My body wasn't in the computer world I could see around me,
but one of my hands had accompanied my point of view onto the
vast electronic plain that seemed to surround me, replacing the
crowded laboratory I had left behind where my body groped
and probed. — HOWARD RHEINGOLD[1]

Beyond the relations of actualized forces, virtual ecology will not
simply attempt to preserve the endangered species of cultural life
but equally to engender conditions for the creation and develop-
ment of unprecedented formations of subjectivity that have never
been seen and never felt. — FELIX GUATTARI[2]

3 virtuality
actualizing bodies, abstracting selves

Virtuality, Reality and Digitality

Catherine Richards's 1993 installation *The Virtual Body* is seduc-
tively named, having appeared at a particular time in the history
of new media arts and entertainment and being deceptively
simple in its realization (figure 11). If the culture of information
and its aesthetics were dominated by any two tendencies during
the late 1980s to mid-1990s, they were virtuality and interactivity.
The virtual, more than any other quality or dimension associated
with digital technologies, has promised to leave the body and its
"meat" behind, as minds, data and wires join together in an ec-
static fusion across the infinite matrix of cyberspace. But Rich-
ards's installation asks us to focus upon the body in relation to the
virtual just as the rhetorical hype about the body's disappearance

FIGURE 11. Installation shot of *The Virtual Body* (1993) by Catherine Richards.
Photograph by Herman Van Aerschat. Courtesy of the artist.

through cyber-apotheosis was reaching a climax. But what kind of body
might this be if, as she specifically directs us in the work's title, it is now
inseparable from that very condition that is everywhere disassembling
it—the virtual? *The Virtual Body* is not what one expects to find, given that
slick, real-time, three-dimensional immersive environments are what
first come to mind in association with virtual reality (VR) technologies.
Initially realized for the Antwerp '93 Festival, the installation sits in a
nineteenth-century rococo-style room in Belgium's Centrum Voor Beeld-
cultuur, literally translated as the "center for picture culture."[3] A heavy
crafted wooden and glass box with a viewfinder positioned centrally on
top and a steel-ringed hole on one of its sides is mounted waist-high on a
polished wooden plinth. As Richards comments, the piece is not an overt
reference to technology, at least not *new media technologies,* and it lures the
viewer visually into a world of optical instruments that might now be
found in a museum with its "alluring, warm, fine materials, reminiscent
of the column stereoscopes of the mid-nineteenth century."[4] The cabinet
on top of the plinth is in fact a miniaturized representation of the room
in which the work is installed. It uses glass and a video projection up

through the "floor" of the little room to create the illusion—popular from the baroque right through to the late rococo periods—of a room within a room. The contemporary viewer can both peer into the room through a viewfinder on top of the cabinet and place her hand inside its space from the cabinet's side.

Although not immediately obvious to the participant, this dislocation between *looking* at one's hand and *experiencing* one's hand in receding motion is similar to the designs of the early 1970s and 1980s for single-person interaction in VR environments. This is further enacted in Richards's piece by the triggering of a moving image due to the insertion of the participant's hand into the miniature room:

> The floor pattern on the monitor begins to scroll. In a few moments the spectator begins to sense a body illusion: a displacement of the body, an illusion of motion. One's hand appears to be infinitely traveling away from the body. Then the arm begins to take the body with it. It is as if miniature space is folded into infinite space, as if stillness is folded into motion. The body loses all references: inside/outside, giant/miniature, spectator/object, part/whole.[5]

What is fascinating about the sense of virtuality evoked in Richard's work is that, despite the strange displacement produced between having an arm that feels attached to one's body and looking at/experiencing an arm simultaneously departing from the rest of the body, this does not produce a *disembodied* digital experience. Richards suggests instead that a folding occurs between pairs of dissonant experiential states and spaces. This discord leads to a loss of extensive and locative referentiality for the body. Bodies may no longer be sensed as anchor points in information culture. Yet, as *The Virtual Body* suggests, the heightening of corporeal and affective experiences through the very dispersion of bodily location has become a key aspect of information aesthetics.

As I will suggest in this chapter, in spite of VR and indeed much of the late-twentieth-century cyberculture's disregard for the body, virtuality does not exist in a realm beyond or transcend corporeal experience. Rather, to borrow John Beckman's phrase, there is a "virtual dimension" to digital embodiment.[6] So far I have concentrated on the relation between the baroque and the digital from the perspective of what early modern relations between matter, aesthetic perception and a new scientific knowledge of the sensory world offer the reactivation and rethinking of contemporary body-technology relations. From this point, the baroque will become a

force within contemporary information aesthetics as we enter the spheres of virtuality, human-computer interaction and globally networked information. My argument throughout the remainder of this book, and the examples I draw upon, will be more firmly planted within present times, bringing the concepts of folding, differentiality and machinism to bear directly upon themes within information aesthetics and culture.

During the 1990s, VR technologies became almost synonymous with the quintessence of digital research and development; they both represented the high end of military-industrial and entertainment advances in technological simulation and promised bubble worlds of techno-utopian enclosure and escape. In Hollywood depictions of virtual reality such as the films *Lawnmower Man* (1992) and *Disclosure* (1994), in countless theme park rides in Disney, Universal Studios and game arcades, and in the less publicly accessible domains of medical and military simulation, enormous quantities of capital were invested in high-tech body prostheses. These prostheses all promised alternate or "out of body" experiences for the "operator," as virtual world participants have been called.[7] Invariably these depictions and realizations have taken the virtual to be both an extension of and a supplement to the real. As Howard Rheingold's detailed observations of the state of VR research in the early 1990s remind us, virtual experiences of this kind strive to replicate human perception and provide an added metaphysical dimension to sensory experience.[8] One effect of the hyperbolic rhetoric and representation of VR was to cast a shadow over everyday reality, which in contrast comprised the inadequate qualities of daily life and human corporeality. Virtual reality, while striving technically to duplicate the complexity of everyday life, nevertheless undertook to exceed it through the offer of neverending accumulation: more than the physical extension of the body, it offered greater movement, more freedom, the plunge into a future of pure consciousness.

Many theorists of cyberspace have remarked upon a gap that seems to structure the relations between cyberspace and physical space. Alluquere Rosanne Stone, for example, characterizes virtual systems in terms of their split between projected electronic space and everyday physicality: "Cyberspace is a physically inhabitable, electronically generated reality, entered by means of direct links to the brain—that is, it is inhabited by refigured human 'persons' separated from their physical bodies, which are parked in 'normal' space."[9] For her, virtual/real splitting initiates a schema of projected proprioceptive movement that accompanies navigation through the cybersphere, such that one feels exclusively caught up in and affectively immersed within the virtual environment. But at the same time she

acknowledges that these noumenal affects produce a growing distance from the substance of the organic, stationary body. Although Stone seems to offer us an enriched version of virtuality, one in which the virtual mind is accompanied by its virtual body, her actual, physical bodies subsequently undergo a demotion. They continue to run but really only take up space back at the parking bay; their "motors" are not really running.

On the face of it, then, technological virtual worlds seem bent upon enlarging the gaps that separate them from the coordinates of the material world, coordinates that require us to have bodies in order to have experience. Indeed, VR has achieved much of its notoriety and criticism from the claim that it can disconnect consciousness and perception from their anchors in living human matter.[10] Although virtuality and the digital are not synonymous, they are nonetheless imbricated. Three terms circulate in proximity to the virtual: the actual, the possible and the real. In digital configurations of virtuality, the real is most often invoked as its partner, simultaneously imbuing virtuality with the modality of possibility and its concomitant task of *realizing* possibilities. It is not that this is the wrong configuration of these terms, which, as Pierre Lévy has suggested, form poles that are immanent to each other.[11] Rather, the problem lies in this configuration's creation of only one actualization of virtuality: that is, to make real possibilities that have already been prefigured, whether as imaginary or mimetic manifestations.

But the virtual is not of the order of representation; that is to say, it does not proceed from reality. Nor does it precede the real as ideality, model or simulation. It is, rather, a set of potential movements produced by forces that differentially work through matter, resulting in the actualization of that matter under local conditions. To return to Richards's *The Virtual Body*, the virtual dimension for corporeal experience evoked here lies in the way it poses the potential for *embodied distribution as a condition of experience for information culture* by dislocating habitual bodily relations between looking and proprioception. Virtual forces are vectors that pulse through the contours and directions of matter. They may or may not break off into other directions, connect with other lines or encounter other forces and matter that cause their flows to be blocked. As Lévy suggests, drawing upon Deleuze's virtual-actual counterpoint relationship, the actual is a particular response to a set of virtual forces rather than the realization of a possibility.[12] Virtuality and actuality form a differentiated continuum of force and materiality, promising to move according to one set of tendencies, then encountering the forces of differentiated matter and actualizing in both foreseeable and unpredictable ways. The virtual-actual relation has

the advantage over the virtual-real partnership of draining the theological flavor from virtuality. If conceived as a possibility waiting to be made real, as is the case with much initial VR conception and design, the possibilities themselves feel like preordained scenarios waiting for the right conditions under which to unveil their destiny.

But how does the alternative use of the virtual-actual pair and trajectory help to explain the movement of technosocialities in what appears to be the inverse direction, toward virtualization? How can we account for the breakup of the structure of private and interiorized subjective experience or the informatic transformation of the referential world, both of which were hastened by the dematerializing tendencies of electronic media and now computational processes? Although the claims for the disembodied nature of VR can be attributed to the dependency of the digital upon Cartesianism, the strangeness of embodied technological experiences—in which, for example, VR environments produce both dematerialized senses of the self *and* intensified corporeal sensations or actualizations—remains underinvestigated. Rheingold himself implicitly drew attention to virtual splitting by convincing himself that he had left his inept corporeality behind him when he suited up and toured virtual environments, yet he nevertheless noted that he was trailed by "one of his hands." This hand had miraculously managed to attain a double identity as both part of his inert body and part of his virtuality. As Janet Murray has remarked, it is this relation between a virtually perceived and felt body and an actually lived body (that is, embodiment localized in a place and through duration) that captivates us in digital engagements: "When the controller is very closely tied to an object in the fictional world, such as a screen cursor that turns into a hand, the participant's actual movements become movements through the virtual space. This correspondence, when actual movement through real space brings corresponding movement in the fantasy world, is an important part of the fascination of simple joystick-controlled videogames."[13] Murray's argument concerning correspondence here is not premised on resemblance to the real. It is, in fact, more in line with the virtual-actual relation I have been arguing is crucial to understanding even a digital virtual experience that rigidly seeks an aesthetic of realism. For, as she points out, the spaces we have come to regard as virtual in contemporary culture are not simply steeped in realism but are also simultaneously perceived as imaginary, fantastical spaces. If we look at where VR is most readily consumed, it is predominantly in terms of entertainment: amusement rides or cheaper versions that appear as games in video arcades or home computer entertainment. Of course, one could argue that this only accounts

far run or act of virtualization. Taken as part of a technosocial trend, as Lévy argues, it has become, the virtual condition engulfs all spheres, turning our notions of work (the virtual office), science and medicine (telesurgery) or the economy (speculative currency) upside down.

Yet Murray's argument has the merit of being able to account for why virtual experiences involve a degree of making strange in the experience of digital embodiment. She argues that virtual spaces are culturally demarcated through their separation from everyday experience. The animated VR ride one experiences in Disney World as a trip through the marketplace of Aladdin's land has an exit and entry point that announces it as "a ride." One formally enters and exits the virtual world, just as one starts and finishes a computer game: arrival is indicated by the "loading" progress bar or bay, and departure from the world usually spurs a series of computer prompts/announcements asking the user if they wish to leave or save their exit point. Immersion, for all its realist trappings, is also an unreal place, in which bodies are distributed between the fantastic and the actual, moving around impossibly in one sphere and feeling movement in the other. This splitting and doubling produces a relation of correspondence between differential fields, and *this* is what makes VR an affective aesthetic experience. Yet it remains one for which we really have no cultural vocabulary to adequately describe those affects.[14]

The reductive maneuver of situating digital technologies as the cause of virtual experiences can be detected in the early cyberculture frenzy surrounding high-end VR technologies. But it has broadened into an ascription attached to the general effect of digital imaging processes and immersive online and offline graphic environments. The task of this chapter will then be to disinter the virtual dimension from its status as a byproduct of digital media alone. I will also examine the contribution virtuality does make to sensory engagements with digital technologies. By exploring the virtual dimension within the time of the digital, we shall then see that one of the wider aesthetic implications of processes of digitization has been to impinge upon and give a certain form to manifestations of the virtual. This threefold set of tasks will be steered by the hypothesis that, at a general level, computation brings to our cultural, aesthetic and corporeal engagements with technology a mutable and conditional measure of abstraction. Computation, especially within the arts, allows for the visual, sonic and spatiotemporal production of the conceptual modeling of data: visualizations of conceived, potential environments might be, for example, another way to describe VR spaces. Computer space is in many ways a kind of cognitive space for problem production: within its parameters

concepts can be sketched, planned, tried out, tested, revised and erased. Yet the very mutability of data—the infinitely reconfigurable arrangements of code as varying responses to user interaction, and as results of nonhuman interactions (networked communication with other machines, infrastructure and technologies)—means that the abstract elements of computation are constantly subjected to external transformation and rearrangement beyond their programmed parameters. This process subjects the abstract space of information and its relationship with purely conceptual operations to the contingencies of corruption, nonstandardization, incompatibility and accident.

Thus we need to qualify the more general aspect of the hypothesis by adding a second qualifying level, in which we can propose that computation duplicates, through fluctuating degrees of variation, the general mutability and contingency of sentient life. Contrary to a strong cultural tendency within computational aesthetics that is oriented toward realistic representation, this form of duplication is not one that *resembles* reality. It is, rather, one that *corresponds* with—in the sense of exchanging missives— the actual, sensory world. The abstract quality of digital processes apparently disengages us from immediate corporeality and the physical environment. Yet there is nevertheless a set of corresponding points, tendencies or capacities between computation and the everyday world that produces zones for sensory and affective engagement with, and interaction between, computers and humans.

The universe of computational spacetime both differs from and repeats the coordinates of human corporeal experience. The two universes form orders that are serially connected to and differentiated from each other: the abstract informational world engages the virtual dimension of human experiences; the sensory and contingent plane of living bodies is doubled and variably reconfigured through computational schemas. The virtual dimension of computation moves us toward abstraction and the infinite reconfigurability of algorithmically produced space; the actual processes of computation, as they form assemblages with concrete circumstances and activities, comprise and compose facets of contemporary embodiment. We should not imagine that these two orders simply support relations of aggressive superimposition or maintain a benign coexistence. The virtualization that computation moves us toward is not, then, a replacement of materiality, bodies or humans but a process that can combine with and multiply the virtual propensities of all of these. In order to grasp the digital's impact upon virtuality as it shapes and inflects it in ways that cannot be reduced to realist representational trajectories, we need to look to the

breadth of digital culture itself. Many instances of VR environments and technologies can be revisited by engaging the dynamic between virtual and actual processes to enrich our somewhat paltry understanding.

The Digital Production of Virtual Time

One set of corresponding tendencies between the virtual, abstract computational domain and actual embodied experience lies in both orders' potential for producing temporal compression and simultaneity. Digitization has been said to produce cultural historical amnesia through areas as diverse as computer gaming and digital museum display. In particular, digitally produced and manipulated worlds appear to seamlessly assemble past, present and future moments and artefacts. The effects of recreating history might be considered exemplary of a more general propensity to "virtualize" the past if we consider processes such as three-dimensional software modeling and compositing between fictional and archival footage, as showcased in movies such as *Jurassic Park* (1993) and *Forrest Gump* (1994). The past is dusted off, as it were. Any material phenomena providing it with distinctive historicity, such as context, decay and the unreliability of memory—all of which forestall exact replication—is filtered out through computer processing.

But does a digital reconstruction of the past necessarily entail a disengagement from the material world? In fact, we might surmise that repetition, in cohorts with decontextualization, is actually doing something new to history, producing a deliberate reimagining of the past rather than a faithful but tired attempt to authenticate through resemblance. When the digital is harnessed to the forces of realism it inevitably fails to match up to the past, becoming either a poor imitation, as can be witnessed in the countless museum projects for digitizing Great Masters collections, or else too perfect, erasing the material and cultural differences that constitute the differential rhythms of temporal experience. But if we recast the digital as an aesthetic force capable of producing new kinds of sensations and affective responses, we might instead see it as belonging to the activity of imagining. This is what Brian Massumi has termed "felt thought" in reference to a relation between thinking and affecting rather than to representing the real.[15]

The six-part English series *Walking with Dinosaurs* (1998), produced by BBC Television, is ostensibly concerned with the prehistoric past.[16] It uses the genre conventions of nature documentaries, such as authoritative voiceover combined with close-up location footage, to speculatively reconstruct the behavior and habits of extinct species. Yet all of the episodes are

aesthetic masterpieces, equal parts metaphysical speculation and sensory aesthetics. Of the 180 minutes of total television footage, 132 minutes are computer generated; the remainder of the dinosaur footage uses animatronic models. Alec Knox, the senior technical director of computer animation for the series, gleefully admitted that the animators invented behavior in order to build up a "lifestyle" for the creatures.[17] On the one hand, then, the shows present a monumental endorsement of the power of digital technologies to erase the "real" evidence of palaeontology, telling us little about the known life lived by and between species of dinosaurs. But on the other hand, the pedestrian notion of the digital's virtual dimension as a flattening and dematerializing force cannot account for what is so captivating about the programs.

What is affective about *Walking with Dinosaurs* lies in the juxtapositions that arise through its compressions and decompressions of time, in which the long lost past is brought into immediate relation with the coordinates of contemporary technology. The series achieves this through animation, modeling and imaging techniques, dwelling on vibrant images of prehistoric viscerality: reptilian skin that drips with the slime of some primeval swamp; ripped flesh clinging to the jaws of a velocoraptor, a winged dinosaur. The detailed imaging of digital dinosaur viscera may be the result of exhaustive 3-D texture-mapping, but it has the effect of introducing into the somewhat anthropomorphized narratives an utterly nonhuman, almost alien, element. From the perspective of what digital imaging offers us aesthetically, *Walking with Dinosaurs* reinvents natural history as imagining—as "felt thought"—about the potential of the past to reenter into sensory relations with the present. Past, present and future, the factual, actual and digital, fold in and out of one another in a sensory mélange that is fascinating and unnerving and affects the very seat once thought to be responsible for producing affect: the guts.

This kind of "virtual" telescoping of time accompanies the "loss" of spatial orientation in cyberspace, with each feeding into a frenzy of accusations about its disembodying propensities. Peter Lunenfeld speculates that the lack of spatial referentiality and the compressed scale of liquid, digital spaces when compared with everyday proprioceptive space may be the reason for a proportional loss of duration for users in virtual environments.[18] In this understanding of the digital production of virtual time, a participant's movement through digital space is responsible for driving an unfolding sense of digital time. The problem here is that we resort to modeling movement in digital space upon an imagined, indeed already virtualized, experience of spatial navigation. Anyone who has observed a user immersed in

a full head-mounted VR situation will immediately recall the amusing image of a body whose blinkered eyes are negotiating a complex terrain but whose limbs spasmodically jerk around, limited by their VR prostheses. The virtual/actual spatial discrepancy underlines the fact that digital space does not unfold in direct relation to the bodily traversal of it through time. Instead, digital spaces are moebius-like, comprised of asynchronous feedback that loops between a doubling of and a splitting from bodily awareness. These loops bind and differentiate the experience of immersion in VR from everyday proprioception. Furthermore, there is a technical production and specification of spatial coordinates in VR prior to any corporeal engagement with it. The experience of virtual space for the user is a negotiation between this digitized spatiality and her own habituation to ordinary, everyday embodied movement. Likewise, digital virtual time is technically constituted *prior* to an engagement with VR environments. Hence, the VR environment pulls the user into a negotiation between the time of its technology and regular experiences of duration. The "loss" of experiential time reported needs to be understood at the juncture of these processes of negotiation between technically produced and corporeally habitual space and time. Digital technologies pull temporality through a pre-designated coordinate grid, processing it as if it were a quantitative effect of traversing digital spaces. Yet almost counter to this capability, the digitized processing of space and time allows temporality to be experienced in a qualitatively different way, recalling modes that resonate with the non-linear processes of human cognition and experience such as memory.

Much of VR is described in terms of spatial perception; that is, in terms of the navigation of virtual worlds or an immersion in computer-generated graphics and sound. But the full VR perceptual experience gained by wearing a head-mounted display is in fact generated via temporal manipulation. The effect of feeling immersed in a computer-generated 3-D graphic world is produced by alternating the left and right eye views of the small monitors mounted in front of the immersant's eyes. This process, known as "time multiplexing," literally shuffles alternating images every one-thirtieth of a second or even faster to produce the illusion of stereoscopy.[19] As VR experiences have become increasingly sophisticated, time multiplexing has also been used as a solution for providing individuated visual perspectives for multi-user VR experiences. Here, alternating "world views," combined with other technical features, ensure that each user of the system is presented with an image correctly corresponding to the body tracking information that the computer has received for that participant."[20] Although the subjective experience of VR is filtered by a representational image layer of

traversable terrain and accompanied by action modes such as navigation that utilize the everyday metaphors of physical space, it is digitally realized by breaking time down into discrete states and quantities.

This quantifying vector produces movement in digital virtual space as a succession of alternating instants in time. Thus we might see the technology of VR as part of a direction that has always haunted time-based media: movement captured by stitching its instances together. This direction picks up speed through postindustrial forms of automation, channeling the virtual dimension through ever more rapid and minute processes of quantification. The perceiving body becomes aligned with this general economy of quantified time. It does so by "buying back" its own perceptions as storable instants always available for access: think of the Polaroid Instamatic camera, home video and now the databanks of images being forwarded around the world from cell phones. This commodification of time into instances is exactly the scenario presented to us in the film *Strange Days* (1996), directed by Katherine Bigelow.

In the film, which is set on the eve of the second millennium, the relatively unobtrusive headset device donned by the characters provides, for a hefty black market fee, access to the full sensory recall of their recorded and stored memories. In an early scene Lenny, a trader in virtual memories on the black market, replays and accesses emotional and sexual fragments from his lost relationship. The film revisits a memory of a romantic outing with his girlfriend, in which Lenny's first-person perspective of his lover whirling and ducking on roller-blades is contrasted with the present reality of his lonely and groping body attempting prosthetically to recapture the movements of past sexual desire. The sequence comes to an abrupt end as the data on the memory disk corrupts and his virtual past world crumbles into pixellation. It is as if the futuristic peepshow the film's audience has paid to drop in on suddenly exhausts its line of credit.

But this conception of memory as a perfectly formed illusion of full and present perception is not just futuristic fantasy. It haunts the contemporary relation between virtuality and reality as well. As Lev Manovich argues, the quantification of virtual experiences in digital culture delivered through paid connection time online means that produced "reality" will soon be manufactured and exchanged through digital technologies in the global marketplace like any other product: "The bottom line: the reality effect of a digital representation can now be measured in dollars. Realism has become a commodity. It can be bought and sold like anything else. This condition is likely to be explored by the designers of virtual worlds. If today users are charged for the connection time, in the future they can be

charged for visual aesthetics and the quality of the overall experience."[21] One direction new media produces for virtual time, then, is toward quantification, particularly where virtual experience is construed as a replication of real experience.

Yet the temporal telescopy that is foregrounded within the aesthetics of digital realism also allows other kinds of virtual time to emerge. In fact, if we take note of the kind of movement that occurs when we engage with virtual spaces—whether in nonimmersive encounters such as Internet surfing, semi-immersive environments using Virtual Reality Mark-up Language (VRML) and computer game interfaces that offer 180-degree spatial interaction or fully immersive simulated environments—what is happening more closely resembles a traversal between levels and interfaces. All kinds of nonsequential and multidirectional negotiations of temporality are necessary to sustain these activities. Computer gaming, for instance, will often require a user to take a "timeout" to return to a check screen and account for "fuel" use, verify supplies and reload for further action. Online interaction is similarly made up of returns to index pages, revisiting in boxes and retracing hyperlinks. In VR environments, this coming and going is extended to all axes of the spatial coordinate system, ensuring that large stretches of time are spent just flailing around in the virtual surrounds. This multidirectionality qualitatively changes any straightforward narrative of temporality from present back to past or toward the future; time is instead compressed into vertical strata of nonlinear, simultaneously existing layers. The loss of time experienced during computer absorption and immersion can be better described as a temporal encounter comprised of these nonsequential modes, where instants are compressed and rearranged into levels, layers and intervals, becoming multi-accessible from any given single moment. Instead of going anywhere, or moving purposefully in a way we can "account for," experiences of digital virtuality are made up of this "lost" time.

Just by tracing the complex array of potential user movements that is generated through our engagement with new media as a database or an information environment, we reveal the presence, even if in a rather weak form, of nonlinear, virtual time. A stronger understanding still of virtual nonlinearity sees it emerging as the differential outcome of many kinds of interaction between human rhythms and information flows, in which abstract informatic times mingle with embodied forms of duration. The experience of nonlinear time, emerging from the dynamic between computational compression and layering and the correlative durational capacities humans already have to function in nonlinear modes, is a key aspect of in-

formation aesthetics. Indeed, it may be that new media can reacquaint us with temporal experiences that are lost in the march of time to the tune of industrial and postindustrial quantification. Here we need to remind ourselves that the differential unfolding of new media—played out in this field of immersive and computer-mediated environments through the relations between the virtual propensities of information and the actualizations of information in concrete social-technical assemblages—can tend toward both convergence and divergence. Wherever new media is actualized aesthetically so as to quantify and sequence time, it converges with and contributes to the production of a commodified information society. Where it displaces and destabilizes temporal and spatial habitual experience *yet continues to work with and transform our embodied selves,* new media has the potential to produce a diverging virtual ecology.

In Deleuze's interpretation of the Bergsonian concept of duration, he presents an understanding of memory in which time is no longer conceived of in a linear manner as the succession of the past by the present.[22] Instead, past and present can coexist simultaneously. A recollection, for example, does not take us backward from the now to the then; it can only occur if we make an ontological leap into "pastness":

> We have to put ourselves into the past in general, then
> we have to choose between the regions: in which one do
> we think that the recollection is hidden, huddled up wait-
> ing for us and evading us? We have to jump into a chosen
> region, even if we have to return to the present in order to
> make another jump, if the recollection sought for gives
> no response and does not realize itself in a recollection-
> image. These are the paradoxical characteristics of a non-
> chronological time: the pre-existence of a past in general;
> the co-existence of all the sheets of the past; and the
> existence of the most contracted degree.[23]

Rather than an independent memory residing within us as a recollection or preserved within objects and data, as is depicted within Lenny's virtual memories in *Strange Days,* we exist coterminously with active temporal processes of memory construction. There is a nonlinear complexity composed by shifting from any moment of the present to coexisting regions of the past and then back to present moments again. Biochemist Steven Rose has a different way of formulating the operation of nonchronological multiplicity that manifests itself in human processes of recollection: he suggests that memory is multimodal.[24] In a mundane example drawn from

everyday temporal experience, Rose foregrounds the way in which one's recollection of items from a meal consumed the evening before involves modes for transforming the menu's printed information. These modes range from sensory memory to cognitive work done upon memory to processes of selection and semantic translation: "Information in the printed text of the menu was transformed into recollections of earlier tastes, then the spoken order to the waiter, and then the material reality of the food and its actual taste. And now when I tell you I ate broccoli soup and salmon I neither offer you the printed menu nor the food—still less do I expect you to taste it directly—instead I further modify last night's experience by translating it into a few spoken words."[25] When broken into its different modalities in this way, the "processing" of information through various means of accessing the past—via sensation, linguistic recall, chronological ordering and so on—seems phenomenal. And yet this is part and parcel of our daily negotiation of the world. It should come as no surprise then that as organisms we already have the capacity to shift laterally, to follow biurficatory paths and to move in tandem with the phase/state/mode transitions of the nonlinear nature of computational culture.

To return, then, to the issue of an experiential loss of duration experienced in virtual reality environments, we are in a better position to begin to account for this if we accept that the time we sense in computational immersion is not primarily successive instants but is composed of nonlinear periods and cycles. In digital manifestations of nonlinearity, such as we might find in editing time-based footage nonsequentially, or even in the compressed representation of various ancient worlds in a computer game such as Tomb Raider, multiple versions of the past can coexist with the present and be accessible from any given moment. And for every different edit of past and present together, or every sequence of accessing levels within a game, another future begins to unfold. Something of this potential for multiple coexisting sequences of time also forms the experience of the VR user who can reaccess and repeat sequences of the virtual environment that then affect the outcome of future experience within it. Indeed, VR occupies a strange place that, from the perspective of the user, sits partway between computer gaming and digital time-based editing processes. At the same time, engagement with virtual environments from gaming to VR involves a new habituation for the body and contributes to the formation of new kinds of motor-sensory memories. The digital production of virtual time can also therefore be said to operate multimodally. Temporality is sequentially compressed, and yet new types of rhythms become part of the virtual experience. These many modes and regions are stretched out

across a flattened instant, such that time seems to no longer move backward or forward but rather sideways. It is perhaps this lateral rearrangement that accounts for the extended present moment as the frequently experienced duration of digital virtual time. Time is not so much *lost* as compacted into stacked and varying rhythms. And although the quantification of time by a particular sociotechnical regime pulls the virtuality of information toward temporal sequencing and quantification, digital virtuality nevertheless retains its aesthetic dimension: the potential for imaginative virtualization through the underscoring of the existence of many durations.

The Digital Production of Virtual Space
In the majority of fully developed immersive virtual environments, spatial axes and properties such as gravitational pull operate to provide a navigational transition between the user's physical environs and the terrain of the virtual world. Once immersed and familiarized with the head-tracking or data-glove interface commands that will execute virtual movement, relatively ordinary spatial navigation and negotiation of the virtual space can commence. As Murray has noted, immersive virtual environments owe a debt to the shaping of digital space through spatially flattened interfaces such as the Pacman game, playable on Atari computers through the 1970s and 1980s.[26] The first fully interactive virtual environment, Aspen Movie Map, designed by the Architecture Machine Group from MIT in 1978, was literally a cartographic navigation of Aspen, Colorado. It assembled photographic images of the city's streets, shot at three-meter intervals. Although VR was further developed using 3-D graphics by Scott Fisher's work at the NASA-Ames workstation in 1989, the visualization of virtual spaces owes a considerable debt to the coordinates and conventions of Western mapmaking.

Yet maps are not, nor have they ever been, replicas of physical spaces. Instead they deploy a multitude of codes, from scale to color and orientation, to produce representations of space, which in turn affect the way we conceive of and navigate our way back through the places they depict. In their extensive investigation into the cartographies of cyberspace, Martin Dodge and Rob Kitchin put it the following way: "Maps are powerful graphic tools that classify, represent and communicate spatial relations . . . a method to visualize a world that is too powerful and too complex to be seen directly."[27] But, as they further argue, cyberspace is space in the making: it does not exist prior to its myriad visualizations, and hence the very process of imaging forms its contouring and construction. The digital production

of virtual space, like virtual time, oscillates between two socio-technical-aesthetic poles: the fabrication of space through familiar strategies of realist representation such as continuity, directionality and referentiality, and the creation of largely unvisualized spaces that operate according to a combination of discontinuity, nonlinearity and distributed connection. Hence virtual spaces are also governed by these two vectors of convergent enfolding and divergent unfolding.

There are a number of historical and political reasons why the first of these poles seems to dominate the cartography of virtual space. Positioned as representations of physical spaces, the new media technologies that have enabled the visualization of virtual spaces are intimately connected with the simulation of terrains constructed for military training and the enactment of combat scenarios.[28] But it is not simply an act of recent historical complicity that brings together virtual spaces and military operations. The relation between the military and cartography is an old one, discernable in the visual economy that belongs to both enterprises: surveillance. Military surveillance involves the stakeout, keeping an eye on the target subject or area, assessing the terrain ahead of time, as it were, and taking into account any contingencies that might unfavorably impinge upon the goal to be achieved. Surveillance thus produces space as terrain to be navigated through for the purpose of accomplishing a particular goal or task. The military heritage of digital virtual spaces has therefore also provided contemporary cyberspaces with cartographic practices that lean toward techniques of surveillance. It is little wonder, then, that most digital virtual spaces exhibit directional, goal-oriented spatial qualities. In the commercial data project MapBlast! an entire server is devoted to cartographic information that can be used to pinpoint locations using a series of zooming techniques that recall the movement of satellite surveillance cameras honing in on their targets.[29] The data can be manipulated to create various maps available to be navigated interactively onscreen. On the demonstration available through the project's Web site, it is possible to enter a global street name in a text field and to generate a zoomable, interactive map, displaying options for differently scaled views of the street. As it happens, there is a more direct connection between these virtual street cartographies and military surveillance. The street maps are graphical facsimiles of data collated from satellites. The GPS (Global Positioning System) satellites were initially set up by the U.S. military, and the data gathered was later sold to corporations, who now find everyday commercial uses for it.

Cybergeographers, VR developers and digital theorists have all argued that virtual spaces need to draw upon the codes of cartography and habits

of negotiating proprioceptive space in order to guide the user through the unfamiliar territories of data negotiation.[30] Yet there are also other modes of negotiating space, particularly urban space, that comprise an alternative cartographic tradition in Western culture. In these strolls and wanders that appear in the literature of Baudelaire, the cultural criticism of Walter Benjamin and the polemic and aesthetics of the Situationists, new modes of charting and moving in space then compose new kinds of spaces and new abstractions of the embodied self. The idle sauntering of the *flâneur*, the rapt absorption of the modern human absorbed in panoramic spectacles of consumption and the breaks and disjunctive collages of the Situationist *dérive* or "drift" come close to mapping experiences of engaging with and losing oneself in virtual spaces. Although many of the more commercial or instructional examples of virtual environments have emphasized navigation and task achievement, there is no necessary reason to construe data space in this way.

Furthermore, in spite of all of the requisite cartographic markers, virtual environments, particularly in the case of VR, nevertheless induce experiences of disorientation. This disorienting propensity, which we might more positively understand as the emergence of new and unfamiliar forms of spatiality, has been explored more often by artists who have chosen to produce spaces that negotiate the loss of boundaries, direction and mission. I want to examine some different approaches to the aesthetic production of digital virtual spaces, approaches that both intervene and experiment with the conception of cyberspace as easily navigable. These are exemplified by the practices and writings of the artists discussed below, but I believe they also form the basis for formidable alternative cartographies of cyberspace. These approaches are based upon the idea of virtual *dérive*, in which a number of contemporary artists using VR, the Internet and mixed-reality media have begun to create a form of drifting that not only signals a different kind of movement through, but also a different production of, digital spaces.

The mid-twentieth-century images and theories of Unitary Urbanism, the *dérive* and a critique of the everyday, all exemplified by the Situationists and associates such as Henri LeFebvre, were a series of actual and representational experiments with urban space.[31] In the hope of abandoning official demarcations of the city's districts, images such as street maps that delimited one district from another, and the class distinctions that marked off and distinguished various quarters from each other, groups of Situationists would walk and move through different zones of Paris and Amsterdam. Equipped with walkie-talkies for traversing road

and communication spaces, they would attempt to bring disjunctive areas of urban experience into contact with each other. In 1957, Guy Debord published his alternative map of Paris, *Naked City,* which he constructed by ripping up and randomly collaging fragments of a street map of the city that were then linked together with arrows. The *dérive* experiments were both critical and productive: on the one hand, they worked to reveal the way in which images of the city, whether as maps or as government impositions of urban planning, created a simulacrum of seamless space. This construction of space masked the realities of urban dissonance as they were experienced on a day-to-day level as class and ethnic ghettoization and conflict. On the other hand, the Situationists attempted psychogeographical reconstructions of the cityscape that produced spaces of coexistence between people communicating with each other through low-tech devices. For the individual traversing the city in this manner, experiences and memories were subjectively activated and conjured by negotiating the city's disjointed districts. For the Situationists, the drift was a mode of radically overhauling experiences of urban space, which had been historically unmoored from the actual lives of people and had come to be imposed upon, rather than composed by, them.

Throughout the 1990s and into the twenty-first century, the idea of the *dérive* has inspired a number of artists to experiment with and through digital virtual spaces. British artist and activist Heath Bunting has produced several works that appear *dérive*-inspired, including *Underground Movement* (1994), *Visitor's Guide to London* (1995) and *BorderXing Guide* (2001). Bunting's art is interesting because he works between physical and digital spaces and media, sometimes combining physical movement with digital mappings and other times choosing to work exclusively in one space or the other. Hence, the notion that virtual spaces proceed from or replace actual locations in contemporary culture has little relevance to Bunting's work. He moves relatively easily and rapidly between both and pulls his audience and participants across the hype and disjunctions that might be presupposed to divide them. In *Underground Movement,* for example, the artwork comprises a performance by Bunting in which he traces the letters of the alphabet by moving through the London underground tube system. The trace of this performance remains accessible through Bunting's Web site as an image representing the rearrangement of the official transport map that he produced. But the piece is more than a performance and an image; it invites a conceptual interaction in which we begin to rethink what it might mean to disentangle a system of urban movement that was designed to facilitate mass transportation (yet all the while drastically failing and

growing into an increasingly convoluted sprawl) into a system for textual communication such as the alphabet. Bunting foreshadows the transformation of material space by information systems but manages to chart the nonsensical element that this also heralds; his performance ultimately provides only letters arranged into a preordained system that is itself devoid of meaning. If there is sense to be derived from Bunting's work, it lies, as it did for the Situationists, in the personal and political act of moving through the representations and imposed chartings of spaces themselves. This physical experience leads to the discovery of the restrictions placed upon openings that are nevertheless still available for human movement within systems of ordered information.

In *BorderXing Guide* Bunting attempted to cross the twenty-eight borders of Europe without legal papers (figure 12). Here, a direct form of sociopolitical *dérive* comes into play, for Bunting's point is that although incorporeal and informatic flows are constantly crossing the lines between nations, producing what we have come to think of as globalism, the physical movement of humans has been increasingly monitored and restricted.[32] This tension has become a point of critique of and intervention in information culture by a number of artists, Keith Piper, Shilpa Gupta and the collective Mongrel, who have variously experienced the colonial legacy of nation-states as enduring in spite of the so-called freedom brought
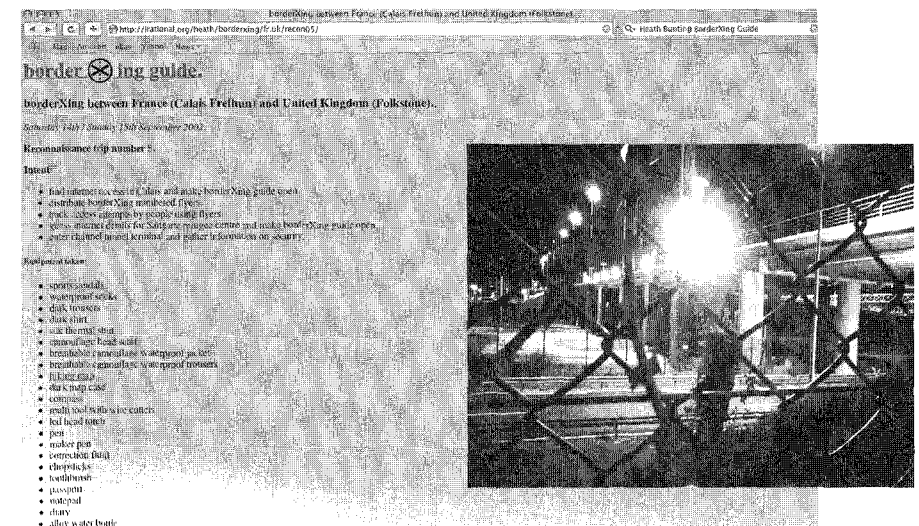

FIGURE 12. Screenshots of *BorderXing Guide* (2001) by Heath Bunting. Courtesy of the artist.

about by the information age. I will return to these artists in chapter 5 in order to examine the critical and aesthetic relations between movement, globalization and new media that their work signals. Bunting does not simply point to the tension but multiplies it through a process of reversal and restriction. Viewing the sites he both crossed and was unsuccessful in crossing can only be done by either visiting their physical locations or accessing their full documentation at publicly maintained IP addresses. These include a number of art and educational institutions that maintain public access to their Internet servers. A list of authorized online viewing points can be found in the Web documentation of the project and a request to be listed as an authorized point of access can also be made online.[33] Access points to geographical borders are increasingly surveyed in order to regulate the movement of people in and out of nation-states for the purposes of shifting migrant labor forces to areas of postindustrial production and for closing down access to those without working visas or independent financial support. Public or state points of border access are thus put into the service of the private sector. Our "freedom" to roam the great information superhighway is bluntly called into question by Bunting's reverse gesture, as it is only by our being verified as a virtual private citizen with a virtual private address (and a credit card) that we enter the virtual space of restricted information servers in the online world. Bunting's selection of online public access points for his project attempts to build an alternative form of public space through information technologies themselves. Moreover, Bunting's physical negotiation of alternative places to cross the European borders reads like a "how-to" manual for asylum seekers and illegal immigrants. His descriptions and images documenting each crossing detail the physical labor undertaken in order to perform and endure such actions. This is a reminder that migration, especially undertaken on the run, is never easy and involves immense pain and hardship.

Einstein's Brain, the collaborative and ongoing project between Alan Dunning and Paul Woodrow, produces a different kind of virtual space, one given over to flux, chaotic journeying and disorientating sensations. Directly referencing the Situationists, one element of this project, titled "Dérive," produces an explorative, immersive space for the interactant that is accessed through the physical interface of an anatomical model of the human body (figure 13).[34] Tracing the contours of the model with their hands, participants activate sensors to visually navigate the projection of a night sky filling the four walls of the installation. As with other phases of *Einstein's Brain,* random image sequences begin to be projected as the participant selects a point to focus upon in the journey around the body/
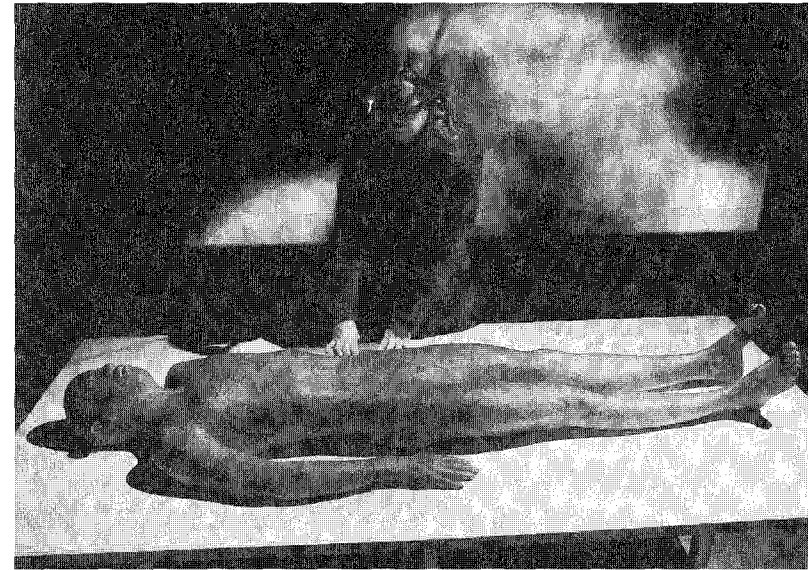

FIGURE 13. A participant interacts with Anatomically Lifelike Interactive Biological Interface (ALIBI). From "The Madhouses: 2001–2004. Pandaemonium" by Alan Dunning and Paul Woodrow (The Einstein's Brain Project, 2002). Courtesy of the Einstein's Brain Project.

map. Dunning and Woodrow play with formal and historical image conventions, suggesting visual and social memories and compositional formulae. But the visual space that is produced never allows an order, purpose or task to clearly emerge for the participant:

> The worlds that are invoked provide a 360° immersive experience in which participants find themselves disoriented and misled by the usual visual codes. These nested worlds present situations and environments, sometimes architectural, sometimes organic, sometimes textual or audio, sometimes hallucinatory, that suggest an understanding of a world in flux, sustained only by the flimsiest of signposts and the most fleeting of memories.[35]

The illusion of user navigational control in virtual space rapidly gives way to the patterns of color, texture and movement emerging and collapsing around the participant. The work signals two trajectories for spatial reconfiguration. First, a drift occurs between the participant's body in actual space, the anatomical representation of the body as interface, and the effects that the sensations of the digital images arranging and rearranging

themselves in virtual space produce at a corporeal level for the participant. Neither distance from the body nor full immersion occur: instead, a series of loops traces an iterative cartography, sometimes covering the same ground, sometimes opening new spaces. Second, VR is not conceived as a map of the world that is knowable or accessible outside of human perception and movement. Like the *dérive*, virtual environments can become experiments for changing the meaning and value of space for us. The resultant experience is one in which the corporeal experience of perception and the social codes of visual representation are thrown out of alignment:

> We are developing worlds in which the raggedness of the virtual reality systems are exaggerated and invoke those dysfunctions of perception associated with brain damage and mental illness. Vision is blurred, detail is shifting and inconstant, slower or faster frame rates suggest a rendering engine behind the scenes, left or right hand sides of stereoscopic vision blink out, depth perception is lost, objects only appear when one is in motion, the edges of the worlds visibly reinvent themselves.[36]

Rather than seamlessness and integration, effects that digital audiovisual technologies often attempt to sustain, marginal perception and the edges of visual space occupy the visual field of *Einstein's Brain*. And here we return to the idea of perception as a continuum from the peripheral to the orderly, and to the way in which new media might actively help us attend to the emergence of visually coherent worlds out of chaos. We detect the resonance of the differential aesthetics of baroque perception.

Virtual Selves—Actual Embodiment
On the face of it, digital virtuality has seemed bent upon enlarging the gaps that separate its times and spaces from the coordinates of the material world, coordinates that need bodies in order to have experiences. It has achieved much of its notoriety and criticism from the claim that it can disconnect consciousness and perception from their anchors in living human matter. As we have seen, artists have used strategies of reversal and subversion that promote drift and disorientation over the navigability and task-oriented character of more mainstream virtual spaces. Yet what is nevertheless forming across all kinds of virtual environments, those where time compacts and space intensively unfolds, is the production of a new kind of embodiment.

In Scott Fisher's description and schematization of NASA's early investment in a VR model and system, the user's body seems so encumbered by technology that it disappears beneath the hardware:

> When combined with magnetic head and limb position tracking technology, the head-coupled display presents visual and auditory imagery that appears to completely surround the user in 3D space. The gloves provide interactive manipulation of virtual objects in virtual environments that are either synthesized with 3D computer-generated imagery, or that are remotely sensed by user-controlled, stereoscopic video camera configurations. The computer image system enables high performance, realtime 3D graphics presentation that is generated at rates up to 30 frames per second as required to update image viewpoints in coordination with head and limb motion. Dual independent synchronized display channels are implemented to present disparate imagery to each eye of the viewer for true stereoscopic depth cues.[37]

This detailed description has become a seminal diagram for the relation between VR hardware, software and the user's body (figure 14). And yet, like virtuality itself, this diagram adds a dimension. But it is one that is difficult to visualize or perhaps just to spatialize in ordinary Cartesian terms. It comes closer to being circumscribed by lines of connection and direction than by anything else, lines that are virtual, as they are not all quite there. These lines cut across the captive body of the VR user, the prosthetic clothing worn, the exterior, interface devices, and the representation of 3-D surround sound and images, and they traverse and couple all of these areas with each other. These lines suggest to me the criss-crossed complexity, rather than the predesignated nature, of virtuality. They are the best thing I can find for signposting the more subtle relations coalescing in Fisher's model between materiality and information, actual and virtual, the human and the machinic. For rather than rising above or beyond the matter of our bodies, rather than disappearing past the horizon of the actual, even hyped and overly technophilic notions of the virtual, engage transversal relations to materiality.

As the NASA model shows, the user/immersant's body acts like a kind of power point. For all of its technological trappings promising freedom from this world, VR interfaces eventually lead back to the ground of embodiment from which they claim to depart. But because most versions of VR are inclined to wish away this ground, they tend to restrict the range of

VIRTUAL INTERFACE ENVIRONMENT
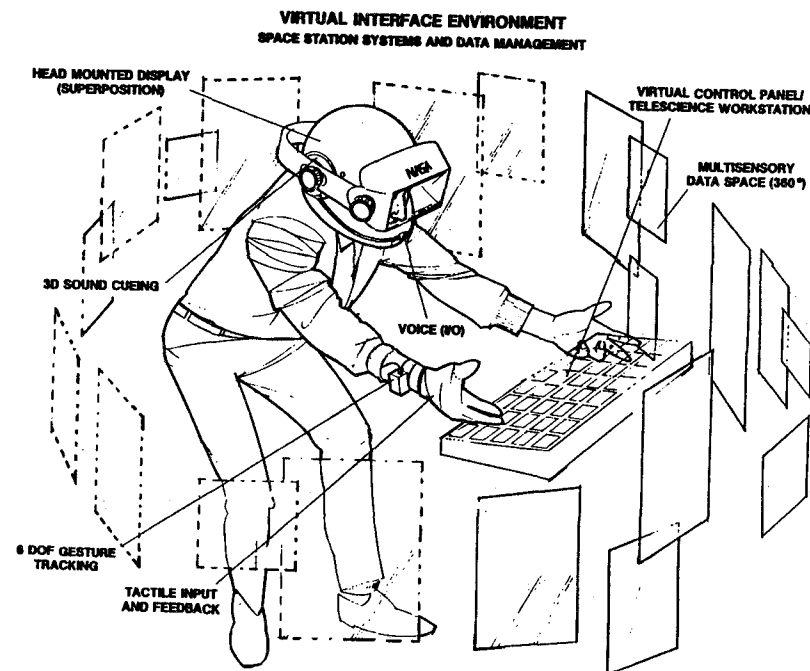SPACE STATION SYSTEMS AND DATA MANAGEMENT

FIGURE 14. Virtual Environment Workstation Project (VIEWlab) at NASA Ames Research Center, 1998. VIEWlab system included helmet mounted display with 3-D sound, speech recognition, and datagloves. Project Director Scott S. Fisher. Photo: NASA/S. S. Fisher, W. Sisler, 1988.

impact and activity of their foundation, loading the body of the user up with wires and sensors and thereby turning it into a joystick for the machine's operations. Yet we can nevertheless begin to think about the lines of connection that cut across the virtual production of the self in digital spacetime and the actual corporeality of the user in its perceptual and social dimensions as an emergent technological embodiment.

The limitations on human movement produced by the restrictive nature of VR experience and representation have led, more recently, to attempts to produce different technical experiences of the virtual. Noting the restriction of bodily freedom that wearing a head-mounted display creates, MIT technicians during the mid-1990s developed the CAVE project.[38] The user and other participants enter a cubed room made up of 3-D sound and moving image. Instead of all of the cumbersome clothing, there are only slimmed-down head-tracking and hand sensor devices that allow repositioning of sound and graphics in real time on the four surrounding screens

in relation to the viewpoint of the main user. In somewhat naïve adulation for this alternative "room" as compared to the encumbered VR platform, Michael Heim has suggested that a virtual environment such as this adds to and amplifies corporeal experience: "Because the user's body is immersed without having to adapt to the system's peripherals (heavy helmet, tight data glove, calibrated earphones), the CAVE immersion does not constrict but rather enhances the user's body."[39] More radically, the Canadian artist Char Davies has developed a VR interface for her works *Osmose* (1995) and *Ephémère* (1998) that senses both the breath and the balance of the user, deploying them to move in a floating form of navigation through her world of luminous and transparent 3-D images.[40] This, she claims, simulates the experience of scuba diving and facilitates a sense of both space and embodiment that removes one from the sphere of everyday life but not from the corporeal.

Both Heim and Davies make ontological claims for these forms of VR, suggesting that they return their participants to a renewed sense of "being in the world." This term they both appropriate somewhat haphazardly from phenomenology to refer to the bridging of mind and body enabled by new negotiations of VR. Here, nature and the material world are supposedly augmented rather than replaced, and technology functions to center and resubjectify rather than instrumentalize and objectify the world for the immersant. Heim and Davies pay tribute to the Heideggerian critique of technology by focusing on the phenomenological experience of body and self in VR. In its military/industrial/entertainment version, VR can be seen as symptomatic of the brutal modern "enframing" of the world as nothing more than a resource. According to Heidegger, bodies, human or otherwise, are here merely a "standing reserve" to be wrenched from their present and/or historical contexts and used up in the frenzied race to continue to sustain technological systems.[41] A non-instrumentalist deployment of technology within an aesthetic VR environment would allow modern technology to reconnect with *technē*, Heidegger's reworking of the ancient Greek relationship between technology and technique or craft. For Heim and Davies, this can be achieved through the magical gesture of adding the body back into the virtual picture. In spite of our historical experiences, and hence habituations, of living an instrumentalized relationship between technologies and matter, the assumption made by Heim and Davies is that embodiment in its "natural" and rightful state can somehow be revitalized via "care-full" recombination with technologies. We have returned here to the notion that bodies and technologies are constituted components *prior* to their interaction.

How is it that critics, revisionists and apologists for VR all reach almost identical predictions for both its normative and potentially subversive uses and impact? Perhaps in these visions of VR, technology is consistently conceived in a transcendental relation to the body. Contrary to any overt declarations of re-embodying the world, the body in all of these accounts is either perceived to be an impediment that a prostheticized technics must help to overcome or a supplement to be added back into a technology that has lost its "way."[42] This brings us back to those dividing and connecting lines that begin to form as we conceive of different ways of seeing new media technologies as modes of living our embodiment. Lines, I have already suggested, are difficult to spatialize, perhaps partly because VR is frequently theorized and manifests itself as a problem of solving the relations of four-dimensional space/time (lived corporeality) through what is essentially a 3-D sleight of hand (the visual illusion of immersion). The line, on the other hand, is more of a two-dimensional problem that is always threatening to collapse back, fuse or actualize itself in a completely singular way. Turn a line on its side—look at a line from the point of view of its depth, its third dimension—and it is nothing more than a point. The line and its relation to points of singularity may provide us with a way to think of embodiment and virtuality together, as a set of relations between elements simultaneously joined together and deforming as they intersect at certain points and move apart from each other following various vectors or lines.

In Fisher's diagrammatic sketch this singularity is produced, paradoxically enough, in a transversal manner. At least three "incorporeal universes of reference" intersect with each other.[43] Incorporeal universes of reference can here be understood as fields such as the arts, the media, or political or economic forms such as late capital, which exist as ontologically prior to a specific formation of subjectivity or to the production of actual technical objects. Subjectivity experienced as disembodied is thus an actualization that occurs through the intersection, and hence singularization, of several of these universes. In the case of the Fisher model for VR, a number of universes are singularized through transversal relations and thus allow for the actualization of the technical object VR—for example, an incorporeal, electronically mediated universe of 3-D sound and image; a technological universe that makes, via silicon, the material production of the former feasible; and the universe of the gestural and performative human body. And, of course, to keep these fields at just three cuts short the trajectories of these lines. Already we can see in this conventional model for body and technology in virtual reality the sense in which these vectors

move beyond the confines of this VR space, this platform, this room, pointing toward an outside, a connection to yet other universes of reference. These might include a political/economic universe that finances VR, an imaginary universe desiring the concretization of VR based on the familiar territory of Cartesian space, and so on.

What is interesting about these lines of connection between universes of reference is the extent to which they override the distinction between spheres such as the material and the immaterial, the real and the virtual, the corporeal and the technological. They draw our attention toward the ways in which bodies and new media technologies are beginning to operate conjointly. But they simultaneously make us aware of the gaps punctuating this conjunction. Technologies of VR, viewed from this framework of transversal singularity (a gathering of points that cross each other to form divergent lines), can offer an understanding of the mutations that machines and bodies are currently undergoing. They cannot, however, provide a technological fantasy ride into a sublime, virtual realm, nor do they simply represent the culmination of modern technology's inexorable march toward the ultimate in dehumanization: corporeality as instrumentalized objectified experience. Rather, to paraphrase Guattari, they are actualizations of machines of virtuality.[44]

What is important in focusing on the diagrammatic aspect of VR as a means of thinking of virtuality is the ontological shift this brings about. We move away from the subject as self-synthesis of the sentient, and technology as the transcendental subject of history. But, as Brian Massumi has argued, diagrams do not give us a plan of the virtual any more than the 3-D immersive graphics of the NASA-Ames workstation do.[45] Virtuality, as such, cannot appear but can only be inferred through the relations between the elements of a diagram. Lived corporeality is not a state but a flux that flows in and out of the other fluxes of the social machine, technical machine, art machine and war machine. Massumi's insight is to suggest that topology—a geometry of the changes affecting both the alteration and the retention of the morphology of the diagram—provides the contours of the virtual. The fluctuating diagram that might appear in the wake of this virtual tracing would signal both the qualitative changes undergone by parts of the assemblage body-VR and the qualities that also persist and remain impervious to changes.

We would now need to resituate the role of the embodiment of the VR user as centrifugal to the Fisher model. The forces impinging on a user/operator of VR technologies produce a series of sensations that are experienced as continuous, qualitative changes for her or him. It is the analog

experience of living a body in relation to the forces that impinge upon that body that produce those fleeting sensations of virtuality. Massumi indicates the importance of both affective embodiment and the domain of the analog in relation to the virtual. But the digital, scaled down from its commodified hype, may also be a mode of setting off the pulsations, repetitions and multiplications that our bodies, analog compositions that they are, can use to transform themselves and become virtual selves. Analog/digital relations are interdependent rather than separate. With this interdependency also comes the acknowledgment of the interrelations between corporeality and technology, actuality and virtuality. These interdependencies trace out various actualizations of virtual subjectivity. As Hayles has argued, VR technologies may allow us to experience subjectivity that does not remain bounded by our bodies but rather is distributed across our physical bodies and virtual selves.[46] These are doubled in VR environments, games and many other forms of new media interfaces.

Another way to picture this trajectory is to think outside the notion of line as direction or movement toward a finite state of resolution—virtual reality—and to see virtualization as an expanding and contracting field of differentiation, an enfolding of matter by informational incorporeality. Hayles suggests that this trajectory has led to a restructuring of Western culture's ideas about the material world, such that we now see it as inextricably bound up with the immaterial patterns that constitute code: "*Virtuality is the cultural perception that material objects are interpenetrated by information patterns.*"[47] But the way that this "condition of virtuality" is currently understood is in terms of a weighting toward the immaterial. Materiality is conceived of as the carrier for what is ultimately more essential: the information it houses. Information needs something through which to pass in order to transmit its flows. The material is not perceived as a force of equal strength in relation to virtualization but rather as the difference from which the virtual cannot quite seem to escape. The interpenetration of materiality by information is not generally acknowledged to result in interdependency but consistently remainders matter as smaller and smaller differences that effectively no longer matter. Hence we might think of dominant manifestations of VR as a kind of blocking of the virtual elasticity of human carbon bodies (their ability to become other than static, weighty impediments) by an overinvestment/overdetermination of the informatic universe by capital.[48] In this light it has seemed almost "natural" to assert the importance of the "body" or "embodied experience" as an antidote to this movement toward virtualization, as Heim and Davies do. But the point is not to continue to pit body against technology, actuality against

virtuality; rather we must address the question of how to actualize the virtual in ways that take into account the virtual, incorporeal capacities of matter.

Virtualization, understood through transitions and transactions between information and the materiality of our bodies, involves a multiplication of affect, of the capacities of conceptualizing, perceiving and feeling embodiment. It incurs the strange situation, for example, of learning to negotiate a three-handed body, for instance. Two hands occupy ordinary spatial and specular relations with our eyes, while another, split from us via the mediation of the digital, extends an invitation to jump across the physical environment to the information sphere. The virtual dimension of matter, that is, the capacity of bodies to enable this transition, is really an ongoing question: how can our biology continue to become different? This dimension, elaborated through the virtual lines that I have been following in Fisher and Guattari, traces embodied relations of chaotic, biotic, interior flux all the way to emerging thresholds of complex organization. These verge upon and fold into outside forces and forms, such as technical machines. Guattari's lines of virtuality, like the lines in Fisher's diagrammatic sketch of VR, struggle to be registered at the level of representation, but this does not mean they do not register at all. As Massumi notes in his work on affect, these are virtually impossible lines to trace; they happen too quickly to register in our current cultural vocabulary of separating the world into either/or relations: "The virtual is a lived paradox where what are normally opposites coexist, coalesce and connect; where what cannot be experienced cannot but be felt—albeit reduced and contained."[49] What we feel as our ordinary everyday embodiment is only one actualization of intersecting sensory and proprioceptive virtuality, concretized over a period of time into habits and recognizable rhythms. Virtual reality environments can affect those habits by disrupting the speed, rhythm and direction of movement and stasis. This disturbance may temporarily make us feel that we have moved outside of or beyond the boundedness of our bodies. These environments frequently alter our perceptual and spatial relation to the horizon and play with our sense of bodily scale. In Char Davies's works, users learn to travel through vertical, virtual environments by focusing on the rising and falling rhythms of breathing instead of navigating through space organized through the conventions of perspective and so on. Davies's experiments with VR could therefore be rethought in terms of what they offer as new modes of techno-embodiment, rather than simply as a return of the body to virtual reality.[50] But if VR as a digital technology has something to say to us in the register of existence, it is to underscore the fact that bodies in many kinds of experiences are in the

process of becoming virtual; VR is only one among countless other organizations of virtuality.

The issue is not so much one of accrediting new media technologies with the dematerializing of the body; bodies are constantly extending toward an incorporeal dimension as they become virtual. Rather, the problem is the extent to which these technologies claim virtuality as a property unique to themselves, and as the only possible way of organizing the virtual. The problem with VR is its claims for technologically managed and delivered ontology. Frances Dyson signals the extent to which, according to this techno-being, the virtual self is reduced to a predicate of new technologies: "Thus the 'ontology' of cyberspace does not imply the being of some thing or another, rather it signals the attempts to assign Being as an attribute to these new forms of media and communications."[51] As a result, other virtualities, other becomings pass by unnoticed as VR is accorded the status of technologically altering our fundamental modes of being and hurtling us into the next millennium. This is an ethical or political problem in which certain forms of technologically enhanced environments are attributed with more value and hence are invested with greater funding, infrastructural support and expertise than others. Although we cannot actualize the technical object VR outside of the social machine that creates it as an ensemble of disembodied prosthetics and quantifiable spacetime, we might momentarily exploit the paradox engendered by this set of conditions. This paradox lies in the ability of VR to also contribute to the production of technologically embodied experiences.

Furthermore, we might look for these curious moments, mainly highlighted by new media artists, that unfold embodiment as an ongoing and incomplete proposition. In arguing for virtuality to be viewed as a differential in relation to its current and potential actualizations, I have suggested that folding can be made concurrent with the concerns of contemporary aesthetics. Folding now emerges as a discontinuous line of force(s) that brings together informatic selves and organic bodies into a proximity to which they strangely or contingently belong. Where the baroque arts and sciences produced a *scientia* entwined with history, local anecdote and passions to draw the viewing subject into an aesthetic relation with the matter displayed before them, information aesthetics now needs to invent an affectivity for its culture from the sensations and perceptions that its technologies produce. This may better help us to understand the dynamic of information and bodies, of the plastic incorporeal and the extensivity of material life.

An interface is a contact surface.   —BRENDA LAUREL[1]

An interface is an obstacle: it stands between a person and the system being used.   —DONALD NORMAN[2]

4 interfaciality from the friendly face of computing to the alien terrain of informatic bodies

The Interface and the Problem of Facialization

Between the two seemingly opposed approaches of Brenda Laurel and Donald Norman to the design of computer software and hardware, an even playing field defining the dominant relations between humans and computers has been mapped out over the last two decades. Laurel, who has had considerable influence in the areas of software interface design, digital theory and digital art practice, evokes the specter of the inhuman, alien computer.[3] Held at arms reach, it stretches across to our world, making contact with the human at surface points only. Here, the interface functions as glue, tenuously holding together the incompossible worlds of the machinic and the organic. It desperately seeks out