Immersion in Technology: Art and Virtual Environments

Edited by Mary Anne Moser

ARTECA
From the MIT Press

Embodied Virtuality: Or How to Put Bodies Back into the Picture

N. Katherine Hayles

Cyberspace, we are often told, is a *disembodied* medium. Testimonies to this effect are everywhere, from William Gibson's fictional representation of the "bodiless exultation of cyberspace" to John Parry Barlow's description of his virtual reality (VR) experience as "my everything has been amputated." In a sense, these testimonies are correct; the body remains in front of the screen rather than within it. In another sense, however, they are deeply misleading, for they obscure the crucial role that the body plays in constructing cyberspace. In fact, we are never disembodied. As anyone who designs VR simulations knows, the specificities of our embodiments matter in all kinds of ways, from determining the precise configurations of a VR interface to influencing the speed with which we can read a CRT screen. Far from being left behind when we enter cyberspace, our bodies are no less actively involved in the construction of virtuality than in the construction of real life.

If it is obvious that we can see, hear, feel, and interact with virtual worlds only because we are embodied, why is there so much noise about the perception of cyberspace as a disembodied medium? Perhaps we can find a clue in how the constructions of virtuality are constituted. To create the illusion of disembodiment, it is necessary to draw a sharp boundary between the body and the image that appears on screen, ignoring the technical and sensory interfaces connecting one with another. Then the screen image (which can be made to appear three-dimensional by exploiting certain characteristics of human visual and aural processing) is reified, treated as constituting a world opening up behind the screen, an alternative universe that our subjectivities can inhabit.

The final step is to erase awareness of the very perceptual processes that brought this "world" into being. The tautology that makes the illusion compelling is now close to the surface: we want this alternate world to exist so that the body can be left behind, and we know the body can be left behind because this world exists.

Why do we want to leave the body behind? No one has inscribed this desire more clearly than Hans Moravec, head of the Carnegie-Mellon Mobile Robot Laboratory. In *Mind Children,* Moravec argues that the age of the protein-based life forms is drawing to a close, to be replaced by silicon-based life forms.[1] Humans need not despair, however, because they can have their consciousness downloaded into a computer. In the fantastic scenario in which he imagines this operation, Moravec has a robot surgeon cut away a human brain in a kind of cranial liposuction until all the information the brain contained is inside the computer and the skull is empty of brain tissue. Moravec reasons that once human consciousness is safely ensconced inside a computer, it is effectively immortal. If the computer begins to wear out, consciousness can simply be transferred to a new machine.

In this scenario and throughout his text, it is apparent that Moravec equates subjectivity with the mind. The body is treated as a flawed and unwieldy vehicle, necessary in the early stages of human evolution but now become more trouble than it is worth. In the new age of virtuality, as Moravec sees it, the mind will continue unchanged in its incarnation as electronically coded information, and the body will fade away as a superfluous accessory.

Traditionally the dream of transcending the body to achieve immortality has been expressed through certain kinds of spiritualities. Dust to dust, but the soul ascends to heaven. Moravec's vision represents a remapping of that dream onto cyberspace, with an important difference: reversing a long-standing opposition between science and religion, he enlists technoscience as the ally of out-of-body transcendence. To achieve this apotheosis one does not need spiritual discipline, only a good robot surgeon. Such a vision is nurtured by a cultural tradition that has long dreamed of mind as separate from body.

At the end of the twentieth century, it is evidently still necessary to insist on the obvious: we are embodied creatures. Fantasies asserting otherwise can have dangerous consequences. Although this is not the place to debate the technical feasibility of Moravec's project, it is worth remembering that no technology exists that can come remotely close to transferring mind into computer. Moreover, even if such a transfer were possible, mind inside a computer could not possibly remain unchanged from humanly embodied mind. Human consciousness has evolved through millennia with the specific physical structures that comprise its instantiation. Remove these, and everything else changes as well.[2] More objectionable still, the scenario represents an escapist fantasy that late twentieth-century inhabitants can ill afford. Scratch the surface of Moravec's rhetoric and that of like-minded visionaries, and you will find scarcely concealed anxiety about our continued existence on a planet despoiled by environmental poisons and decimated by AIDS. Ironically, such fantasies may be complicit in furthering the very anxieties that engender them. If we can live in computers, why worry about air pollution or protein-based viruses?

The fantasy also has implications for gender politics. Inscribing the female power of reproduction into a technological scenario of (male) parthenogenesis, it identifies subjectivity with the rational mind that has traditionally been encoded masculine, leaving behind the materiality of the body that has been identified with the feminine. Male form, female *materia;* male seed, female ground.[3] Now the (male) technoscientific mind devises for itself a new body, not born of woman, that it imagines will be more suited for its rational thought processes and immortal yearnings. To unpack the implications of these associations, notice that one set of dualisms, male/female, reinforces and powerfully interacts with another, mind/body. As Nancy Leys Stepan has shown using instances of race and gender, the characteristics of one duality can transfer onto another when the two are consistently associated.[4] She instances the notion, popular in the late nineteenth century, that "women are the blacks of Europe." How do such metaphoric equivalences come about, and what implications do they transport from one discursive register to another? In the black/white duality, the black

race is discursively constructed as the opposite of the white race, which is assumed to be primary and originary. Women are similarly constructed as the "opposite" sex to men, who are the original and normative sex. Opposite to blacks are white (men) and to women, (white) men. The analysis reveals the implicit or hidden terms, (white) (men), that are understood but not stated in the white/black and men/women dualities. For the hegemonic terms, *white* and *men,* the hidden components create an area of overlap, white men, around which privilege and value can cluster. For the stigmatized terms, *black* and *women,* the overlap creates an association that brings them into correspondence—hence the expression equating blacks and women. The regulated exchanges that comprise this traffic take place in discourse, but the effects are not limited to verbal formulations. In this instance, they led to extensive studies in physiogomy attempting to show that women and blacks had smaller heads, and therefore supposedly less capable brains, than white men. Here metaphoric equivalences were substantive, for they sparked experiments designed to transmute them into scientific fact.

Similar metaphoric mappings underlie the erasure of the body from cyberspace. The dualities line up as follows: mind is superior to body; silicon technology is superior to protein organism; man is superior to woman. Therefore replace the body born of woman with a computer that can serve as a fitting receptacle for the (male) mind. The privileged terms (mind, computer, male) are linked together in mutually reinforcing connections that seem to make it possible to erase or leave behind the stigmatized terms (body, organism, female). The construction of cyberspace thus happens in two ways simultaneously, through technological interventions and discursive practices. To put the body back into the picture, both need to be addressed.

Cyberspace discourse and technology, metaphor and practice, come together in the concept of virtuality. Let us linger at this crossroads, looking at the high-speed traffic across it as a means of understanding the associations and connections that are in the process of constituting the virtual body. For our purposes, virtuality can be defined as *the perception that material structures are*

interpenetrated with informational patterns. To see how virtuality marks a crossing, consider the Smart House designed by the American Homebuilders Association at a cost of six million dollars. The Smart House uses state-of-the-art equipment to tie all the major house systems—lights, heating, plumbing, windows, and so forth—into a central computer. Lights and heating are adjusted automatically when the owners return or leave; doors lock and unlock appropriately; window shades are drawn or opened. Each of these objects exists as a material structure and can be understood as such. The thermostat, for example, consists of a plastic case, a thermometer, various colored wires, and a mercury switch. But the objects can also be understood as components in an information circuit. The thermostat communicates with the central computer, the air conditioner, and the heating system. The thermostat is virtual because it cannot fully be understood as a material structure; only when its communication and control function is considered does its design make sense. This view of the thermostat is hardly new, dating back to its inception in the nineteenth century. What is new is the extension of this view to a larger environment, in and out of the Smart House. Insofar as the Smart House is doubly encoded, existing both as physical objects and as instantiations of information flows, the Smart House is a microcosm of contemporary first world culture.

Nowhere is this trend toward virtuality more apparent than in the construction of the human body. Since the early twentieth century, the body has been understood in a variety of fields both as a physical structure and as an informational pattern. In the 1940s, Erwin Schrödinger urged biologists to see the body as an expression of genetic information in his influential work *What Is Life?*, a challenge that has been taken up in the Human Genome Project.[5] Coming from the different tradition of cybernetics, Gregory Bateson in the 1950s asserted to his contemporaries that "information is primary."[6] What this meant had been laid out by Norbert Wiener's 1948 *Cybernetics,* which modeled complex behavior through electrical circuits employing the cybernetic principles of negative and positive feedback loops.[7] By the 1980s, the body had been conceptualized in such cyberpunk novels as *Neuromancer* as a cumbersome appendage that

5

consciousness could leave behind when it vaulted into cyberspace.[8] By 1990, researchers at Xerox Palo Alto Research Center (or, as it is known in the trade, the PARC) had begun to talk about embodied virtuality, envisioning a virtualized environment that would communicate fully with the human subject through a variety of miniature computers embedded in and on the body.[9] Employees at the PARC are provided with interactive badges that communicate with sensors in the ceilings, which in turn signal information about the employees' locations to a computer network. In this practice the body, understood biologically as an expression of genetic information, communicates with its environment through external and internal information circuits into which it is fully integrated. Like the objects surrounding it in the Smart House, the body is neither simply material object nor informational pattern but both at once.

The crossings and interpenetrations constituting the virtual body call for a more sophisticated and nuanced approach than simple binary thinking can provide. It is when one duality is chosen over another—when the body is seen only as information—that its erasure seems possible. Putting the body back into the picture requires a mode of analysis that can complicate and unravel the simple dualisms that underlie its erasure, while still acknowledging the force and efficacy of these dualisms in creating cultural constructions. For this task, I will use the semiotic square, a technology of discursive analysis developed by A. J. Greimas and transported into the United States by Ronald Schleifer, among others.[10] The semiotic square is designed to unpack the implications inhering in a binary pair by making explicit the hidden terms that help to stabilize meaning and generate significance. As with the white/black and men/women dualities, explicating areas of overlap shows how associations travel across metaphoric networks to do political work within the culture. Once the concealed terms have been made explicit, I will use them to explore more fully how the virtual body is discursively constituted. Then I will turn to the practice of three artists working in virtual reality technologies to show how the simulations they create challenge, in another mode, the assumption that cyberspace is a disembodied medium.

———

THE SEMIOTIC SQUARE AND THE VIRTUAL BODY

The construction of a semiotic square begins with the choice of a binary pair. Since I am concerned with the material presence of the body, the first term I choose is presence. The second term is generated by taking the negative of the first term: absence. Presence and absence thus comprise the primary duality for my square. It is no accident that this duality has played a central role in the development of poststructuralist theory. In deconstructive analysis the plenitude and self-sufficiency of presence is revealed as a linguistic illusion, a sleight-of-hand that texts practice when they bootstrap themselves into existence by positing an origin outside themselves.[11] Deconstruction points out that presence, far from being self-evident, can stabilize its meaning only through its difference from absence. Thus the duality of presence and absence in the semiotic square signifies concepts in dynamic interplay with each other rather than independently existing terms. This interplay is indicated by a double-headed arrow connecting the terms.

The Beginning of a Semiotic Square

Presence ↔ Absence

The second duality needed to transform the figure into a square is generated by choosing a term that is like the privileged first term of presence, but different from it by being absent where it is present. (The language here is confusing since presence and absence have already been put into play, but bear with me. The relationship between the first and second pairs should become clear shortly.) The purpose of choosing the second duality is to unfold implications contained in the first pair. There is thus no unique solution but a series of solutions, each of which unfolds different implications. Since my interest lies in the construction of the body in information technologies, I choose as the third term a concept important to information theory: pattern.[12] Pattern is like presence in that the recognition of pattern is often associated with the perception of presence. When

————

7

the pattern of a dark blob is recognized, for example, it becomes a tree rather than a shadowy mass. But unlike presence, pattern need not imply the material existence of an object. Films, for example, rely on viewers to recognize visual patterns on the screen, even though the objects figured by these patterns are absent. The fourth term is generated by taking the negative of pattern: randomness. We are now in a position to lay out the four terms of the square.

The Complication of a Duality in the Semiotic Square

materiality
Presence ↔ Absence

information
Randomness ↔ Pattern
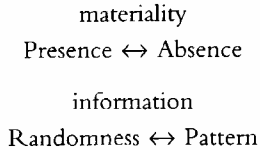
Since the interplay between presence and absence generates the material world, the axis connecting these terms is labeled "materiality." Similarly, the interplay between pattern and randomness generates "information." Information is formally defined by the theorems and assumptions of information theory, formulated by Claude Shannon in the late 1940s.[13] In its technical sense, information remains conceptually distinct from markers that carry it, such as radio waves or newsprint. The quantity of information in a message is mathematically defined as a function of the probability distributions of the message elements. The distributions are calculated along a scale that ranges from complete predictability to complete unpredictability or randomness. In his commentary on Shannon's theory, Warren Weaver explained that information must have some pattern to distinguish it from noise. If it is entirely predictable, however, it is mere repetition rather than new information. A message conveys maximum information when it is balanced between surprise and expectation. Thus information evolves as a dance between pattern and randomness. The lower axis expresses this interplay.

Now that both sets of dualities are in place, the semiotic square can be used to investigate the implications of virtuality as a crossing between materiality

8

and information. These implications are made explicit by considering the relationships that tie the various terms to one another. The semiotic square is designed to exhaust the relational possibilities between the various terms. For our square, the diagonal connecting presence with pattern can be labeled "replication," for when presence and pattern coincide, object and form are united with no dissonance or separation between them. This is the realm of mimesis, ruled by commonsense assumptions about objects that maintain their form through time. The diagonal connecting the negative terms of absence and randomness can be labeled "disruption." Just as absence disrupts the plenitude of presence, so randomness disrupts the expectation that pattern will be replicated over time.

Virtuality and the Semiotic Square
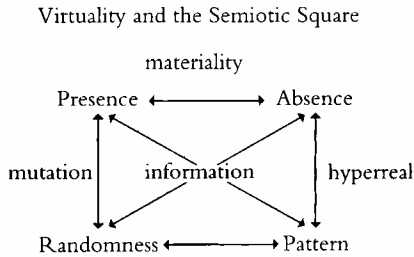
The vertical axis connecting absence and pattern signifies what Jean Baudrillard has called the "hyperreal."[14] The hyperreal comes about, Baudrillard explains, when the chain of displacements connecting a series of imitations to an original becomes so attenuated that the original is lost as a referent. Consider, for example, an audio compact disk produced by sampling sounds from several different recording sessions and digitally manipulating them to achieve the desired effects. There never was a recording session that sounded like the music on the disk, yet clearly the disk is a copy of something. In fact it is a simulacrum, a copy without an original. The simulacrum gives a sense of being a copy because it replicates a pattern, but in the absence of a referent it becomes a copy without an original. The phenomenon of the hyperreal is predicted by

9

the semiotic square as a result of the interplay between the axes of materiality and information.

Continuing with our analysis, we can label the vertical axis connecting presence and randomness as "mutation." Mutation occurs when random variation becomes physically manifest in a material object. Random variations in the genetic code, for example, can result in a freak or mutant. It is no accident that mutation has become an important theme in postmodern literature and culture, for when information is the coin of the realm, the dance between pattern and randomness is central.[15] The mutant is visible proof that randomness is always already present, capable of disrupting pattern at any moment. As with the hyperreal, the semiotic square predicts that mutation would become an important topic once presence/absence is put into interplay with pattern/randomness.

As numerous commentators have pointed out, including Fredric Jameson and Shoshana Felman, the four nodes of the semiotic square recall the four quadrants of a Cartesian graph.[16] The Cartesian analogy helps to explain why the positive term of the second pair, pattern, is placed on the lower right rather than the lower left. In Cartesian grids, the lower right quadrant represents a positive x-value combined with a negative y-value. Recall that pattern is generated by taking the absence of the positive first term, presence; it therefore represents the combination of a positive and negative, analogous to the third quadrant. The fourth term, randomness, is produced by taking the negative of the third term, pattern, which is already marked by negativity. Thus the fourth term represents a negation of a negation. Because of this double negation, it is the least explicitly specified of all the four terms, and therefore the most productive of new complications and insights. It is from the "elusive negativity" of the fourth term, as Felman calls it, that the new is likely to emerge, for the fourth term carries within it the most noise and the fewest expectations about what it will be.

What does the semiotic square as developed above tell us about the virtual body? It shows schematically the possible relationships that can emerge when materiality and information mutually imply each other, thus providing a theoretical framework in which such apparently diverse ideas as hyperreality and mutation can be understood as different manifestations of the same underlying

phenomenon. In David Cronenberg's *The Fly,* for example, a scientist believes that if he can transform his body into information, he can transport it instantaneously across distance. He tries the experiment on himself, but a fly inadvertently enters the chamber with him, so that the information of the two bodies gets jumbled together. Is the body that comes out of the transformer after this event the original, or a copy? We might be tempted to say it is the original—at first the scientist appears to be exactly what he was—until the horrifying changes start that will transform him into a monster. As these differences erupt into physical expression, it becomes clear that a random event has intervened to alter the pattern of the man's genetic information.

So the body that emerges is not the original but an imperfect copy. But then, the putative original of this copy bears within itself the stamp of an earlier event (the cell division and chromosome mixing that occurred when sperm fertilized egg) that marks it as a copy rather than an origin. The information contained in that sperm and egg also came from prior events, namely the fertilizations that created the phenotypes who produced the sperm and egg. Thus the origin is displaced into a receding series of genetic events stretching back into the dim mists of prehistory. This displacement provides the basis for Richard Dawkins's argument that human beings are mere "lumbering robots" operated by our genes, who manipulate us for their own selfish ends.[17] Dawkins almost certainly had no knowledge of Baudrillard's work when he wrote *The Selfish Gene,* but it is not difficult to see that, in Baudrillard's terms, his argument implies that human beings are simulacra, copies without originals. The power and efficacy of being associated with an origin is taken out of the realm of human subjectivity altogether and given to the "selfish genes." When the body is an informational pattern, the origin is understood as the point where the pattern begins, not where spirit or breath enter. Like the mutant, the selfish gene testifies that the solidity of flesh is interpenetrated and rendered vulnerable by the informational patterns that determine its destiny.

The devastating effect this interplay between pattern and presence can have on traditional concepts of identity appears in a different mode in *The Fly,* which teaches that the physical durability of the body is an illusion. When the body is an expression of an informational pattern, randomness can always intervene

----

11

to disrupt or change that pattern. Moreover, although the eruption of randomness into the body is represented as an accident in the film, it is not really an accident but an inevitability waiting to find expression in the physical world, for the very existence of pattern implies a background of nonpattern or randomness against which pattern can be perceived as such. Because pattern and randomness do not exist in isolation from one another, it is impossible to guarantee that one will not leak into the other. I am reminded of the wonderfully oxymoronic phrase that Emerson used in a euphemism for death: "If perchance the inevitable should happen . . ." The disruption of pattern by randomness is as chancy—and as inevitable—as death.

The semiotic square, evoking a space in which randomness can couple with presence and absence can interpenetrate pattern, suggests that the evolution of deconstruction is not yet complete. Beyond poststructuralism lies the posthuman, which can be understood as the realizations that await us when the dialectic of presence/absence is integrated with the dialectic of pattern/randomness.[18] Put another way, the posthuman represents the construction of the body as part of an integrated information/material circuit that includes human and nonhuman components, silicon chips as well as organic tissue, bits of information as well as bits of flesh and bone. The virtual body partakes both of the ephemerality of information and the solidity of physicality or, depending on one's viewpoint, the solidity of information and the ephemerality of flesh. I believe that those who nostalgically try to deny the importance of information in understanding the virtual body are as misguided as those who, like Moravec, try to reduce the body only to information. Either position misses the complexities of the crossings and interpenetrations that constitute the virtual body at this cultural moment.

CROSSING THE VIRTUAL DIVIDE

The cultural constructions that identify masculine subjectivity with the mind, female subjectivity with embodiment, may be responsible for actual physical differences in how men and women react to immersion in VR. When a user

4. Brenda Laurel and Rachel Strickland, *Placeholder* (1993), installation view with programmers Dorota Blaszczak (foreground) and John Harrison in the helmets and Glen Fraser (far left) watching the monitors. Photo Donald Lee and Cheryl Bellows.

enters a VR simulation, body boundaries become ambiguous. Body motions affect what happens in the simulation, so that one both is and is not present in the body and in the simulation. The body marks one kind of presence; the point of view, or pov, that constructs the user's position within the simulation marks another. As a marker of subjectivity, pov is more than an acronym, more even than a noun. In the parlance of VR, it functions like a pronoun, a semiotic container for subjectivity. According to anecdotal evidence from a number of researchers, including Sandy Stone and Brenda Laurel, women are apt to feel more disoriented by the transition to and from VR than men, and they are more prone to motion sickness while in VR.[19] The reason, these researchers conjecture, is that men adapt more readily to the idea that pov can move independently of the body, whereas women are accustomed to identifying pov with the body. Although this informal observation remains to be tested by a systematic study, its performance is already being staged in a variety of cultural documents.

It forms a powerful subtext for *Neuromancer,* the novel that made cyberspace a household word. Case, the male protagonist, sees his body as so much "meat." He feels completely alive only when he is in cyberspace, where his physicality is transformed into a dance of information. Molly, assigned to protect Case and to run interference for his hacking, is a cyborg warrior who delights in her physical prowess. Whereas virtuality for Case means leaving his body behind, for Molly it means modifying her physicality to make it into a more effective weapon. Occasionally Case will need sensory input when he is in cyberspace. By flipping the appropriate switch, he can transport his consciousness inside Molly's sensorium and voyeuristically share her sensations of her body. The difference between riding in a sensorium as a passenger and being constituted through the sensorium is sharply drawn when Molly is injured. Whereas Case can flip back to cyberspace to escape the pain, Molly has no choice but to endure it. Gibson's text illustrates how the experience of virtuality gets overlaid with an encoding that constructs the ephemerality of information as masculine and the materiality of the body as feminine. Virtual reality is no exception to the observation made by many feminist theorists that wherever dualistic hierarchies

14

exist, the privileged term is identified with masculinity and the stigmatized term with femininity.

Feminist responses to a construction of cyberspace as an escape from the body are enacted along a spectrum of resistance, from contestations of what physicality means to reinterpretations of what it implies to reconfigure the physical body with virtual stimuli. Each of these interpretations is struggling to establish itself in a field dominated by militaristic values and male high-tech culture; none is secure from reappropriation by masculinist projects. Although the artistic projects I want to discuss operate from different assumptions, they share a common goal of forcing a reexamination of physicality in an age of virtuality. Moreover, even an analysis of their differences helps to vivify the stakes in how the technology is interpreted and understood.

Brenda Laurel and Rachel Strickland's *Placeholder* simulation illustrates one kind of artistic response.[20] Laurel and Strickland wanted to create a simulation that would model for the VR industry a different aesthetic than the violence, sexism, and racism that are staples of video game productions. They envisioned a simulation that would situate embodied actions within an interactive environment. They wanted the aesthetic choices to grow out of a respect for the complex interactions that take place between embodied creatures and the world they inhabit. Reflecting these priorities, the first choices they made were the sites that would serve as models for the environments recreated in the simulation. They explored the breathtaking terrain around Banff and finally settled on three locales: the vertical rock formations known as the hoodoos, revered by native people as the home of spirits; a natural cave; and a mountain waterfall. They shot panoramic videotapes of each site at four different times of the day and used the tapes to lay video tiles onto wireframe models to create the landscapes for the simulation.

Having chosen the sites, they worked with actors from Precipice Theatre, an improvisational troupe, to create narrative material that could be incorporated into the simulation. Some of this work took place in the troupe's regular rehearsal space, but some of it was done on location. The actors hooted at the hoodoos, splashed in the waterfall, dripped in the cave along with the stalactites.

15
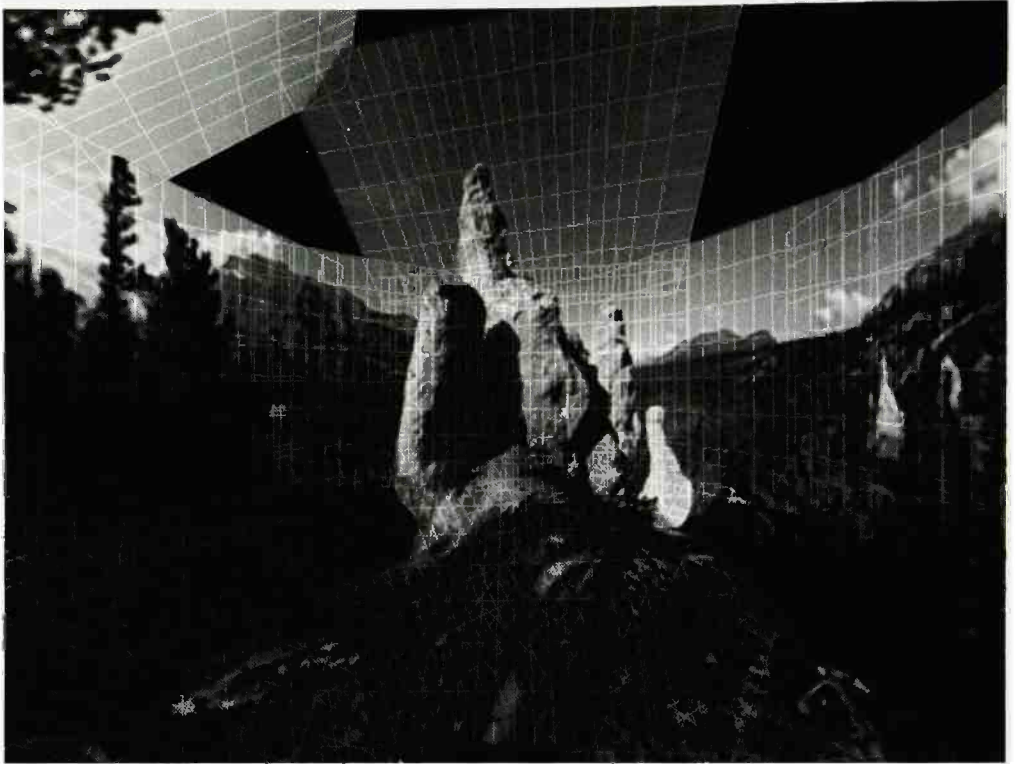
5. Brenda Laurel and Rachel Strickland, *Placeholder* (1993), video image showing the tiling for the Hoodoos environment. Digital image courtesy the artists.

As they interacted with the environments, the idea grew that the simulated environments should be animated. Laurel and Strickland commissioned Russel Zeidler, an architect, to come up with an icon, reminiscent of a petroglyph, that could be used to give a local habitation and a name to the simulated landscape. Zeidler created a schematic face that functions as a "voiceholder," a virtual container that holds recorded messages. When a user touches the face icon, its eyes open. The user can then collect the recorded messages that others have left or leave a calling card herself.

Embodiment in *Placeholder* is enacted through Smart Costumes. To interact with the simulation, a user chooses one of four forms: spider, crow, snake, or fish. In the simulation, the user visually appears as her chosen form. Moreover, voice filters are used to alter the user's voice in ways characteristic of the four Smart Costumes. Crow sounds raucous and masculine, spider wise and feminine, whereas snake and fish are gender-indeterminate. Movement functionalities are determined by the form of embodiment the user chooses. Crow can fly, for example, while the other forms cannot. With snake, vision is affected as well, shifting into the infrared. It is important to note that the simulation does not restore a "natural" connection between the user's pov and the body, most obviously because human beings do not naturally have sensoriums that process information in these ways. The person who experiences this simulation is a techno-bio-subject whose body has been resurfaced and reconfigured by its interface with the technology. What the simulation does insist upon, however, is the connection between pov and incorporation. It is not possible, the semiotics implies, to have experiences without a viewpoint constituted through sensory-motor apparatus specific to the form pov occupies.

Designed to foster interaction with the environment, *Placeholder* encourages interaction between participants as well. The simulation can accommodate two users at once. They stand in neighboring circles formed of river stones. As they interact with the simulation, they move about, learning the limits of the cables connecting them to the simulation through the tactile feedback of stubbing their toes on the stones. Each can see the other in the simulation and hear the voice-filtered comments her or his companion makes. Participants can shapeshift

---
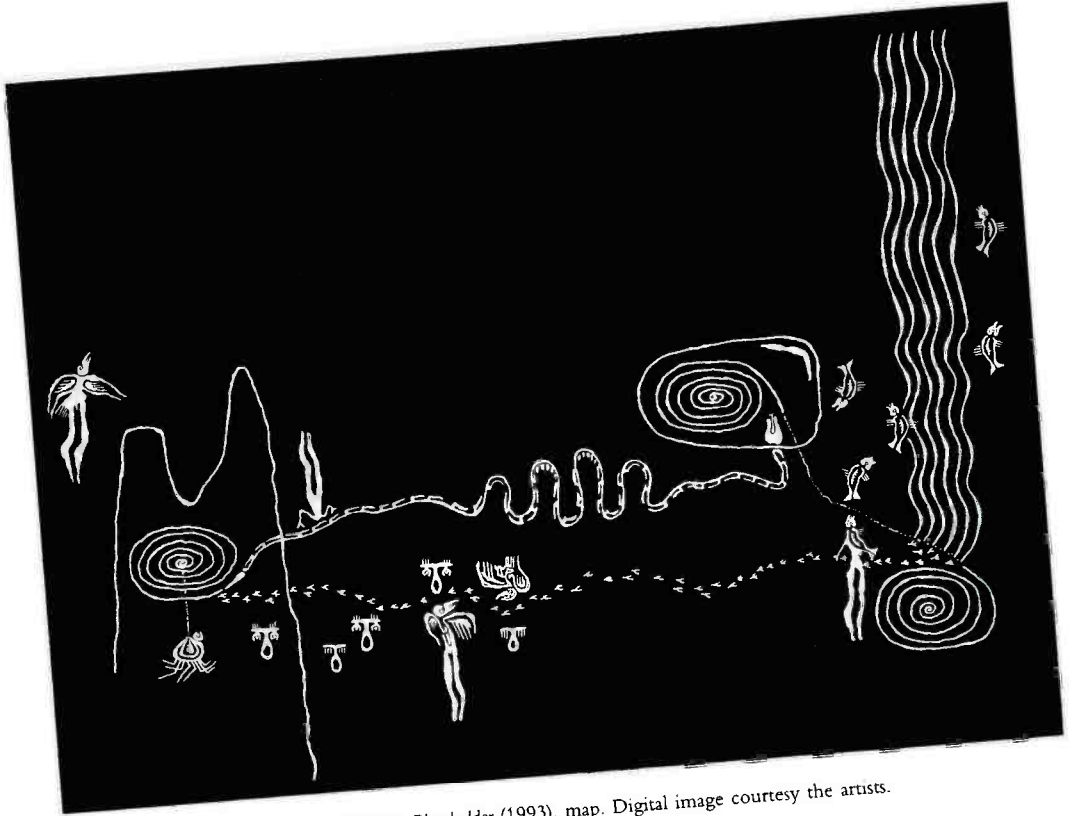
6. Brenda Laurel and Rachel Strickland, *Placeholder* (1993), map. Digital image courtesy the artists.

by touching the appropriate totemic icon. Improvising on cues provided by the environment and each other, they create narrative. To further enrich the narrative possibilities, the simulation provides for a Goddess, a role played by someone who watches the simulation on monitors and interjects comments, suggestions, and commands. The Goddess's voice is spatially localized over the user's head, giving the eerie sensation of coming from *inside* rather than outside. This role was often played by Laurel, and occasionally by others.

A simulation this elaborate does not come cheap. Consisting of over 25,000 lines of code, it ran on no less than eleven computers, including three Onxy Reality Engines and a Macintosh Powerbook. Even so, the simulation remains unfinished, only a partial realization of the ambitious project that Laurel and Strickland had intended. Plans called for further development of the narrative material provided by the Precipice Theatre group, amplification of the sensory modalities associated with the different totemic forms, and many more runs with different kinds of participants, along with even more interviews afterward to get their reactions to the simulation and their interpretation of the experience. Despite the stated aim of providing an alternative for the video game industry, the simulation is not commercially viable in its present form. It requires such a massive amount of equipment and provides so many opportunities for break-downs that in fact it never got beyond the prototype stage. Most of the runs of the full simulation occurred at Banff during an intense but relatively short period. Since then the machines that ran it have been taken off that assignment and used elsewhere. At present the simulation exists less as a running program than as the videotape records that Laurel and Strickland made to document its operation.

From these records, Laurel and Strickland produced a video on the making of *Placeholder*. Like Christo's *Running Fence,* the video will be seen by many more people than ever experienced the actual simulation. If VR is a simulation of real life, what is a video production that simulates VR? Is it not a simulacrum, a copy without an original? The aura of originality that was traditionally im-portant, as Walter Benjamin has observed, in establishing the authenticity of an artwork is here almost completely dissipated, for the video is as much or

---

7. Brenda Laurel and Rachel Strickland, *Placeholder* (1993), video image of the composition of a three-dimensional environment. Digital image courtesy the artists.

more the work of art as the VR production itself. If there is a lesson to learn in this precession of simulacra, surely it is that once materiality and information are intertwined, neither is likely to manifest itself in any simple or unambiguous way. The simulation emphasizes embodiment precisely through its artificiality, and the video captures immediacy through its mediation. When matter and information begin to copulate, more is destabilized than contemporary constructions of the body. Also at issue are traditional categories of art criticism, including orginal/copy, artist/technician, and copyright holder/paid labor. Just as it is no longer sufficient to think of the body as flesh or code alone, so it is no longer sufficient to accept distinctions that rely on putting artists in one category and technicians in another, or originals in a gallery and copies in Walmart. It is not only the human body that is undergoing a sea-change. Also in the throes of mutation is the body of art.

In the video, also named *Placeholder,* one clip shows Laurel explaining to her colleagues that if the simulation is not up and running by the time that executives from Interval Research (her employers) show up at Banff, she will be out of a job. The scene poignantly captures the stress of trying to create an ambitious artwork within the constraints of a for-profit company. Unfinished, imperfectly documented, commercially unviable, and captive to capitalist financing, *Placeholder* testifies to the importance of embodied action in many senses. In a virtual world, it is as real as it gets.

Whereas Laurel and Strickland emphasize the materiality that interpenetrates virtuality, the Canadian artist Catherine Richards focuses on the virtuality that interpenetrates materiality. Her work explores the extent to which virtuality has overtaken RL—the real life that VR researchers shorten to an acronym, semiotically declaring its equivalence to VR. In her art video *Spectral Bodies,* Richards focuses on proprioception, the sensory system that uses internal nerve receptors at joints and muscles to give us the sense that we inhabit our bodies.[21] Normally we know, without thinking about it, exactly where our body boundaries are and how to move our bodies to negotiate complex spaces and topologies. Precisely because it is automatic, the importance of proprioception normally tends to be veiled from us. In the video Richards alludes to Oliver Sacks's essay

"The Disembodied Woman," in which he writes about Christine, a patient who lost her proprioceptive sense as a result of neurological damage.[22] With great effort, Christine was able to relearn how to sit, walk, and stand; what she was not able to recapture was the sense that she was inside her body. She felt that she was positioned somewhere outside, forced to manipulate her body through conscious effort as if she were a puppetmaster moving an inert doll.

Sacks's essay is only one of many sources that *Spectral Bodies* draws upon in exploring the possibility that proprioception, far from being secure except in instances of rare neurological damage, can quite easily be manipulated to give radically different experiences of body boundaries. The video includes footage shot in the laboratory of Mark Green at the University of Alberta. In the laboratory, Catherine Richards conducts a demonstration showing that the perceived boundaries of the body can be remapped by the low-tech method of stimulating the surface of the arms and hands with a vibrator. Already interested in VR through her pioneering work in the Banff Centre's Bioapparatus project, she was quick to see the connection between virtual experience and this proprioceptive remapping of the body surface. The video shows her enacting the experiment with various blindfolded subjects, who describe what they feel happening to their bodies. One woman reports that she feels her neck shrinking and then thickening, becoming like a bull's neck. The process continues until her head retreats into her chest, her shoulders forming an unbroken line across the top of her body. Another woman remarks that her arms are growing longer and longer, stretching six feet or more away from her body.

Combined with these images are visual and verbal references to virtual reality. As the video begins, lettering on the screen informs us that Richards is combining "body illusions with VR to bring to the surface the intervention of VR in the psychological (re)mapping of our bodies." When I spoke with Richards about the video, she pointed out that all of film, television, and video evolved from a single "perceptual glitch"—the fact that when the human eye is presented with images in rapid succession, it perceives the images as motion. She sees a similar plethora of technologies evolving from the "perceptual glitch"

she explores in her video—the fact that our sense of body boundaries can easily be destabilized and reconfigured by even low-tech interventions. When the intervention consists of stimulating surface muscles while the subject is blind-folded, the reconfiguration is easily detected as a hallucinatory experience. The subjects in the video knew that their experiences were not "real," because ordinary experience as well as other sensory channels told them that the body was in fact remaining stable. Imagine, however, a VR simulation that would visually reinforce the changing image the subject has of her body. What if the woman not only felt proprioceptively that her neck was shrinking, but also saw it shrinking through VR eyephones? What if she interacted with her environment through this changed form, for example by trying to wear a hat and having it fall off because she had no exterior head? Then the borderline between hallucination and reality would become harder to detect. It is not difficult to imagine a technological intervention powerful, sustained, and consistent enough to remap a subject's body with compelling intensity.

Spectral Bodies is not an argument or an exposition, although it contains elements of both. Rather, it is an intervention that comes to the viewer through multiple channels, combining print, images, sounds, and narrative in a suggestive collage that hints at a synergistic collaboration between the informational and material body. In my conversation with Richards, she remarked that she did not think the interpenetration of materiality by information was primarily due to the development of VR technology. Rather, she sees VR technology developing because we who inhabit first world countries are already convinced of our virtuality. Everything else is becoming virtual—money is displaced by automatic teller machine (ATM) cards, physical contact by phone sex, face-to-face commu-nication by answering machines, an industrial economic base by information systems; why shouldn't our bodies be virtual too? Yet even as she foregrounds this shift and wants to explore it, Richards insists on the continuing importance of our material existence. It is for this reason that she locates her work at the site of the body, because she sees the body as the crossroads where the psychological, material, and virtual intersect. The feminist edge to Richards's work comes not only from her insistence on materiality but also from her implicit assumption
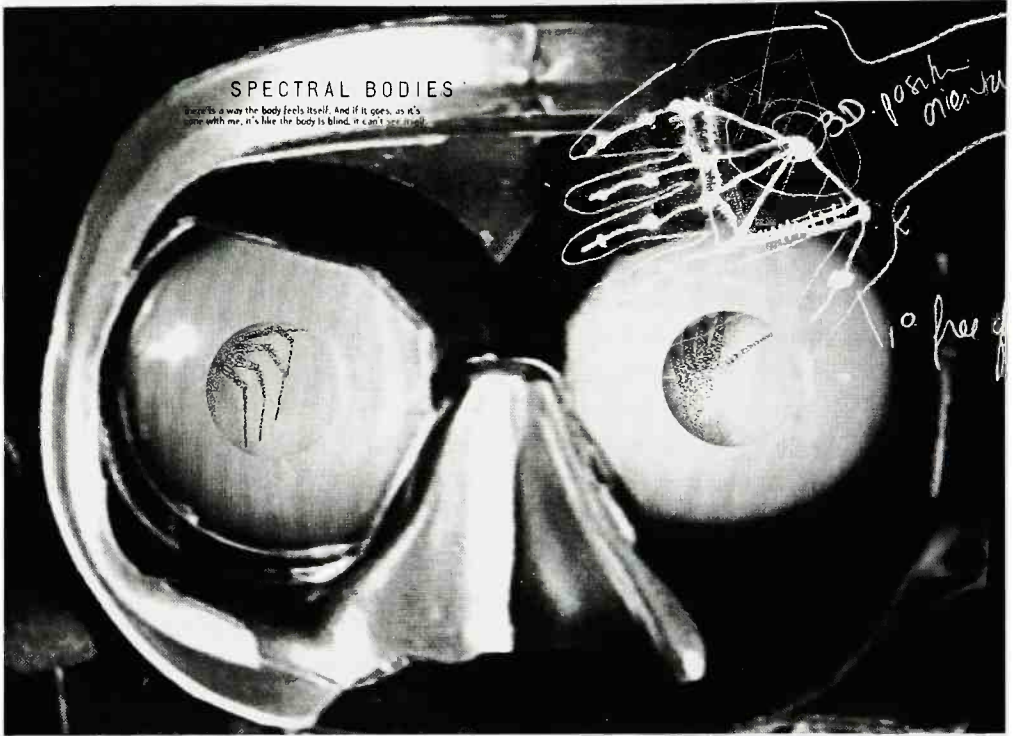
8. Catherine Richards's *Spectral Bodies* videotape, created in 1991, includes a segment of virtual reality in a set of stories about the loss of bodily presence. By embedding this component of virtual reality among other narratives, the artist treats virtual reality as one of a number of ways in which body boundaries can be destabilized.
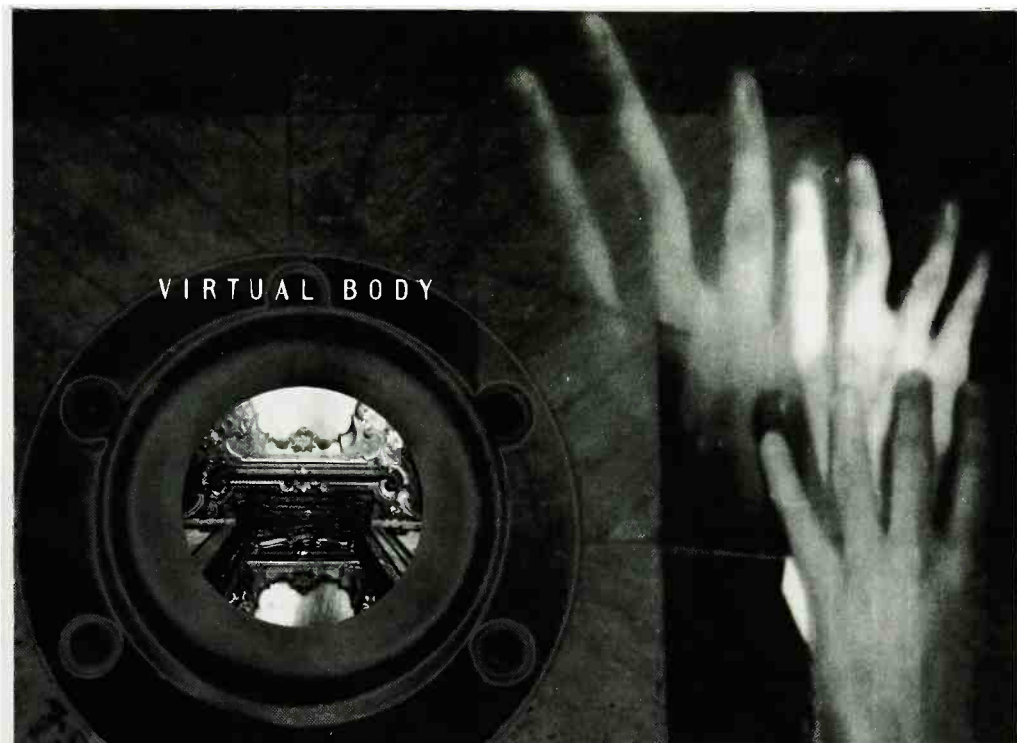
9. *The Virtual Body*, created in 1993, encapsulates artist Catherine Richards's concerns with the relationship between the body and new technologies. What appears to be, at first glance, a nostalgic material object is, in fact, an interactive artwork that blurs the boundaries between spectator and object.

that body and mind interact and that any reconfiguration of the body must necessarily affect how subjectivity is constituted. In this sense she has more in common with Laurel than she does with Moravec or Gibson.

Spectral Bodies ends with the voiceover of a subject who experienced radical body distortions asking, "Can you put me back [the way I was]?" As the VR artists discussed here realize, it is not possible for us in first world countries to return to a state of "natural" wholeness. I believe Laurel, Strickland, and Richards are correct in seeking to find a way *through* these powerful technologies rather than condemning or boycotting them. "I would rather be a cyborg than a goddess," Donna Haraway proclaims at the end of "A Manifesto for Cyborgs."[23] The question for us now is, what kind of cyborg? Dreams of transcendence, of freedom from the flesh, exacerbate rather than solve our problems. Although our bodies may not be "natural," they are still material, and they are still necessary for our survival on this planet. However resurfaced with virtuality, the physical world is our one and only home.

NOTES

1. Hans Moravec, *Mind Children: The Future of Robot and Human Intelligence* (Cambridge: Harvard University Press, 1988).

2. The point is eloquently made by Francisco J. Varela, Evan Thompson, and Eleanor Rosch in *The Embodied Mind: Cognitive Science and Human Experience* (Cambridge: MIT Press, 1991).

3. For a discussion of these gender identifications, see Carolyn Merchant, *The Death of Nature: Women, Ecology and the Scientific Revolution* (San Francisco: Harper and Row, 1980).

4. Nancy Leys Stepan, "Race and Gender: The Role of Analogy in Science," *Isis* 77 (1986), 261–277.

5. Erwin Schrödinger, *What Is Life? with Mind and Matter and Autobiographical Sketches* (Cambridge: Cambridge University Press, 1944; reprinted 1992).

———

26

6. Gregory Bateson, *Steps to an Ecology of Mind* (reprinted New York: Ballantine Books, 1972).

7. Norbert Wiener, *Cybernetics: Or Control and Communication in the Animal and the Machine* (Cambridge: MIT Press, 1948, 2d ed. 1961), 1.

8. William Gibson, *Neuromancer* (New York: Ace Books, 1984).

9. The phrase "embodied virtuality" was coined Mark Weiser of Xerox PARC. I am indebted to Mark Weiser for making it possible for me to visit Xerox PARC and see these technologies firsthand.

10. A. J. Greimas, "The Interaction of Semiotic Constraints," *On Meaning: Selected Writings in Semiotic Theory,* trans. Paul J. Perron and Frank H. Collins (Minneapolis: University of Minnesota Press, 1987), 48–62. See also Ronald Schleifer, *A. J. Greimas and the Nature of Meaning: Linguistics, Semiotics and Discourse Theory* (London: Croom Helm, 1987), 22–55. Also helpful is the discussion of the semiotic square in Ronald Schleifer, Robert Con Davis, and Nancy Mergler, *Culture and Cognition: The Boundaries of Literary and Scientific Inquiry* (Ithaca: Cornell University Press, 1992).

11. The classic text here is Jacques Derrida, *Of Grammatology,* trans. Gayatri Chakravorty Spivak (Baltimore: Johns Hopkins University Press, 1974).

12. The explanation of the relation of information to pattern/randomness, condensed here for reasons of space, can be found in fuller form in N. Katherine Hayles, "Virtual Bodies and Flickering Signifiers," *October* 66 (Fall 1993), 69–91.

13. Claude E. Shannon and Warren Weaver, *The Mathematical Theory of Information* (Urbana: University of Illinois Press, 1947).

14. Jean Baudrillard, *Simulations* (New York: Semiotext(e), 1983). See also Jean Baudrillard, *The Ecstacy of Communication* (New York: Semiotext(e), 1988).

15. For examples of the emphasis on freaks and mutation in contemporary literature, see Katherine Dunn's *Geek Love* (New York: Knopf, 1989) and Tom DeHaven's *Freaks'*

27

Amour (New York: Penguin, 1986; first printing, William Morrow and Company, 1979). This aspect of contemporary literature is discussed in N. Katherine Hayles, "Postmodern Parataxis: Embodied Texts, Weightless Information," *American Literary History* 2 (1990), 394–421.

16. Shoshana Felman, *The Literary Speech Act: Don Juan with J. L. Austin, or Seduction in Two Languages,* trans. Catherine Porter (Ithaca: Cornell University Press, 1983), 141–142. See also Fredric Jameson, "Foreword," in Greimas, *On Meaning,* xvi.

17. Richard Dawkins, *The Selfish Gene* (Oxford: Oxford University Press, 1976).

18. The era of the posthuman has been discussed by Howard Rheingold in *Virtual Reality* (New York: Simon and Schuster, 1991) and Bruce Mazlish in *The Fourth Discontinuity: The Co-Evolution of Humans and Machines* (New Haven: Yale University Press, 1993).

19. These effects were reported to me in informal conversation with Stone and Laurel and anecdotally confirmed by researchers at the University of Washington Human Interaction Laboratory.

20. *Placeholder* is among the works presented in this book; Rachel Strickland and Brenda Laurel also showed the video on *Placeholder* at the Banff Centre for the Arts Symposium on Art and Virtual Environments in May 1994. I am indebted to the Banff Centre for making it possible for me to attend the conference and for their generous support and encouragement.

21. Quotations from *Spectral Bodies* are used with permission of Catherine Richards.

22. Oliver Sacks, "The Disembodied Woman," in *The Man Who Mistook His Wife for a Hat and Other Clinical Tales* (New York: Summit Books, 1985).

23. Donna Haraway, "A Manifesto for Cyborgs: Science, Technology, and Socialist Feminism in the 1980s," *Socialist Review* 80 (1985), 65–107.