—Human Interaction Conference, I came into VideoPlace to find two researchers lying on the floor with their feet up in the air. They were making a W. As I watched, they performed X, Y, and Z. I had missed the rest of the alphabet. I then recognized one of them as Scott Kim, known for his creative calligraphy and word play, author of Inversions [1].

Transformations of Human Images

The next class of interactions frees your image from the constraint of gravity. As noted earlier, your image can be moved, scaled, and rotated in real time. If your image fills the screen, there is a limited number of relationships that you can enter into with graphic objects or
graphic creatures. On the other hand, if your image is small, you are free to move around the screen. You can hide under graphic objects, float over them, or play with cursors on equal terms.

HUMAN CRITTER
The oldest interaction in this genre is HUMAN CRITTER. Your image is reduced to one-tenth of its normal size. You fly your image about the screen by pointing your hand in the direction you want to go.

After one minute of erratic flight, a box appears at the bottom of the screen. The intent of the box, like the second symbol that appeared during the MAZE interaction in PSYCHIC SPACE, is to lure you into landing on it. Although the attraction is not as strong, participants usually land on the box in a short time.

When you alight, your image starts to grow. Your new body consists of your original image and its mirror image reflected downward (Fig. 3.15). After spending a few moments exploring the behavior of your new body, you discover that you can use the hands of the reflected image like feet. If you raise your hands, the image of your reflected arms lengthens and pushes against the graphic platform, elevating your body.

After further experimentation, you discover that raising your hands rapidly propels your body off the box. You can jump in the air and descend back to the box under simulated moon gravity. During the slow descent, you can twist and turn, posing your vertically reflected body.

On your fifth jump, the launching pad disappears, and a new platform appears on your left. When you reach this new stage, a host of new images joins you. They hold hands with one another to form a chorus line—the Rockettes. Each of these silhouettes is from an earlier moment in time. Your movements ripple down the line in true Busby Berkeley fashion (Fig. 3.16).

MANDALA
In MANDALA, seven copies of your silhouette are arranged in a circular pattern on the screen. The left edge of one silhouette is joined to the right edge of the adjacent one, creating a pattern that initially appears to be abstract (Fig. 3.17). Movements of your limbs are repeated simultaneously all around the pattern. Raising an arm causes a concentric movement from the outside to the inside of the MANDALA. The size of the circular pattern changes as you move. The resulting kaleidoscopic medium can captivate people for an hour. Participants often move smoothly in and out of awkward postures that suggest they are doing Tai Chi in free-fall.

Skiing
By shrinking your image, we can place you in a graphic scene. Although it would be trivial to create an elaborate setting in which interactions can
occur, our informal rule has been to put nothing on the screen with which participants cannot interact. Creating a truly interactive setting is a more difficult problem. One simple example that has been implemented in VIDEOPACE places your silhouette on graphic skis at the top of a graphic mountain (Fig. 3.18). To maintain your equilibrium, you must bend your knees and control your center of gravity. If you do this when you hit the jump, you take off and land smoothly. If you fail to bend your knees, you wipe out, and end up rolling down the hill.

VIDEODESK ↔ VIDEOPACE Teleconference
One fundamental ingredient in the original Metaplay exhibit and in the Bicentennial Proposal was telecommunication. In 1987, I became nostalgic for the personal contact between the artist and audience that Metaplay had required. There was a nice amateur feeling about Metaplay. Much of what happened was unexpected, discovered jointly by the artist and participants.
In Metaplay, human intelligence stood in for future computer intelligence. It seemed time to use human intelligence again, to control the sophisticated computer reflexes that were now part of VIDEOPACE.
A second VIDEOPACE environment had been created so that we could continue development while the first system was being exhibited. Since we had only one video projector, this second environment was limited. It consisted of a light table with a camera mounted above and aimed down at the table’s surface (Fig. 3.19). If you rested your hands on the table, their image appeared on a monitor in front of you.
When the exhibit system returned, it was natural to connect the two systems together so that the giant image of one person’s hands was juxtaposed with the image of the other person’s body, which could be full screen or scaled down in size. By itself, this visual effect was interesting. Many of the VIDEOPACE interactions can be shared by the people in the two environments. They can play with CATERPILLAR OR CAT’S CRADLE. They can cooperate on a drawing. Without instruction, people pick up tricks that they see the other person use.
To date, the person at the VIDEODESK has been an informed participant who understands the system. There is a menu of interactions from which to choose, operated by VIDEOTOUCH. The person at the VIDEODESK plays hostess to the participants in the VIDEOPLACE environment.

Our purpose in putting human intelligence in control of the computer reflexes was to force ourselves to focus on issues such as choosing new interactions intelligently, timing novel responses, teaching the other participant about the interactions, and seeing whether a vaudevillian sense of humor could be conveyed interactively. Just as we later automated the decisions we made during METAFLAY, we plan to use this experience to improve the intelligence of the system.

TICKLE
tickle dates back to the 1972 "VIDEOTOUCH" proposal submitted to the National Endowment for the Arts. If a person in one environment touches the person in the other environment with a finger, the computer responds with a sound—the more fingers, the more sounds. Each person sounds different when touched. This interaction often becomes quite comical as people realize what is happening.

MAN-IPULATE and TELEVISION
In MAN-IPULATE, the giant hand of the VIDEODESK operator reaches in and pushes the VIDEOPLACE participant's image across the screen. After a moment, the participant typically resists, pushing back and then punching. A full-scale battle often ensues. At some point, the hand pokes the participant in the face. The participant's image tips over and pops up again. This punch line gets a genuine laugh, suggesting a whole new avenue of VIDEOPLACE interaction and performance (Fig. 3.20).
A moment later, the situation is repeated, but this time, when the participant touches the giant hand, he lops it off, sending it spinning off the screen. This interaction was put in to maintain the balance of power between the two environments (Fig. 3.21).

BALLOONACY
Another series of interactions revolves around the idea of throwing and catching. In BALLOONACY, every motion of the participant's hands causes a ball to appear and travel in the direction of that motion. If the participant tries to throw to a particular location, one of the balls will go there. The purpose of this phase of the interaction is to introduce the idea of throwing. Gradually, fewer balls are created, until only a single ball appears with each throwing motion.

At this point, the giant hand appears. The participant throws a ball toward it. The hand extends a finger. The ball orbits around it and proceeds back to the thrower, who discovers that he also can attract the ball with his hand and accelerate it smoothly back toward the hand. After a few minutes of this play, the VIDEOPLEX hand positions itself with four fingers extended vertically so that they appear as one in silhouette (Fig. 3.22). The thumb is opened to the left, making a basket and inviting the participant to shoot. When thrown, the ball hits the upright fingers and bounces off the backboard they form. It then bounces on the thumb and back to the backboard before sinking in between thumb and forefinger.

for a score. Actually, no points are awarded. Instead, the giant hand reaches over and pats the tiny participant on the head.

ARTWHEELS
In ARTWHEELS, your image rolls down a graphic string extended between the upright forefingers of the desk operator's two hands (PLATE 6). If you are in VIDEOPLEX, you can change your shape by raising and lowering
VIDEOPLACE

your arms and kicking your legs. This motion influences your movement down the string. It is also possible to do cartwheels along the contour of the VIDEOPLACE operator's hands. By shifting your center of gravity, you can control the direction in which you roll. If the second giant hand is nearby, you can decide whether you want to reach for and swing to that hand. It will soon be possible to leap from one hand to the other and to do gymnastics by swinging from finger to finger.

HANGING-BY-A-THREAD
The final two way interaction is one of my favorites, both for its simplicity and for its wordless communication of a subtle opportunity that is usually grasped instantly by the participant. In HANGING-BY-A-THREAD, the v Encore hand appears with a string hanging down from the extended forefinger. The image of the VIDEOPLACE participant is dangling at the end of the string (PLATE 5).

After a moment's investigation, the participant wonders whether it is possible to swing on the string. He shifts his weight from side to side, and his image shakes a bit. Then, he moves more obviously from side to side, and his image starts to swing. By synchronizing his movements with the swinging on the screen, he can pump for greater elevation.

Everyone wonders, is it possible to do a 360? By running back and forth frantically, the participant can make his image swing over the top. The crowd cheers. Then, the giant finger twitches, sending his image flying. The v Encore participant demonstrates her superior power by effortlessly twirling the participant around and around. This scenario is not hypothetical or even unusual—it has been repeated many times.

VIDEOPLACE Plans

I would like to tie together many VIDEOPLACE environments across a great distance. Each participant would enter a large and complex graphic world from a different physical location. Each would see only a small portion of that world, including her own image and those of other participants who are also in that part of the graphic world. The participant could interact with the others or could leave the current location and travel to a different part of the graphic world. Along the way, she would encounter other participants from other real locations. Such a megaenvironment could include hundreds of participants (Fig. 3.23).

Figure 3.23
The Megaenvironment.

Now that the medium has been created, we must balance its various components so that all are equally mature. In particular, auditory responses have thus far received less emphasis than have visual ones. We have been working to improve the sound responses, and to include an auditory component in all interactions. In addition, many of the current interactions define a single relationship for the participant to explore. In the future, interactions will unfold, creating plausible sequences with smooth transitions that fit together like the scenes in a well-edited movie.

Simultaneously, we will upgrade all aspects of the medium. High-resolution graphics will permit smooth animation and three-dimensional graphic scenes. High-resolution cameras will allow the computer to
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watch the participant's whole body and yet still to discriminate small features, such as the fingers. With a higher video sampling rate, the system will be able to track rapid movements more accurately. By using several cameras, the system will perceive the participants' movements in three dimensions. As always, the purpose of these improvements will be to produce more sophisticated, more interesting, and more compelling interactive compositions.

Conclusion

I always saw VIDEPLACE as closely related to a technology that had been invented earlier by Ivan Sutherland and that we shall discuss in the next chapter. I saw my work on unencumbered full-body participation and telecommunication as complementing his. Both technologies were instances of a larger concept that I called artificial reality. An artificial reality is a graphic fantasy world in which a person uses her whole body to participate in an experience created by the computer. I realized that this was more than a technology—it was a culture-defining concept. From the beginning, I wanted to establish an interdisciplinary facility in which to develop the medium, and to ensure that it was applied to aesthetic, scientific, and practical ends simultaneously.

References