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SEEING WITH THE BODY
## THE DIGITAL IMAGE IN POSTPHOTOGRAPHY

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In a well-known scene from the 1982 Ridley Scott film *Bladerunner*, Rick Deckard scans a photograph into a 3-D rendering machine and directs the machine to explore the space condensed in the two-dimensional photograph as if it were three-dimensional [see fig. 1]. Following Deckard's commands to zoom in and to pan right and left within the image space, the machine unpacks the "real" three-dimensional world represented by the two-dimensional photograph [see figs. 2–3]. After catching a glimpse of his target—a fugitive replicant—reflected from a mirror within the space, Deckard instructs the machine to move around behind the object obstructing the two-dimensional photographic view of the replicant and to frame what it sees [see figs. 4–5]. Responding to the print command issued by Deckard, the machine dispenses a photograph of the replicant which is, quite literally, a close-up of an invisible—indeed nonexistent—part of the two-dimensional original [see fig. 6]. And yet, following the fantasy of this scene, this impossible photograph is—or would be—simply the image of one particular data point within the data set comprising this three-dimensional data space.

As fascinating as it is puzzling, this scene of an *impossible* rendering—a rendering of two-dimensional data as a three-dimensional space—can be related to the crisis brought to photography by digitization in two ways. On the one hand, in line with the film's thematic questioning of photography as a reliable index of memory, this scene foregrounds the technical capacity of digital processing to manipulate photographs. In this way, it thematizes the threat posed by digital technologies to traditional indexical notions of photographic realism. On the other hand, in what has turned out to be a far more prophetic vein, the scene presents a radically new understanding of the photographic image as a three-dimensional "virtual" space. Such an understanding presupposes a vastly different material existence of the photographic image: instead of a physical inscription of light on sensitive paper, the photograph has become a data set that can be rendered in various ways and thus viewed from various perspectives.

The first position corresponds to the arguments made by William Mitchell in his now classic book, *The Reconfigured Eye*. In a comprehensive analysis of the techniques and possibilities of digital imaging, Mitchell concentrates on demarcating the traditional photographic image from its digital *doppelgänger*. While the specter of manipulation has always haunted the photographic image, it remains the exception rather than the rule: "There is no doubt that extensive reworking of photographic images to produce seamless transformations and combinations is technically difficult, time-consuming, and outside the mainstream of photographic practice. When we look at photographs we presume, unless we have some clear indications to the contrary, that they have not been reworked" [Mitchell 7]. To buttress this claim, Mitchell sketches three criteria for evaluating traditional photographic images: (1) does the image follow the conventions of photography and seem internally coherent? (2) does the visual evidence it presents

ZM 0000   NS 0004   EW 0007

ZM 3852   NS 0157   EW 0334
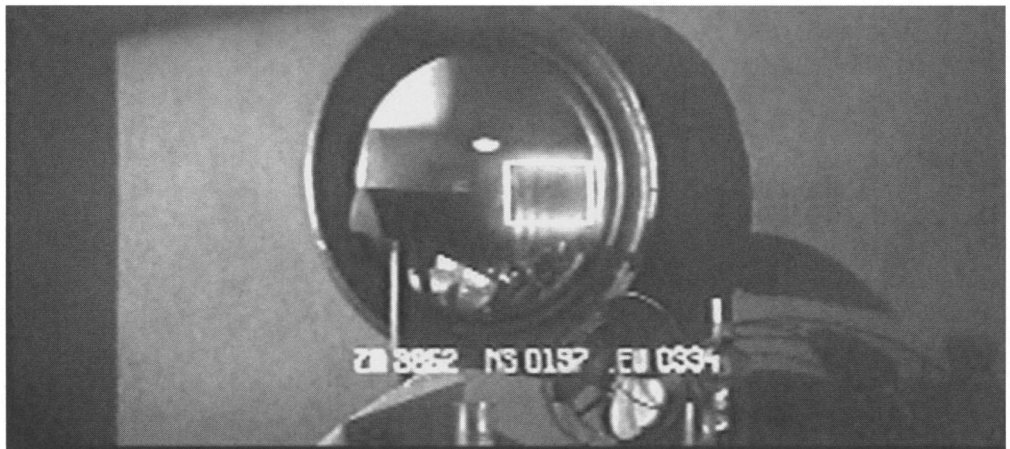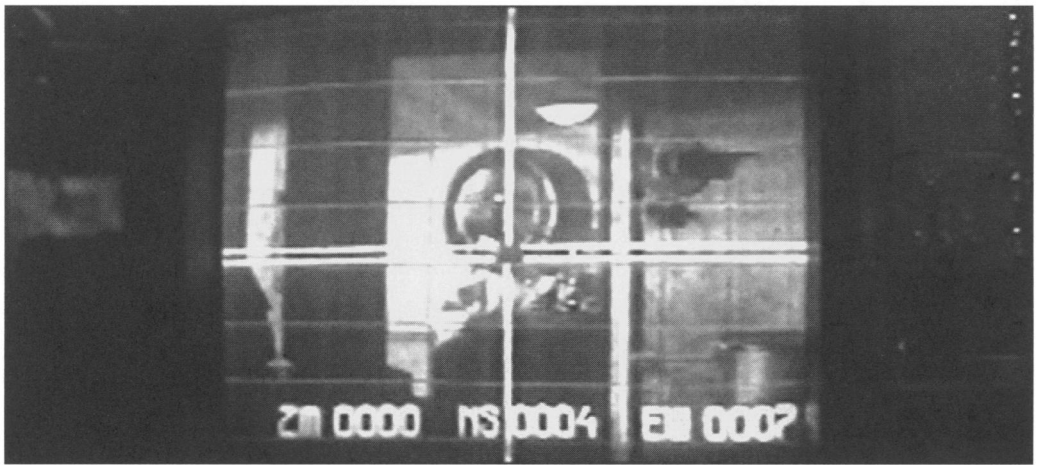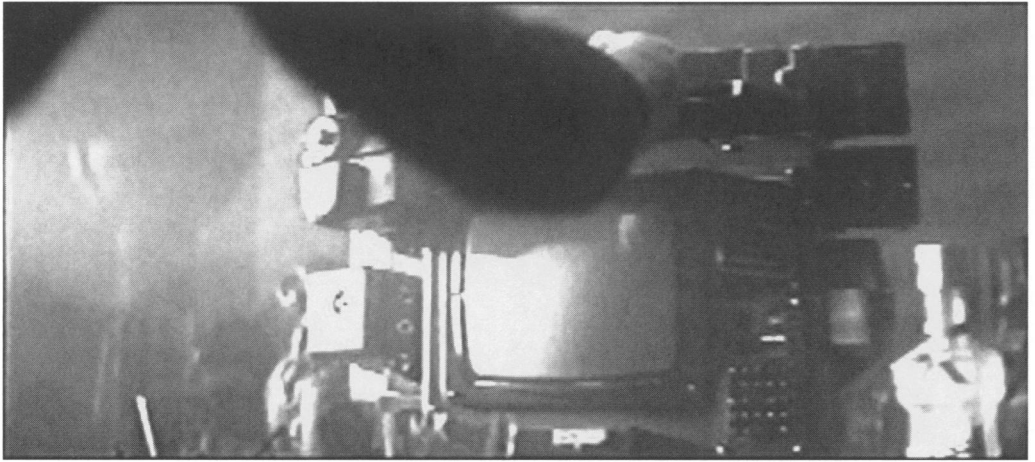
Figs. 1–3. Stills from Blade Runner *(Ridley Scott, 1982), courtesy of Warner Brothers Home Video. Rick Deckard navigates a two-dimensional image as a three-dimensional space.*
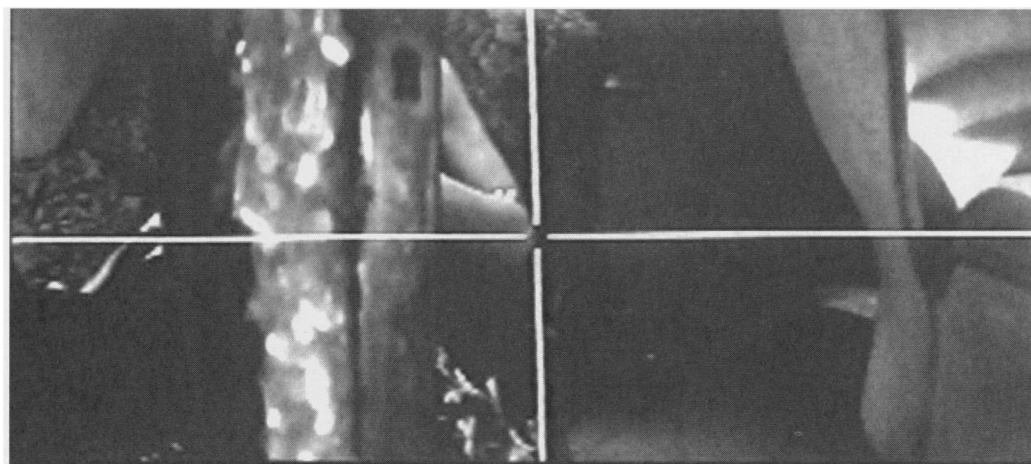
Figs. 4–6. Stills from Blade Runner *(Ridley Scott, 1982), courtesy of Warner Brothers Home Video. Rick Deckard navigates a two-dimensional image as a three-dimensional space.*

support the caption or claim being made about it? and (3) is this visual evidence consistent with other things we accept as knowledge [43]? Clearly, with the development of digital imaging techniques, these criteria and the constraint imposed by the difficulty of manipulation lose their salience. The result, according to Mitchell, is a "new uncertainty about the status and interpretation of the visual signifier" [17] and the subversion of "our ontological distinctions between the imaginary and the real" [225].

These conclusions and the binary opposition on which they are based need to be questioned. Beyond the morass of difficulties involved in any effort to affirm the indexical properties of the traditional photograph, we must evaluate the adequacy of Mitchell's conception of digitization. To this reader, Mitchell's depiction of digital photography as manipulation of a preexisting *image* imposes far too narrow a frame on what digitization introduces. We might do better to describe digital photography as "synthetic," since digitization has the potential to redefine what photography is, both by displacing the centrality accorded the *status* of the photographic *image* (i.e., analog or digital) and by foregrounding the procedures "through which the image is produced in the first place" [Manovich, "Paradoxes" 4]. Digital photography, that is, uses three-dimensional computer graphics as a variant means of *producing* an image: "Rather than using the lens to focus the image of actual reality on film and then digitizing the film image (or directly using an array of electronic sensors), we can . . . construct three-dimensional reality inside a computer and then take a picture of this reality using a virtual camera also inside a computer" [4]. In this case, the referent of the "virtual" picture taken by the computer is a data set, not a fragment of the real. Moreover, the perspective from which the picture is taken is, in relation to human perception, wholly arbitrary: "The computerization of perspectival construction made possible the automatic generation of a perspectival image of a geometric model as seen from an arbitrary point of view—a picture of a virtual world recorded by a virtual camera" [Manovich, "Automation" 6].

With this deterritorialization of reference, we reach the very scenario presented in the scene from *Bladerunner*—the moment when a computer can "see" in a way profoundly liberated from the optical, perspectival, and temporal conditions of human vision.[1] With the material fruition of the form of computer vision imagined in this scene, in other words, we witness a marked deprivileging of the particular perspectival image in favor of a total and fully manipulable grasp of the entire data space, the whole repertoire of possible images it could be said to contain.

What is fundamental here is the radical resistance of this data space to any possible human negotiation. Thus, one way of making sense of this negotiation would be to understand this data space as a form of *radical* anamorphosis, in which the cumulative perspectival distortions that lead to the final image do not mark a "stain" that can be resolved from the standpoint of another *single* perspective (however technically mediated it may be). Unlike Holbein's *The Ambassadors*, where an oblique viewing angle reveals the presence of a skull within an otherwise indecipherable blob, and unlike Antonioni's *Blow-Up*, where photographic magnification discovers a clue initially invisible in the image, what we confront here is a multiply distorted technical mediation that requires the abandonment of any particular perspectival anchoring for its "resolution."

This transformative operation furnishes a case study of what Kate Hayles has dubbed the OREO structure of computer mediation: an analog input (the original photograph)

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1. Indeed, Manovich's characterization of automated sight furnishes what is, in fact, a wholly apt depiction of this scene: "Now the computer could acquire full knowledge of the three-dimensional world from a single perspectival image! And because the program determined the exact position and orientation of objects in a scene, it became possible to see the reconstructed scene from another viewpoint. It also became possible to predict how the scene would look from an arbitrary viewpoint" ["Automation" 15].

undergoes a process of digital distortion that yields an analog output (the close-up) [Hayles]. If we are to understand the impact of this complex transformation, we must not simply attend to the analog outsides, but must deprivilege our modalities of understanding enough to allow the digital middle to matter. Paradoxically, then, the imperative to find ways of "understanding" the digital middle becomes all the more significant as computer vision parts company with perspective and photo-optics altogether. Indeed, the apotheosis of perspectival sight marks the very moment of its decline: due to the intrinsic underdetermination of the image, vision researchers quickly realized that the perspective inherent to photographic optics was an obstacle to the total automation of sight, and they went on to develop other, nonperspectival means, including "range finders" such as lasers or ultrasound, as the source of three-dimensional information.[2]

No one has expressed the cultural significance of this unprecedented moment more pointedly than art historian Jonathan Crary, who cites it as the very motivation for his reconstruction of the technical history of vision:

> *Computer-aided design, synthetic holography, flight simulators, computer animation, robotic image recognition, ray tracing, texture mapping, motion control, virtual environment helmets, magnetic resonance imaging, and multispectral sensors are only a few of the techniques that are* relocating vision to a plane severed from a human observer. . . . *Most of the historically important functions of the human eye are being supplanted by practices in which visual images no longer have any reference to the position of an observer in a "real," optically perceived world. If these images can be said to refer to anything, it is to millions of bits of electronic mathematical data.* [Crary 1–2, emphasis added]

The work of the cultural theorist—like that of the new media artist—begins at the very point where the human is left behind by vision researchers; the apotheosis of perspectival vision calls for nothing less than a fundamental reconfiguration of *human* vision itself.

Machinic Vision and Human Perception

In a recent discussion of what he calls "machinic vision," cultural theorist John Johnston correlates the digital obsolescence of the image with the massive deterritorialization of information exchange in our contemporary culture. In a world of global, networked telecommunications assemblages, Johnston wonders whether we can still meaningfully speak of the image as having any privileged function at all:

> *Unlike the cinematic apparatus, . . . contemporary telecommunications assemblages compose a distributed system of sentience, memory and communication based on the calculation (and transformation) of information. Within the social space of these assemblages . . . , the viewing or absorption of images constitutes a general form of machinic vision. . . . As a correlative to both these assemblages and the distributed perceptions to which they give rise, the image attains a new status, or at least must be conceived in a new way. . . . In the circuits of global telecommunications networks, . . . the*

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2. See in this regard, Kittler's recent discussion of the digital image in "Computer Graphics: A Semi-Technical Introduction." I discuss Kittler's position in my essay "The Affective Topology of New Media Art." (This discussion does not appear in the revised version of the essay, namely chapter 6 of New Philosophy for New Media.)

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> *multiplicity of images circulating ... cannot be meaningfully isolated as material instances of cinema (or television) and brain. Many of these images, of course, are perceived, but their articulation occurs by means of another logic: the incessant coding and recoding of information and its viral dissemination. The image itself becomes just one form that information can take.* [Johnston 46]

For Johnston, the informational infrastructure of contemporary culture quite simply necessitates a radical disembodiment of perception. As he presents it, this disembodiment follows upon and extends the disembodiment to which Gilles Deleuze (in his study of the cinema) submits Bergson's conception of perception as the selective filtering performed by an embodied center of indetermination. (For those to whom this is less than familiar territory: in the first chapter of *Matter and Memory*, Bergson sketches a monist view of matter and memory according to which perception would involve not something in addition to matter [such as idealist positions maintain], but rather the subtraction or "diminution" from the universe of images as a whole precisely those images which are relevant for a given perceiving body. Accordingly, perception [or perceived matter] would be itself a part of matter as a whole. Furthermore, Bergson goes on to insist that perception is always mixed with affection and memory, bodily faculties that mark the positive contribution of the body to the process of perception. In *Cinema 1*, Deleuze appropriates Bergson's conception of perception *qua* subtraction as an altogether apt description of how the cinematic frame works; in order to do so, however, he is compelled to disembody the center of indetermination, such that the process of subtraction is no longer mixed with the contribution of the body, but is instead the function of a purely formal, technical agency—the camera.[3]) For us, the interest of Johnston's extension of Deleuze's disembodiment of Bergson comes at the precise point where it diverges from Deleuze: namely, where the disembodiment of perception is correlated with the contemporary achievement of automated vision. Not only does this correlation bring to material fruition the universal flux of images that Deleuze claims to discover in the cinema of the time image, but it marks *the very culmination of the image's function as a privileged vehicle for perception.* Reconceived in the context of today's global telecommunications assemblages, the image is said to comprise

> *the perceptual correlative of actions in and reactions to a milieu (Bergson), but a milieu now defined by a variety of agents and subagents in human-machine systems. While Deleuze never explicitly describes this new machinic space, nor the specific kind of vision it elicits, both are anticipated in his Bergsonian study of the cinematic image, where the viewer is always already in the image, necessarily and inevitably positioned within a field of interacting images, with no means to step back, bracket the experience, and assume a critical distance. ... [O]nce the brain no longer constitutes a "center of indetermination in the acentered universe of images," as it did for Bergson, and is itself decomposed into distributed functions assumed by machines,* perception can no longer be simply defined in terms of the relationship between images. [57]

Johnston parts company with Deleuze from the moment that he correlates the digitization of the image with the technical distribution of cognition *beyond* the human body-brain: as functions formerly ascribed to it "have been autonomized in machines operating as parts of highly distributed systems," the brain has become a "deterritorialized organ"

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3. *I explore Bergson's conception of perception and Deleuze's appropriation of it at great length in the study from which this essay is excerpted,* New Philosophy for New Media.

[45]. The result is a "generalized and extended condition of visuality"—machinic vision—in which the task of processing information, that is, perception, necessarily passes through a machinic circuit [45].[4] In this posthuman perceptual regime, the selection of information is no longer performed exclusively or even primarily by the human component (the body-brain as a center of indetermination).

It is hardly surprising, then, that what Johnston refers to as the "digital image" can only be "perceived" by a distributed machinic assemblage capable of processing information without the distance that forms the condition of possibility for human vision: ". . . for the digital image there is no outside, only the vast telecommunications networks that support it and in which it is instantiated as data" [39]. The digital image has only an "electronic underside" which "cannot be rendered visible" precisely because it is entirely without correlation to any perceptual recoding that might involve human vision. Accordingly, the digital image is not really an "image" at all: far from being a correlate of the imaginary domain of sense experience, it designates the "objective" circulation of digital data—Kittler's endless loop of infinite knowledge[5]—emancipated from any constraining correlation with human perceptual ratios.

Despite his professed commitment to *machinic* vision as resolutely posthuman, however, Johnston's analysis is significant, above all, for the (perhaps unintended) contribution it makes toward reconfiguring human vision for the digital age. Specifically, Johnston's machinic vision must be differentiated from the automation of vision explored above, and the human must be resituated in the space of this very difference: whereas visual automation seeks to replace human vision *tout court*, machinic vision simply expands the range of perception well beyond the organic-physiological constraints of human embodiment. One way of understanding this expansion (Johnston's way) is to focus on its transcendence of the human; another, more flexible approach, however, would view it as a challenge to the human, one that calls for nothing less than a reconfiguration of the organic-physiological basis of vision itself. Taking up this latter perspective, we can see that machinic vision functions precisely by challenging the human to reorganize itself. In this sense, machinic vision can be understood as profoundly Bergsonist, since it occasions an expansion in the scope of the embodied human's agency in the world, a vast technical extension of "intelligence."

In another sense, however, machinic vision would appear to ignore the core principle of Bergson's theory of perception—the principle that there can be no perception without affection:

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4. Perception qua *machinic vision thus requires "an environment of interacting machines and human-machine systems" and "a field of decoded perceptions that, whether or not produced by or issuing from these machines, assume their full intelligibility only in relation to them" [27].*

5. *Kittler conceives of the digital condition as one of medial convergence or technical dedifferentiation:*

> The general digitization of channels and information erases the differences among individual media. Sound and image, voice and text are reduced to surface effects, known to consumers as interface. Sense and the senses turn into eyewash. . . . Inside the computers themselves everything becomes a number: quantity without image, sound, or voice. And once optical fiber networks turn formerly distinct data flows into a standardized series of digitized numbers, any medium can be translated into any other. With numbers, anything goes. Modulation, transformation, synchronization; delay, storage, transposition; scrambling, scanning, mapping—a total media link on a digital base will erase the very concept of medium. Instead of wiring people and technologies, absolute knowledge will run as an endless loop. *[Kittler, Gramophone, Film, Typewriter 1–2]*

> *... we must correct, at least in this particular, our theory of pure perception.*
> *We have argued as though our perception were a part of the images, detached,*
> *as such, from their entirety, as though, expressing the virtual action of the*
> *object upon our body, or of our body upon the object, perception merely isolated*
> *from the total object that aspect of it which interests us. But we have to take*
> *into account the fact that our body is not a mathematical point in space, that*
> *its virtual actions are complicated by, and impregnated with, real actions, or,*
> *in other words,* that there is no perception without affection. Affection is, then,
> that part or aspect of the inside of our body which we mix with the image of
> external bodies; *it is what we must first of all subtract from perception to get*
> *the image in its purity.* [Bergson, *Matter and Memory* 58, emphasis added]

For Bergson, any "real" act of perception is always contaminated with affection—both as a factor determining the selection of images and as a contribution to the resulting perceptual experience. What this means, of course, is that there simply can be no such thing as "machinic perception"—unless, that is, the human plays a more fundamental role in it than Johnston wants to acknowledge. Thus, what Johnston describes as a new "machinic space" should be understood less as an expansion of the domain of perception itself than as a vast increase in the flux of information from which perception can emerge.

Rather than demarcating a new deterritorialized regime of perception—a "generalized condition of visuality"—what the phenomenon of machinic vision foregrounds is the urgent need, at this moment in our ongoing technogenesis, for a differentiation of properly human perceptual capacities from the functional processing of information in hybrid machine-human assemblages, of vision proper from mere sight. Only such a differentiation can do justice to the affective dimension constitutive of human perception and to the active role affectivity plays in carrying out the shift from a mode of perception dominated by vision to one rooted in those embodied capacities—proprioception and tactility—from which vision might be said to emerge.

Precisely such a differentiation and an altogether different understanding of the automation of sight informs the aesthetic experimentation with computer vision and image digitization that is my focus here. For today's new media artists, the historical achievement of so-called "vision machines"[6] comprises nothing if not a felicitous pretext for an alternative investment in the bodily underpinnings of human vision. At the heart of this aesthetic approach to the automation of sight is an understanding of the vision machine as the catalyst for a "splitting" or "doubling" of perception into, on the one hand, a *machinic* form, mere sight (roughly what Lacan, and Kittler following him, understand as the machine registration of the image[7]) and, on the other, a *human* form tied to embodiment and the singular form of affection correlated with it, vision proper. Such a splitting of perception is simply the necessary consequence of the vast difference between the computer and human embodiment: whereas "vision machines" transform the activity of perceiving into a computation of data that is, for all intents and purposes, instantaneous, human perception takes place in a rich and evolving field to which bodily

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6. *The term is Paul Virilio's and, in accord with my distinction here between "vision" and "sight," would better be rendered as "sight machine."*

7. *Lacan develops his materialist notion of consciousness in* Seminar II. *Kittler appropriates it in his understanding of the technical properties of computer graphics: "... in a 'materialist definition' of consciousness any 'surface' suffices where the refraction index biuniquely transfers individual points in the real to corresponding though virtual points in the image. So-called Man, distinguished by his so-called consciousness, is unnecessary for this process because nature's mirrors can accommodate these types of representation just as well as the visual center in the occipital lobe of the brain"* [Kittler, Literature *131].*

modalities of tactility, proprioception, memory, and duration—what I am calling affectivity—make an irreducible and constitutive contribution. As the pretext for an alternative investment of the embodied basis of human visual perception, this splitting is fundamental for any aesthetic redemption of the automation of sight. While theorists like Deleuze and Johnston miss the call for such an investment, new media artists directly engage the bodily dimensions of experience which surface, as it were, in response to the automation of vision. Their work can thus be said to invest the "other side" of the automation of vision—the affective source of bodily experience that is so crucial to reconfiguring human perception in our contemporary media ecology.

Reembodying Perception

To contextualize this aesthetic investment of the body, we would be well advised to revisit the work of French media critic Paul Virilio—the theorist of the "vision machine" as well as the proximate target of Johnston's critique. More than any other source, it is Virilio's critical insight into the basis for automation—the technification of perceptual functions traditionally bound up with the body—that informs what I would call the "Bergsonist vocation" of aesthetic experimentations with embodied vision.

Far from being the nostalgic has-been of Johnston's imagining, Virilio shows himself to be just as attentive to the advantages of technification as he is to its human costs. In this sense, his evolving analysis of the vision machine can be said to pursue two equally important ends. On the one hand, it functions as a critique of the disembodying of perception that informs the historical accomplishment of what Virilio has termed the "logistics of perception," the systemic technical recoding of formerly human-centered perceptual ratios. But on the other hand, Virilio's analysis forms the basis for an ethics of perception rooted in a defense of the body as an ever-evolving perceiving form. Accordingly, the very position for which Johnston berates Virilio—his refusal to abandon the phenomenology of the body—takes on a newfound and decisively positive significance: as the "victim," so to speak, of the logistics of perception, the body becomes the site of a potential resistance to—or more exactly, a potential *counterinvestment* alongside of—the automation of vision. *Contra* Johnston, Virilio's concern is not the body as *natural*, but the body as an index of the impact of technological change: the body *as it coevolves with technology,* and specifically, *as it undergoes self-modification through its encounter with automated vision.*

Given Virilio's sensitivity to the bodily costs of technification, it is hardly surprising that his position strongly resonates with our understanding of the transformation of the image. As the culminating moment of a fundamental transfiguration in the materiality of the image, the vision machine instantiates precisely what is radically new about the digital image: the shift in the "being" of the image from the objective support of a technical frame to the impermanent "mental or instrumental" form of visual memory. With this new material status comes a profound shift in the scope of the technological recoding of perception: from this point forward, it is the *time* of perception itself, and not its material support, that forms the "object" of technical investment:

> *Any* take *(mental or instrumental) being simultaneously a* time *take, however minute,* exposure time *necessarily involves some degree of memorization (conscious or not) according to the speed of exposure. . . . The problem of objectivisation of the image thus largely stops presenting itself in terms of some kind of paper or celluloid* support surface—*that is, in relation to a material reference space. It now emerges in relation to time,* to the exposure time that allows or edits seeing. [Virilio, *Vision Machine* 61]

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To this shift in the *object* of technical investment corresponds a profound displacement of the human role in perception. In contrast to earlier visual technology like the telescope and the microscope (not to mention cinema itself), which function by *extending* the physiological capacities of the body, contemporary vision machines bypass our physiology (and its constitutive limits) entirely. What is important is not just that machines will take our place in certain "ultra high-speed operations," but the rationale informing this displacement: they will do so "not because of our ocular system's limited depth of focus . . . but because of the limited *depth of time* of our physiological 'take'" [61]. In short, what we face in today's vision machines is the unprecedented threat of our *total* irrelevance: because our bodies cannot keep pace with the speed of (technical) vision, we literally cannot see what the machine can see and are thus left out of the perceptual loop altogether. Thus when he pronounces the image as nothing more than an "empty word," Virilio brings home just how profoundly intertwined the body's *epochē* is with the digital obsolescence of the image.[8]

What most critics—Johnston included—fail to appreciate is that Virilio's analysis does not culminate with this bleak diagnosis of our contemporary situation. Not only does he repeatedly invoke the necessity for an ethics capable of addressing the splitting of perception, but his intellectual trajectory witnesses an increasing attentiveness to the violence of the vision machine's recoding of embodied human functions as disembodied machinic functions. In so doing, Virilio manages to raise his analysis of the vision machine above the limiting binary—human versus machine—that he is so often accused of reinscribing. For in the end, what is at stake in his analysis is neither a resistance to humankind's fall into technology nor an embrace of a radical, technical posthumanization, but something more like the possibility for a technically catalyzed reconfiguration of human perception itself: a shift from a vision-centered to a body-centered model of perception.

Nowhere is this potential perceptual reconfiguration more clearly on display than in the incisive analysis accorded the virtual cockpit in *Open Sky*. Here Virilio pinpoints the fundamental tradeoff of visual automation: embodiment for efficiency. A hi-tech helmet that functions in the place of the instrument panel and its indicator lights, the virtual cockpit combines the superiority of machinic processing with the drive to recode complexly embodied capacities as instrumental visual activities, entirely purified of any bodily dimension: "since th[e] type of fluctuating (real-time) optoelectronic display [offered by the virtual cockpit] demands substantial improvement in human response times, delays caused by hand movements are also avoided by using both voice (speech input) and gaze direction (eye input) to command the device, *piloting no longer being done 'by hand' but 'by eye,'* by staring at different (real or virtual) knobs and saying *on* or *off* . . ." [*Open Sky* 93]. Examples like this lend ample testimony to Virilio's complex interest in the dehumanizing effects of automation: far from being simple moments in an inexorably unfolding logistics of perception, technologies like the virtual cockpit serve above all to expose the concrete costs of visual automation. Indeed, in Virilio's hands, such technologies are shown to function precisely by mounting an assault on the domain of embodied perception; they thereby expose just how much the recoding of human vision as an instrumental function of a larger "vision machine" strips it of its own embodied basis.[9]

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8. "Don't forget," he reminds us, "that 'image' is just an empty word . . . since the machine's interpretation has nothing to do with normal vision (to put it mildly!). For the computer, the optically active electron image is merely a series of coded impulses whose configuration we cannot begin to imagine since, in this 'automation of perception,' image feedback is no longer assured" [Vision Machine 73].

9. "Ophthalmology thus no longer restricts itself to practices necessitated by deficiency or disease; it has broadened its range to include an intensive exploitation of the gaze in which the

This concern with the correlation between automation and the recoding of the body seems to have motivated a subtle yet significant shift of emphasis in Virilio's research, a shift that centers around the role to be accorded the invisible or the "non-gaze." For if, in *War and Cinema* and *The Vision Machine*, Virilio tends to assimilate blindness to the visionless sight of the vision machine, in *Open Sky*, he begins to speak instead of a "right to blindness." Rather than yet one more domain for machinic colonization—the "latest and last form of industrialization: *the industrialization of the non-gaze*" [*Vision Machine* 73]—blindness becomes the basis for an ethics of perception: "it would surely be a good thing if we . . . asked ourselves about the individual's *freedom of perception* and the threats brought to bear on that freedom by the industrialization of vision. . . . Surely it would then be appropriate to entertain a kind of *right to blindness* . . ." [*Open Sky* 96]. More than simply a right not to see, the right to blindness might best be understood as a right to see in a fundamentally different way. For if we now regularly experience a "pathology of immediate perception" in which the credibility of visual images has been destroyed, isn't the reason simply that image processing has been dissociated from the body, from the very source of our visual sensibility [90]? Doesn't the all-too-frequent contemporary predicament of "not being able to believe your eyes" in fact compel us to find other ways to ground belief, ways that reactivate the very bodily modalities—tactility, affectivity, proprioception—from which images acquire their force and their "reality" in the first place?[10]

Expanded Perspective

New media artists can be said to engage the very same problematic as machine vision researchers, though to markedly different effect. As interventions in today's informational ecology, both exploit the homology between human perception and machinic rendering; yet whereas the project of automation pushes this homology to its breaking point, with the result that it brackets out the human altogether, new media art explores the creative potential implicit within the reconceptualizing of (human) perception as an active (and fully embodied) rendering of data. In a recent discussion of the digitization of the photographic image, German cultural critic Florian Rötzer pinpoints the significance of this rather surprising convergence:

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depth of field of human vision is being progressively confiscated by technologies in which man is controlled by the machine . . ." [93].

10. In his brilliant analysis of the "nobility of vision," Hans Jonas shows how touch and other bodily modalities "confer reality" on perception:

> Reality is primarily evidenced in resistance which is an ingredient in touch-experience. For physical contact is more than geometrical contiguity: it involves impact. In other words, touch is the sense, and the only sense, in which the perception of quality is normally blended with the experience of force, which being reciprocal does not let the subject be passive; thus touch is the sense in which the original encounter with reality as reality takes place. Touch brings the reality of its object within the experience of sense in virtue of that by which it exceeds mere sense, viz., the force-component in its original make-up. The percipient on his part can magnify this component by his voluntary counteraction against the affecting object. For this reason touch is the true test of reality. [147–48]

Jonas's analysis forms the basis for my consideration of virtual reality environments in "Embodying Virtual Reality."

Today, seeing the world is no longer understood as a process of copying but of modelling, a rendering based on data. A person does not see the world out there, she only sees the model created by the brain and projected outwards. . . . This feature of perception as construction was . . . unequivocally demonstrated by attempts to mechanically simulate the process of seeing . . . in which the processing. . . has to be understood as a complex behavior system. In this context, not only does the processing stage move into the foreground as against the copy, but [so too does] that organism once taken leave of in the euphoric celebration of photographic objectivity, *an organism whose visual system constructs an environment which is of significance to it.* ["Re: Photography" 17–18, emphasis added]

Rötzer's claim underscores the *functional isomorphism* between machine vision and human perception that forms the foundation of contemporary vision research as well as the impetus for artistic engagements with visual technologies. At issue in both is a *process* of construction from "raw" data in which rules internal to the machine or body-brain are responsible for generating organized percepts—"data packets" in the case of the machine; "images" in that of the human.

Of particular interest here is the inversion to which Rötzer subjects the trajectory followed by vision research: for him, what is central is not how the human prefigures the machinic, but rather how the mechanical simulation of sight recursively impacts upon our understanding and our experience of human vision. It is as if the very capacity to simulate sight furnished the impetus for a reconfiguration—indeed, a reinvention— of vision itself. Beyond its contribution to our understanding of the material transformation of the image, Rötzer's analysis thus pinpoints the potential for the machinic paradigm to stimulate artistic practice. By revealing that embodied human beings are more like computer-vision machines than photo-optical cameras, the functional isomorphism between machinic sight and human perception underscores the processural nature of image construction. Rather than passively inscribing information contained in our perceptual fields, we actively construct perspectival images through rules internal to our brains.

We must bear in mind, however, that this homology between human and computer "perception" becomes available for aesthetic exploitation only in the wake of the splitting of vision into properly machinic and human forms. Accordingly, if our perceptual process is like that of the computer in the sense that both involve complex internal processing, the type of processing involved in the two cases could not be more different: whereas vision machines simply calculate data, human vision comprises a "brain-body achievement." Not surprisingly, this difference holds significance for the aesthetic import of the homology as well: whereas machine-vision systems abandon perspective entirely in favor of a completely realized modelization of an object or space, aesthetic experimentations with human visual processing exploit its large margin of indetermination not to dispense with three-dimensionality altogether, but expressly to modify our perspectival constructions.[11]

It is precisely such modification that is at issue in much recent experimentation with the impact of digitization on the traditional photographic image—perhaps the most developed field of new media art practice. By opening extravisual modes of interfacing with the digital information encoding the digital (photographic) image, such experimentation foregrounds the specificity of human processes of image construction.

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11. *In his treatment of digital design, architect Bernard Cache insists that digitally facilitated topological spaces should not be opposed to Euclidean space—as they so often are—precisely because of their experiential dimension, that is, their capacity to be experienced by us [Cache].*
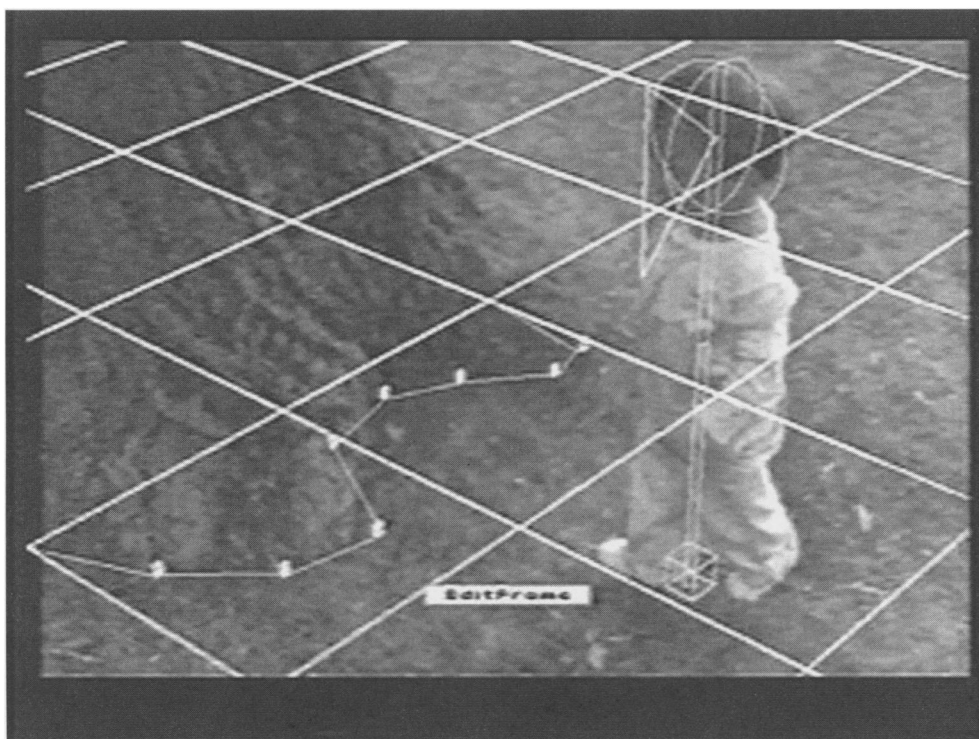
Fig. 7. Tamás Waliczky, The Garden (1992). Computer-generated animation depicting a "synthetic" world from a child's viewpoint; compels the viewer to adopt a "waterdrop" perspective.

In so doing, it pits human image construction against the analog process of photographic rendering, thus drawing attention to the central role played by embodied (human) framing in the contemporary media environment; at the same time, it underscores the fundamental difference between human and computer processing by deploying the latter as an instrument for the former. This double vocation explains the apparent paradox of aesthetic experimentations with the digital infrastructure of the photograph: the fact that exploring the "image" beyond its technical framing (that is, as the photographic or cinematic image) necessarily involves some significant engagement with the technical (that is, with the computer and its constitutive mode of "vision"). In so doing, this double vocation manages to introduce the concrete Bergsonist imperative motivating such experimentation: the imperative to discover and make experientiable *new forms of embodied human perspectival perception* which capitalize on the perceptual flexibility brought out in us through our coupling with the computer.

Consider, for example, new media artist Tamás Waliczky's *The Garden* [see fig. 7]. This computer-generated animation depicts a "synthetic" world oriented around the figure of a child who plays the role of point of view for the camera and thus anchors this point of view, and also that of the spectator, *within* the space of the image. As she moves around in the image space, the child remains the same size, while the objects she encounters change size, angle, and shape in correlation with the trajectory of her movements through the space. By identifying the viewer's perspective with that of the child, Waliczky compels the viewer to deterritorialize her habitual geometric perspective and assume what he calls a "waterdrop perspective" (in a waterdrop, as in a bubble, space is curved around a central orienting point of view). Thus, *The Garden* plays with the flexibility of perspective in a way specifically correlated with human embodiment, and indeed, in a way designed to solicit an active response. As one commentator puts it,

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the work "sets the viewer a task that proves to be hard to grasp—to adopt a decentered point-of-view" [Morse 28]. By disjoining the point of view of the space it presents from our habitual geometric viewpoint, *The Garden* in effect challenges us to reconfigure our relation to the image; and because the act of entering into the space of the image operates a certain alienation from our normal experience, it generates a pronounced affective correlate. We seem to *feel* the space more than to *see* it. Moreover, because it seeks to reproduce the "spherical perspective" of a child's viewpoint on the world, *The Garden* actively forges concrete connections to other modes of perception—for example, to the "egocentric" viewpoint characteristic of children—where seeing is grounded in bodily feeling. As a form of experimentation with our perspectival grounding, *The Garden* thus aims to solicit a shift in perceptual modality from a predominantly detached visual mode to a more engaged, affective and proprioceptive mode.

In his recent work on hypersurface architecture, cultural theorist Brian Massumi grasps the far-reaching implications of such an alternative, haptic and prehodological mode of perception:

> *Depth perception is a habit of movement. When we see one object at a distance behind another, what we are seeing is in a very real sense our own body's potential to move between the objects or to touch them in succession. We are not using our eyes as organs of sight, if by sight we mean the cognitive operation of detecting and calculating forms at a distance. We are using our eyes as proprioceptors and feelers. Seeing at a distance is a virtual proximity: a direct, unmediated experience of potential orientings and touches on an abstract surface combining pastness and futurity. Vision envelops proprioception and tactility. . . . Seeing is never separate from other sense modalities. It is by nature synesthetic, and synesthesia is by nature kinesthetic. Every look reactivates a multi-dimensioned, shifting surface of experience from which cognitive functions emerge habitually but which is not reducible to them.* [21]

Not only does Massumi broaden perception beyond vision, in order to encompass all the sensory modalities of bodily life, but he also suggests that the perspectival flexibility we are exploring here is a consequence of the primordiality of such bodily "vision." On the account he develops, optical vision derives from proprioceptive and tactile "vision," as a particular limitation of its generative virtuality. We might therefore say that new media art taps into the domain of bodily potentiality (or virtuality) in order to catalyze the active embodied reconfiguring of perceptual experience (or, in other words, to "virtualize" the body).

Haptic Space

Precisely such a transformation of what it means to see informs the work of new media artists engaged in exploring the consequences of the digitization of the photographic image. In divergent ways, the work of Waliczky, Miroslaw Rogala, and Jeffrey Shaw aims to solicit a bodily connection with what must now be recognized to be a material (informational) flux profoundly heterogeneous to the perceptual capacities of the (human) body. By explicitly staging the shift from the technical image (for example, the photograph or the cinematic frame) to the human framing function, the works of these artists literally compel us to *"see" with our bodies*. In this way, they correlate the radical agenda of "postphotography" with the broader reconfiguration of perception and of the image currently underway in contemporary culture. With their investment of the body as a

quasi-autonomous site for processing information, these works give concrete embodiment to the fundamental shift underlying postphotographic practice, what pioneering new media artist Roy Ascott glosses as a "radical change in the technology of image-emergence, not only how the meaning is announced but how it comes on stage; not only how the world is pictured, or how it is framed, but how frameworks are constructed from which image-worlds can emerge, in open-ended processes" [166]. By foregrounding the bodily underpinnings of vision, the works of Waliczky, Rogala, and Shaw transform the digital photograph into the source of an embodied framing process that specifies precisely how information can be transformed into experienceable image-worlds.

Unlike Waliczky's *The Garden*, Miroslaw Rogala's *Lovers Leap* does not present a virtual image space, but is firmly rooted within the tradition of photo-optical perspective.[12] It joins together two large-screen video projections of the busy Michigan Avenue bridge in downtown Chicago displayed according to a perspective system that Rogala calls "Mind's-Eye-View." Two photographs taken with a fish-eye lens are processed together into a 360° "pictosphere" that allows exploration along a spectrum ranging from standard linear perspective (when the angle of viewing tends to coincide with the angle of filming) to a circular perspective (when the two angles stand at 180° from one another) [see fig. 8]. Within the space of the installation, the two video screens display views of the same image space from opposite orientations. Caught inside the strange space of the image, the viewer-participant interacts with the image by moving around in the installation or by standing still [see fig. 9]. Bodily movement engages floor-mounted sensors that trigger shifts in the 360° image and that determine whether the shifts are abrupt or gradual, while stasis triggers either an animated sequence of the city corresponding to a given location along the spectrum of the image or a randomly selected video sequence of daily life in Lovers Leap, Jamaica. The installation thus combines elements of chance and viewer control: the viewer-participant's mounting sense of control through movement might be said to be undercut by the random jump cuts to virtual scenes of other places. As Rogala explains: "When the viewer enters the place, one becomes aware that one's movements or actions are changing the view but won't realize how. This means that the viewer is not really in control, but simply aware of his or her complicity. . . . As the viewer's awareness of the control mechanisms grows, so does the viewer's power" [qtd. in Morse 95]. Still, as Margaret Morse observes, the viewer remains powerless to select the content of the experience and can only modify its manner: the viewer chooses "not what is seen, but how it is viewed" [Morse 95]. And, we might furthermore add, what performs the selecting is not the viewer's rational faculties, but her bodily affectivity, which henceforth becomes the link between her mental experience and the space of the image.

In this sense, Rogala's installation might be said to recast the experience of perspective not as a static grasping of an image, but as an interactive construction of what Timothy Druckrey calls an "event-image." In the work, the digitized image becomes "the point of entry into an experience based on the ability to render curvilinear perspective as process" [Druckrey 75]. Effectively, the image becomes an "immersive geometry" in which perspective loses its fixity and becomes multiple. The result is a kind of play with perspective in which the viewer's gestures and movement trigger changes in the image and thereby reconstruct the image as a haptic space. Rogala explains: "movement through perspective is a mental construct; one that mirrors other jumps and disjunctive associations within the thought process" [qtd. in Morse 94]. Moreover, it is the brain which functions to "link" (though, importantly, not to "unite") the physical locality in which the user-participant finds herself with the virtual dimension. "The goal" of the installation, Morse

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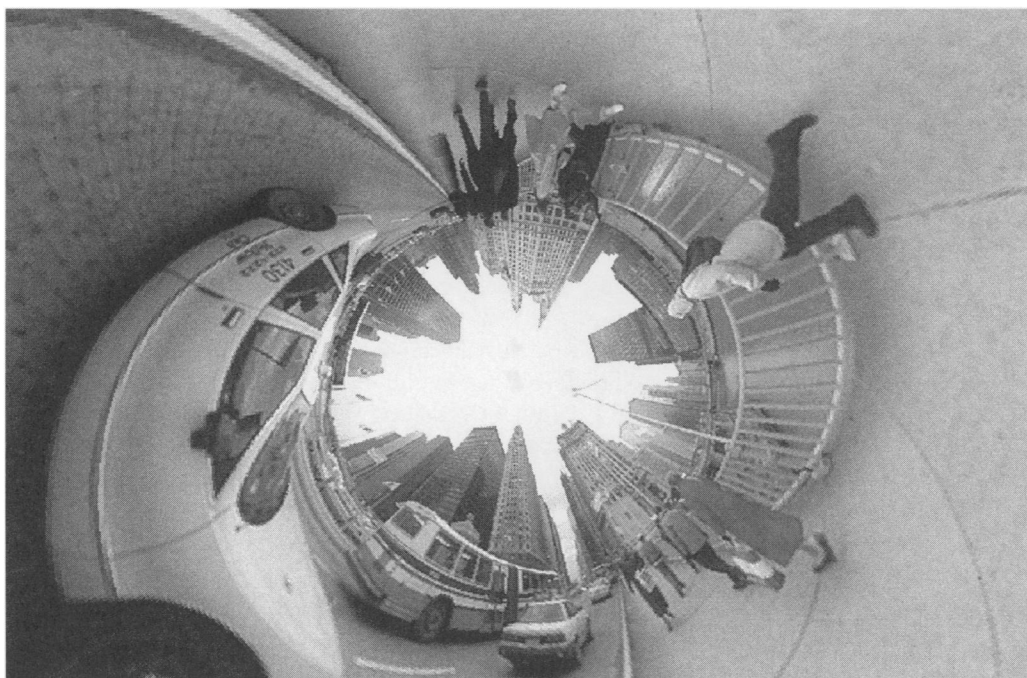12. Documentation of Lovers Leap *can be found at www.rogala.org.*

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Fig. 8. Miroslaw Rogala, Lovers Leap *(1995). Two video screens display views of a 360° "pictosphere"; viewers' physical movement within the space triggers movement of image.*
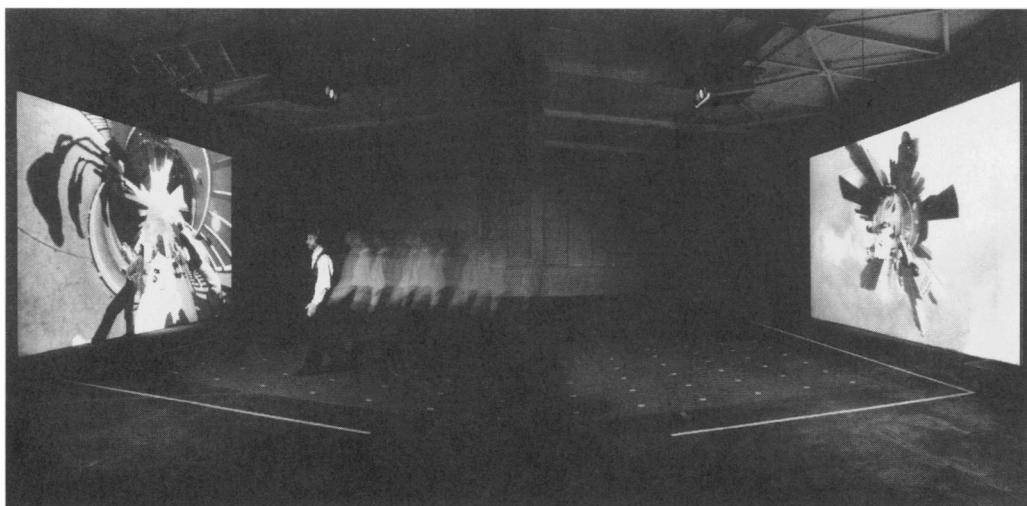

Fig. 9. Miroslaw Rogala, Lovers Leap *(1995). Close-up of 360° pictosphere of downtown Chicago taken with "fish-eye" lens.*

concludes, "is to externalize an internal image in the mind, allowing the viewer to stand outside and perceive it" [96]. Not only does *Lovers Leap* thus suggest a new relation to the photographic image—since, as Druckrey puts it, "the usefulness of the single image can no longer serve as a record of an event" [75]—but it foregrounds the shift from an optical to a haptic mode of perception rooted in bodily affectivity as the necessary consequence of such a shift in the image's ontology and function.[13]

Whereas Rogala's work manages to uproot perspective from its photo-optical fixity without abandoning Euclidean space, Waliczky's work embraces the flexibility of computer mediation and, ultimately, computer space itself in order to confront the anthropomorphic basis of perception with the catalyst of the virtual image.[14] In *The Way*, for example, Waliczky employs what he calls an "inverse perspective system": as three depicted figures run toward buildings, these buildings, rather than getting nearer, actually move farther away [see fig. 10]. In *The Garden*, as we've already seen, Waliczky employs a "waterdrop perspective system" which privileges the point of view not of the spectator, as in traditional perspective, but rather of the child, or more exactly, of the virtual camera, whose surrogate she is. And in *Focusing*, Waliczky dissects a 99-layer digital image by making each of its layers available for investigation by the viewer. What one discovers in this work is that each part of the image explored yields a new image in turn, in a seemingly infinite, and continuously shifting, process of embedding [see fig. 11]. Indeed, Waliczky's work not only furnishes a perfect illustration of Deleuze's claim that any part of the digital image can become the link to the next image,[15] but also foregrounds the bodily activity of the viewer as the filtering agent: what it presents is a truly inexhaustible virtual image surface that can be actualized in an infinite number of ways through the viewer's selective activity.

Waliczky's use of computer space to unsettle optical perspective takes its most insistent form in a work called *The Forest*. Initially produced as a computer animation, *The Forest* uses two-dimensional elements (a single black-and-white drawing of a bare tree) to create the impression of a three-dimensional space. To make *The Forest*, Waliczky employed a small virtual camera to film a series of rotating cylinders of various sizes onto which the drawing of the tree has been copied. Because the camera is smaller than the smallest cylinder, the viewer sees an endless line of trees in staggered rows, when in actuality the trees are mounted on a set of convex surfaces [see fig. 12]. As Anna Szepesi suggests, Waliczky's work combines vertical movement (the movement of the trees), horizontal movement (the movement of the cylinders), and depth movement (the movement of the camera). This combination, argues Szepesi, produces movements running in every direction. The result is a thorough transformation of the Cartesian coordinate system, a replacement of the straight vectors of the x, y, and z axes with "curved lines that loop back on themselves" [Szepesi 102]. And the effect evoked is a sense of limitless space in which the viewer can find no way out. Szepesi explains: "The bare trees revolve endlessly around their own axis, like patterns in a kaleidoscope. The resulting illusion is complete and deeply alarming: the infinity of the gaze leads to a total loss of perspective" [103].

Yet *The Forest* does not present a "posthuman point-of-view," as Morse claims; nor does it restore the conventions of Euclidean vision within a non-Euclidean image space.

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13. As if to reinforce this shift, the work includes a "distorted, circular image," a kind of anamorphic stain—"eerie fish-eye images that look like a ball with buildings growing out of them" [Morse 95, citing Charlie White]—that does not resolve itself into a photo-optic image, but rather calls into being a "mental construct of the omniscient gaze made visible" [Morse 95].

14. Documentation of Waliczky's work can be found at www.waliczky.com.

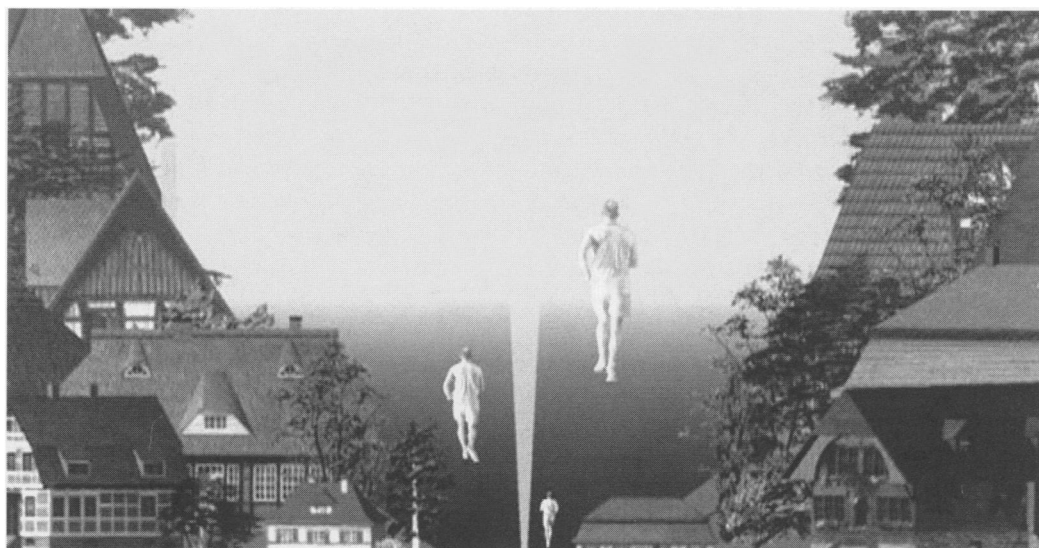15. See Deleuze, Cinema 2, Conclusion. I discuss Deleuze's remarks on the digital image in "Cinema beyond Cybernetics."

Fig. 10. Tamás Waliczky, The Way *(1996).* *"Inverse perspective system" causes objects to diminish in size as the depicted figures run toward the viewer.*

Fig. 11. Tamás Waliczky, Focusing *(1998).* *Interactive, ninety-nine-layer digital image; illustrates the potential for any part of image to generate a new image.*

Fig. 12. Tamás Waliczky, The Forest *(1993). Two-dimensional drawing fed through virtual camera yields illusion of an infinite three-dimensional space.*

Rather, by embedding experientiable vantage points within warped image spaces, *The Forest* opens alternate modes of perceiving that involve bodily dimensions of spacing and duration—modes that, in short, capitalize on the flexibility of the body, and indeed, on the cross-modal or synesthetic capacities of bodily affectivity. In this way, it exemplifies the mechanism driving all of Waliczky's work: namely, the inversion of a normal viewing situation, such that the image becomes the stable point of reference around which the body might be said to move. Morse discerns something similar in *The Way*: "A stationary viewer can interpret his or her own foreground position to be moving. The result is puzzling, an enigma that in any case suggests an ironic or dysphoric vision of motion into what is usually associated with the future or the path of life" [Morse 31]. We must insist, moveover, that what operates such an "interpretation" or "suggestion" is precisely the capacity of the installation to tamper with our ordinary embodied equilibrium: in a reversal of the paradigm of cognitive linguistics (where meaning schemata can be traced back to embodied behavior), what is at stake here is a modification at the level of embodied behavior that subsequently triggers connotational consequences.[16]

These two distinct engagements with photo-optical perspective—one more directly aligned with traditional photography, the other with the virtual image of computer vision research—come together in the work of Jeffrey Shaw. Consider, for example, his coproduction, with Waliczky, of an interactive installation version of *The Forest*. The aim of this installation is to expand the interface between the human viewer and Waliczky's animated virtual world: to open it not simply to the viewer's internal bodily processing, but to her tactile and spatial movement. To this end, Waliczky's world is made navigable via the interface of an advanced flight simulator; using a joystick mounted on a moving seat, the viewer is able to negotiate her own way through the infinitely

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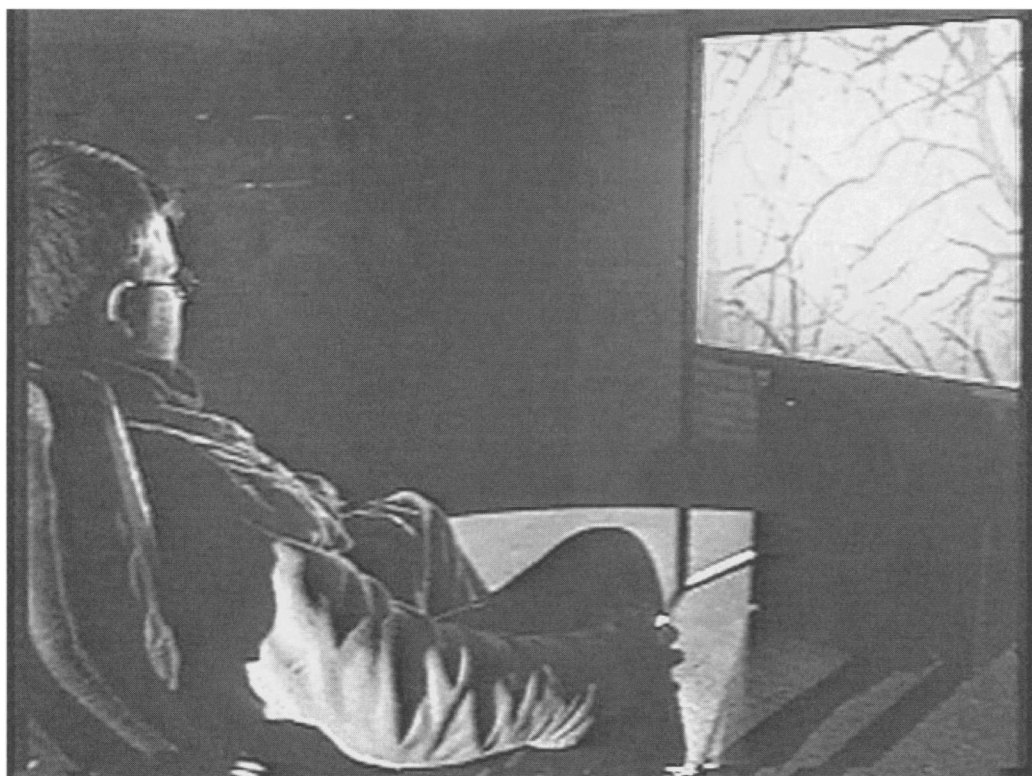16. *For the notion of embodied schemata in cognitive linguistics, see Johnson.*

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Fig. 13. *Jeffrey Shaw and Tamás Waliczky, Installation Version of* The Forest *(1993). Embeds* The Forest *within flight simulator interface; couples illusion of infinite three-dimensional space to possibilities of body movement.*

recursive virtual world of *The Forest* and to experience her journey through the physical sensations of movement that the flight simulator produces in her own body [see fig. 13]. In effect, the process of mapping movement onto the body functions to frame the limitless "virtual" space as an actualized image.

More firmly rooted in the traditions of past image technologies, Shaw's own recent works deploy multiple, often incompatible interfaces as navigation devices for the virtual image spaces his works present.[17] By employing the navigation techniques of panorama, photography, cinema, and virtual reality, he makes their specificity both a theme and a function of his work. Rather than collapsing the technologies into some kind of postmodern *Gesamtkunstwerk*, Shaw layers them on top of one another in a way that draws attention to the material specificity distinguishing each one. The effect of this juxtaposition of incompatible media frames or interfaces is to foreground the "framing function" of the embodied viewer-participant in a more direct and insistent way than either Rogala or Waliczky do. Rather than presenting the viewer-participant with an initially destabilizing interactional domain, Shaw empowers her as the agent in charge of navigating media space: it is the viewer-participant's bodily activity—and specifically, her synesthetic or cross-modal affectivity—that must reconcile the incompatibilities between these diverse interfaces. Thus, as the viewer-participant gradually discovers the limits of the immersive environment, and correspondingly of her own affective processing of this environment, she gains a reflexive awareness of her own contribution to the production of the "reality effects" potentially offered by the interface possibilities. As exhilarating as it is deflating, this awareness serves to place the viewer-participant within the space of the image, although in a manner that, by constantly interrupting

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17. *My book* New Philosophy for New Media *devotes an extended discussion to Shaw's career as the exemplary neo-Bergsonist new media artist [chapter 2].*

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immersion, draws attention to the active role played by bodily affectivity in producing and maintaining this experience.

In two striking instances, this juxtaposition of competing visual traditions concretely exploits the contrast between the photographic image as a static (analog) inscription of a moment in time and the image as a flexible data set. In *Place: A User's Manual*, Shaw deploys the panorama interface in its traditional form—as a photographic image— precisely in order to defeat its illusionist aim. By giving the viewer control over the projection, the frame, and the space it depicts, and by foregrounding the reversibility of the screen (which allows the panorama to be seen from the outside), Shaw opens the photographic space of illusion to various forms of manipulation—all involving bodily movement—which serve to counteract its illusionistic effects [see fig. 14]. Photography is thus transformed into the "condition . . . of another movement, that of movement within virtual space" [Duguet 41]; it becomes the pretext for a movement that is simultaneously *within* the viewer's body *and* the virtual space and that is—on both counts—*supplementary* to the static photographic image. This effect of introducing movement into the photograph from the outside—and its inversion of the conventions of the traditional panorama—is made all the more striking by the content of the panoramic image worlds: deserted sites or sites of memory that, in stark contrast to the tourist sites featured in the nineteenth-century panoramas, are themselves wholly devoid of movement [see fig. 15].

In *The Golden Calf* (1995), Shaw deploys the photographic image as the basis for an experience that reverses the movement foregrounded in *Place* and, by doing so, inverts the traditional panoramic model itself. The work features a white pedestal on which is placed an LCD color monitor connected to a computer via a large five-foot cable. The monitor displays an image of the pedestal with a computer-generated image of a golden calf on top. By moving the monitor around the actual pedestal and contorting her body in various ways, the viewer can examine the calf from all possible angles— above, below, and from all sides [see fig. 16]. The monitor thus functions as a window revealing an immaterial, virtual object seemingly and paradoxically located within actual space [see fig. 17]. Yet, because the calf's shiny skin has been "reflection-mapped" with digitized photographs of the room that were captured with a fish-eye lens, this virtual object also becomes the projective center for a virtual panoramic representation of the space surrounding the viewer, and one, moreover, that brings together past images (again, photography's ontological function) with the present experience of the viewer. Whereas in *Place* the actual panoramic image becomes the pretext for an exploration of virtual space, both within the viewer's body and within the image itself, here the panoramic image is itself the result of a virtual projection, triggered by the images reflected on the calf's skin and "completed" by the embodied processing of the viewer. Rather than enacting the deterritorialization of the photographic image into a kinesthetic space, this work deploys photography as an interface onto three-dimensional space. In this way, it underscores the fundamental correlation linking photography in its digitized form with the "reality-conferring" activity of the viewer's embodied movement in space and the affectivity it mobilizes. If the viewer feels herself to be in the panoramic image space, it is less on account of the image's autonomous affective appeal than of the body's production, *within itself*, of an affective, tactile space, something that we might liken to a bodily variant of Deleuze's notion of the "any-space-whatever."[18] Moreover, if this

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18. *Deleuze defines the "any-space-whatever" in contradistinction to a particular determined space: "It is a perfectly singular space, which has merely lost its homogeneity, that is, the principle of its metric relations or the connection of its own parts, so that the linkages can be made in an infinite number of ways. It is a space of virtual conjunction, grasped as pure locus of the possible. . . . Space itself has left behind its own co-ordinates and its metric relations. It is a tactile space"* [Cinema *109*]. *I discuss Deleuze's concept in relation to new media art in "Affective Topology."*
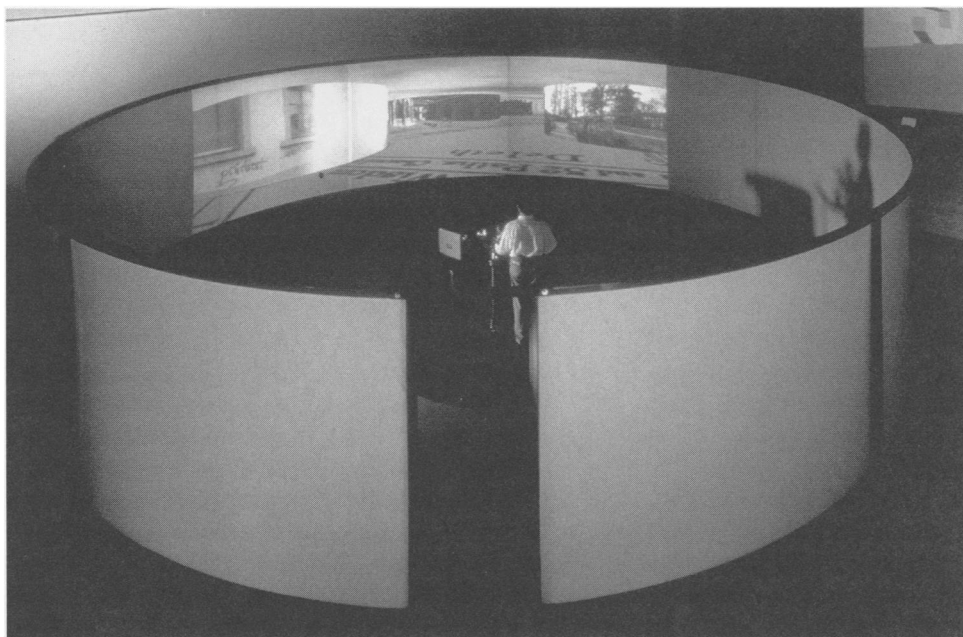
Fig. 14. Jeffrey Shaw, Place: A User's Manual *(1995). Interface platform combining a 360° panorama with*

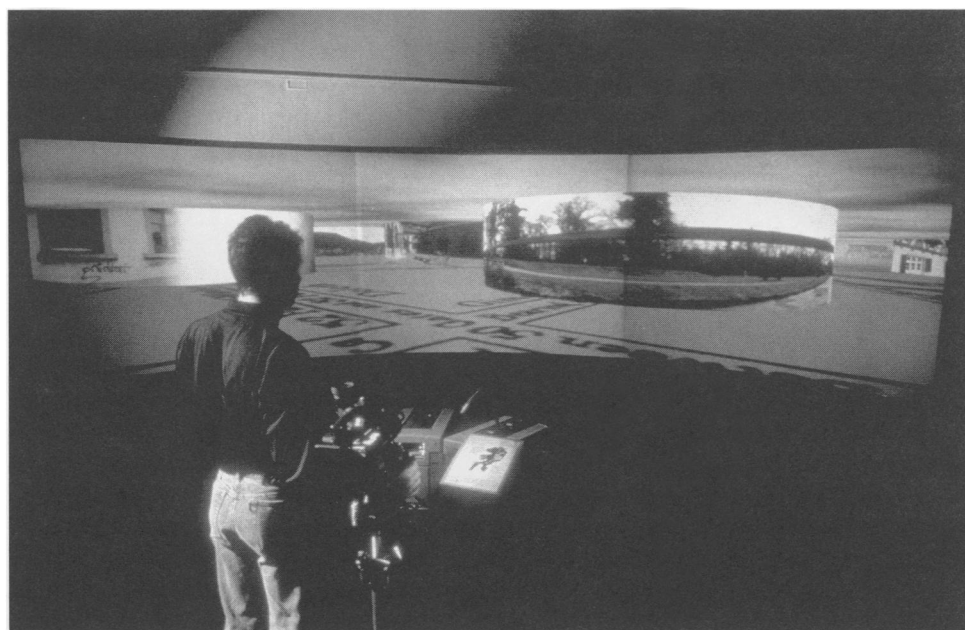*Fig. 15. Jeffrey Shaw,* Place: A User's Manual *(1995). Close-up of panoramic photograph of deserted site of memory.*
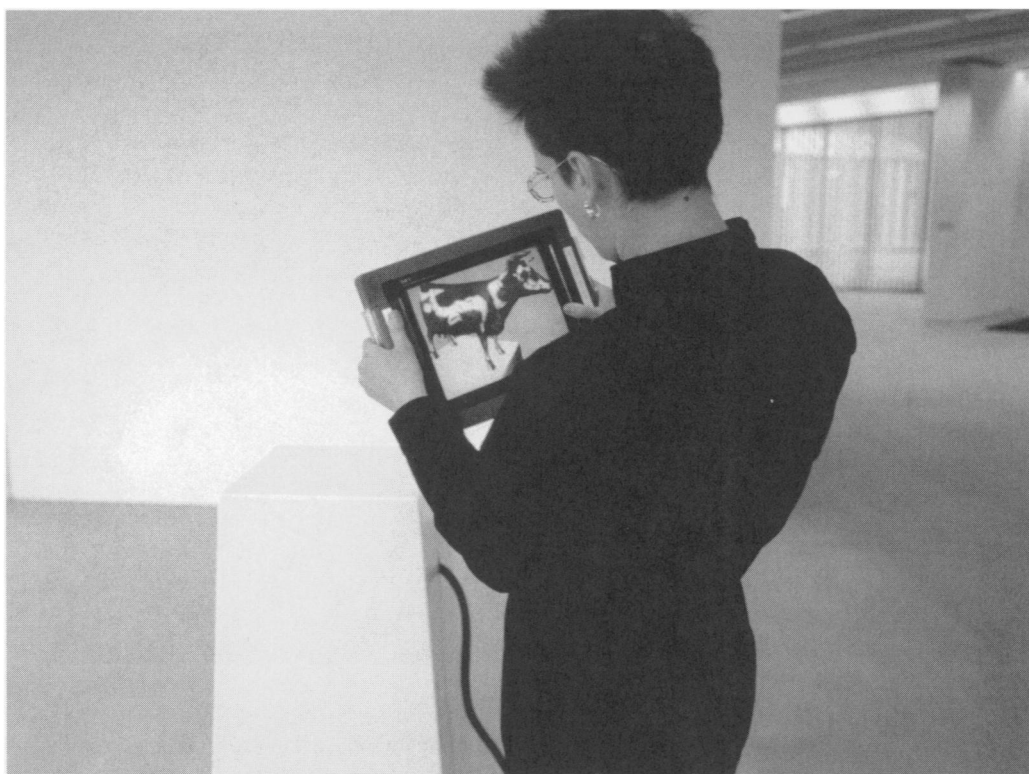
Fig. 16. Jeffrey Shaw, The Golden Calf *(1995). Inverts traditional panoramic model by requiring viewer to align virtual image of golden calf sculpture on a pedestal in physical space.*

Fig. 17. Jeffrey Shaw, The Golden Calf *(1995). Close-up of monitor displaying image of golden* calf sculp-
ture.

penetration into the image necessarily involves a certain fusion between actual and virtual image space, it foregrounds the brain-body's capacity to suture incompossible worlds in a higher transpatial synthesis.

In sum, the digital environments of Rogala, Waliczky, and Shaw foreground three crucial "problems" posed by the digitization of the technical (photographic) image: the problems, respectively, of processural perspective, of virtual infinitude, and of the indifferentiation of virtual and actual space. In all three cases, what is at stake is an effort to restore the body's sensorimotor interval—its affectivity—as the supplementary basis for an "imaging" of the digital flux. Rogala's deformation of photo-optical norms renders perspective as process and maps it onto the body as a site of a variant haptic point of view. Waliczky's perturbation of perceptual equilibrium foregrounds the active role of the body required to frame virtual space as a contingent actualized image. And Shaw's deconstruction of the illusionary effects of photographic representation highlights the bodily basis of human perception and the *infraempirical* function that allows the body to confer reality on actual and virtual space alike.

Embodied Prosthetics

All of these aesthetic experimentations with the digitization of photography exemplify the Bergsonist vocation of new media art: in various ways, they all channel perception through the computer, not as a technical extension *beyond* the body-brain, but as an embodied prosthesis, a catalyst for bodily self-transformation. In so doing, they all foreground the body as the agent of a sensorimotor connection with information that, unlike the sensorimotor logic inscribed into the movement-image, must be said to be *supplementary*.

Insofar at it defines the creative margin of indetermination constitutive of embodied framing, this supplementary sensorimotor connection is precisely what defines the Bergsonist vocation of new media art. We can understand it to be the result of a contemporary refunctionalizing of the two productive dimensions of Bergson's understanding of the body: through it, the subtractive function of the body and the singularizing contribution of affection and memory are brought to bear on what is, in effect, an entirely new world—a universe not of *images* but of *information*. As the privileged vehicle for this refunctionalizing, new media art facilitates a bodily negotiation with the processural environment that is simultaneously a reconfiguration of the body: a broadening of its function as center of indetermination. By widening the correlation of body and technology well beyond anything Bergson could have imagined, new media artworks vastly expand his theory of embodied prosthetics:[19] indeed, the experience they broker fosters the interpenetration of technology and perception and thereby extends the scope of the body's sensorimotor correlation with the universe of information. New media art might thus be said to create, or rather to catalyze the creation of, new modalities through which the body can filter—and indeed give form to—the flux of information.

Architect Lars Spuybroek grasps the profound impact of this new model of embodied prosthetics for our understanding of the body:

> [T]he body's inner phantom has an irrepressible tendency to expand, to integrate every sufficiently responsive prosthesis into its motor system, its repertoire of movements, and make it run smoothly. That is why a car is not an instrument

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19. In line with this theory, new media art would comprise an instance of the augmentation of experience through intelligence that Bergson, in Creative Evolution, associates generally with technology.

or piece of equipment that you simply sit in, but something you merge with. . . . Movements can only be fluent if the skin extends as far as possible over the prosthesis and into the surrounding space, so that every action takes place from within the body, *which no longer does things consciously but relies totally on feeling. . . . [E]verything starts inside the body, and from there on it just never stops. The body has no outer reference to direct its actions to, neither a horizon to relate to, nor any depth of vision to create a space for itself.* It relates only to itself. *There is no outside: there is no world in which my actions take place, the body forms itself by action, constantly organizing and reorganizing itself motorically and cognitively to keep "in form."* ["Motor Geometry" 49, emphasis added]

Rather than extending our senses outward, as the dominant understanding would have it, embodied prostheses impact experience because they augment our tactile, proprioceptive, and interoceptive self-sensing or affectivity:

[E]very prosthesis is in the nature of a vehicle, something that adds movement to the body, that adds a new repertoire of action. Of course, the car changes the skin into an interface, able to change the exterior into the interior of the body itself. The openness of the world would make no sense it if were not absorbed by my body-car. The body simply creates a haptic field completely centered upon itself, in which every outer event becomes related to this bodily network of virtual movements, becoming actualized in form and action. [49]

As a "vehicle" in precisely this sense, new media art configures the body as a haptic field, thereby allowing it to exercise its creative productivity.

Because of the crucial role it accords the computer as an instrumental interface with the domain of information, however, new media art transforms this haptic prosthetic function into the basis for a supplementary sensorimotor connection with the digital. In the process, it helps unpack what exactly is at stake in the shift from an ontology of images to an ontology of information, from a world calibrated to human sense ratios to a world that is, following Johnston's and Kittler's distinct but complementary insights, in some sense fundamentally heterogeneous to the human. Following this shift, we can no longer consider the body to be a correlate of the material flux, and its constitutive sensorimotor interval can no longer define the image as the basic unit of matter. Rather, precisely because it is heterogeneous to the flux of information, the body and its sensorimotor interval can only be *supplemental* to this flux—something introduced into it or imposed on it *from the outside, from elsewhere.* Put another way, the sensorimotor interval can no longer furnish the basis for deducing the body from the material universe, but instead now designates a specific function *of the body itself* as a system heterogeneous to information.[20] The body, in short, has become the crucial mediator *between information and form (image):* the supplemental sensorimotor intervention it operates coincides with the process through which the image (what I am calling the digital image) is created.

Once again, architect Lars Spuybroek pinpoints the profound significance of this transformation in the haptic prosthetic function.[21] As an embodied prosthesis, the

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20. *In this sense, I can agree with Deleuze that there has been a break with the sensorimotor logic of the movement-image without endorsing his rejection of the body. Simply put, the sensorimotor connection is no longer internal to the image, but rather something that is imposed through the process of framing information (and thus creating images).*

21. *Virilio anticipates this break in his characterization of the shift from natural light to laser delivery of light:*

computer lets us perceive movement itself in a way that fundamentally alters what it means to see: the computer, Spuybroek maintains, "is an instrument for viewing form in time." When we see through the computer, "we no longer look at objects, whether static or moving, but at movement as it passes through the object. Looking no longer implies interrupting the object to release images in space. Today *looking has come to mean calculating rather than depicting external appearance*." Looking now means calculating *with the body,* and the image that gets "released" designates something like its processural perception: "we build machines . . . not just to connect perception and process, but more importantly *to internalize these and connect them with the millions of rhythms and cycles in our body*" [Spuybroek, "Motorization"]. Insofar as it employs the computer as a prosthetic "vehicle" to transform the basis and meaning of vision, new media art can be thought of as an apparatus for producing embodied images. It responds to the eclipse of the sensorimotor basis of vision by fundamentally reinvesting the body's sensorimotor capacities, and indeed *by resituating the sensorimotor itself*, transposing it from the domain of vision to that of affectivity! In this respect, the automation of vision can be seen to exert an impact on art that is similar to its impact on (human) perception more generally: just as perception is compelled to rediscover its constitutive bodily basis, so too must art reaffirm its bodily origin and claim the image as its proper domain.

The Aesthetic Supplement

Our exploration of the supplementary sensorimotor imperative of new media art returns us, once again, to the topic of the image and its reconfiguration in the context of contemporary "digital convergence." To bring our exploration of the "digital image" to a close, let us now correlate our picture of the technical basis for contemporary perception with an account of the aesthetic consequences of the Bergsonist vocation of new media art. To this end, we would do well to invoke Raymond Bellour's insightful meditation on the computer image, where the problem of the (digital) obsolescence of the image is recast in terms of the continued possibility for artistic divergence or a new "will to art" (Deleuze)—the possibility, that is, for an aesthetic intervention into what Johnston has dubbed the technical "underside" of the image.

Bellour's meditation succeeds in suturing the technical history of imaging technology with the history of art in the age of its technical reproducibility. In the very process of describing the technical "de-differentiation" of the image currently underway in our emergent digital culture, Bellour gives us a means to appreciate the *aesthetic* stakes of the automation of vision. Specifically, Bellour helps us grasp exactly why our situation is unprecedented. With the computer image, he tells us, the ontology of the technical "image" becomes radically autonomous from the perceptual analogy to which it had been bound (since the invention of photography) in the form of a "double helix."[22]

Faced with this sudden "mechanization of vision," in which the *coherent* light impulse of a laser attempts to take over from the fundamentally *incoherent* light of the sun or of electricity, we may well ask ourselves what is the real aim, the as yet unavowed objective, of such instrumentation—of a kind of *perception* no longer simply enhanced by the lenses of our glasses . . . but by computer. Is it about improving the perception of reality or is it about refining reflex conditioning, to the point where even our grasp of how our perception of appearances works comes "under the influence"? [*Vision Machine* 94].

If we supplement this picture with the scenario of direct stimulation of the optic nerve, we confront a situation where vision occurs in the total absence of light.
    22. The "double helix" structure of the image concerns the intertwining of two forms of analogy specific to the technical era. As Bellour puts it, the double helix

Bellour begins his provocative account of the contemporary status of the image by confronting the following paradox: in a culture as image-saturated as ours, we no longer know what an image is. As he sees it, the proliferation of images—the sheer variety of different kinds of image and, we might add, the almost total flexibility brought to the image by digitization—does not tell us more about the image, but becomes a problem, an impediment to our grasp of the image. There are, says Bellour, "fewer Images, as a result of the virtually infinite proliferation of images, which are characterized by the fissures and combinations (the vagueness) between their different forms rather than by their intrinsic fecundity" [173–74]. In the truly remarkable analysis that follows, Bellour correlates this breakdown in the divide between the image and what is not image, and the disappearance of what he calls "Images," with the transformation operated by video, and subsequently, by the computer. Video materializes the power of the image *as a purely technical dimension* of the image; and the computer renders the deployment of this power technically *autonomous* from all correlation with human perceivers and perceptual processes.

For Bellour, the video image marks a wholesale revaluation of the image: video incorporates the power of analogy, previously limited to the static or moving image, *directly into the materiality of the image*. Due to its "natural" facility at *destroying* (external) analogy, video is able to bring analogy more intimately into the production of the image: "for the first time," notes Bellour, "the bodies and objects in the world become virtually disfigurable (and hence refigurable) according to a power which, in real time or barely prerecorded time . . . transforms the representations that the mechanical eye captures" [181]. Put another way, this power of video involves a certain paradox, one that arises directly from video's correlation with time: "video has gripped analogy in a pair of pincers: on the one hand, it increases its power tenfold, and on the other, it ruins it. In effect, video extends the analogy directly from movement to time; instantaneous, real time . . ." [181]. If this correlation with time means that the video image "can appear to be born as a new image that cannot be reduced to the one that preceded it" [181–82], the reason is that video materially *subsumes all of the analogies formerly expressed in the divergences between the arts*: "capable of attracting, absorbing, and blending all the previous images of painting, photography, and the cinema, . . . [video] reduces all the passages that had functioned until then among arts and *turns the passage capacity both into what characterizes it in relation with each one of them and what defines it (positively and negatively) with respect to the concept of art*" [182, emphasis added]. Video thus marks a fundamental punctuation in Bellour's account of the image in the age of its technical materiality: insofar as it becomes the "passage capacity" itself, the video image subsumes divergence—and hence the function of art itself—within the technical capacity of the image.

If the video image materializes the power of divergence at the level of the image's technical construction, the computer image could be said to *autonomize* this power by

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does homage to the extension of nature foreseen by science. . . . Above all, it underscores the extent of the connection between the two important forms according to which the analogy is constantly threatened and refashioned. The first form has to do with photographic analogy, the way in which the world, objects, and bodies seem to be defined (always partially, and just roughly) in reference to natural vision, a certain fixed state of natural vision, which implies resemblance and recognition. The second form concerns the analogy peculiar to the reproduction of movement. Those are the two forces which, separately and together, are at stake and are misused in a film whenever the image has a tendency towards distortion and the loss of recognition, or its movement is diverted, congealed, interrupted, or paralyzed by the brutal intrusion of photography. . . . *[180]*

decoupling it from all ties to perception and the perceptual basis of analogy.[23] Now that vision takes place in a form radically heterogeneous with human perceptual modalities —as the nonperspectival processing of data—the technical (digital) infrastructure of the "image" loses all intrinsic connection to the analog domain. Insofar as it imperils the very potential for art to produce "divergence"—the potential, that is, for art to introduce a divergence between the "seizure [of the world as such] and its seizure as an image" [179]—the computer image destroys, once and for all, the double helix structure of the image: parting company with all preceding images (including the video image), it breaks through both "edges" of the double-helix structure, rendering perception autonomous from natural vision and subsuming the reproduction of movement into the presentation of time.[24]

    With this diagnosis of the computer image, Bellour's analysis not only converges with the project of automation analyzed above, but does so in a way that foregrounds its specifically *aesthetic* significance. For as Bellour sees it, the radical autonomy of the computer image necessitates a fundamental reconfiguration of analogy: a realignment of analogy with embodied reception *outside* or *beyond* the double helix structure of the modern technical image. Put another way, the computer image raises a challenge to analogical understanding that is unprecedented in the history of Western art. By redefining the "image" as a nonperspectival data set, computer vision marks the moment *when the ontology of the technical image becomes radically autonomous* from the perceptual analogy of natural and cinematic vision. No longer can the retreat into ontological analogy function to provoke a new divergence from the technical embodiment of perception, as it did in the aesthetic avant-garde from at least Cézanne to Warhol,[25] for the simple

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    23. *In schematic terms, we might say that the historical realization of the vision machine breaks the "isomorphism" which had long bound together the technical basis of the image and perceptual analogy and which thereby insured the possibility for artistic divergence.*

    24. *Intended to register something like an immanent material dialectic of the image, the double helix foregrounds the tenuous correlation between the two properly technical forms of analogy: photographic and cinematic analogy. As Bellour explains in the passage cited in footnote 25, both forms constantly threaten and refashion analogy, which might be understood to exist in the divergence between them, between natural and automated vision. Responding to such an immanent dialectic of the image, art is caught between two extremes, both of which threaten it with irrelevance: in the one case (photography), the immanent correlation with natural vision, from which art (painting) has traditionally drawn its privilege, appears to be at an end; in the other case (cinema), the very function of analogy (and with it the possibility for divergence)appears to be in peril, insofar as the image tends to escape all correlation with natural perception in a bid for its own self-sufficiency.*

    25. *Bellour's understanding of art in the age of its technical reproducibility takes off from his postulation of a new form of divergence specifically correlated with the mechanization of the image. This form of divergence is developed within the domain of painting from Cézanne to cubism: "It was as if perceptive analogy, which had first been pushed to the fore by photography, could not burrow into itself and hollow itself out to the point of eliminating itself in favor of a sort of* mental analogy, *until it had, on the contrary, expanded spectacularly by winning the analogy of movement over to its side. Thus the ontological analogy underlying the perceptual analogy became divided in a way that had never occurred before" [179]. Photography's aesthetic significance is thus bound up with the challenge it poses to painting, and the subsequent reaction it catalyzes; moreover, because of its technical nature—or more exactly, its capacity to operate a "passage," a leveling of the difference, between the image and the world—photography provokes painting (i.e., art) to "retreat" to the mental domain, to subsume perceptual analogy into ontological analogy. A protraction of this same dialectic can be seen to inform art in its postwar developments. At each stage, as technological mediation threatens art by reducing the divergence, art responds by seizing back the power of analogy, or more precisely, by placing the power of analogy beyond the scope of the technical image. Yet, at the moment when technology manages to incorporate the power of analogy directly into the image, this dialectic comes to an end. Subsequently, the source*

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reason that the ontological domain at issue here is one totally without relation to analogic (human) perception.

If, nonetheless, we can still speak of the "image" in relation to the computer, it is because the very flexibility the computer brings to the image also possesses a potential *aesthetic* function that must from now on be seen not as a facet of the materiality of the (technical) image but rather as a *reaction* to the automation of vision on the part of the (human) viewer-participant. For all of its technical autonomy, the computer image retains the trace of its origin in embodied perception, as Bellour explains:

> the very idea of a calculated image obtained not through recording but through models, according to a form of expression which, over and above language, has dispelled the doubts about meaning and resemblance, does away with the questions of analogy. . . . But, on the other hand, there is still the eye: there are images, quasi images, what one sees, and what one foresees. The computer image is always connected with what it represents, no matter what the conditions for the formation and appearance of the representation are. . . . [183][26]

In short, the image names the demarcation from computer vision of a supplementary aesthetic figure: no longer a function of the technical interface, the image is itself produced from, and indeed *in*, the processing of computer data by an embodied human perceiver. And it will remain relevant—to recur to the question that opened our analysis—so long as the computer remains correlated with human perception.

When it is contextualized in relation to aesthetic considerations, what the specter of "machinic vision" helps us to realize, then, is just how bound up the contemporary image is, in all of its various forms, with our embodied (human) capacities, on the one hand, to project mental images, and on the other, to embody images through interaction. In fact, these conditions could be said to redefine the image *as an aesthetic supplement of computer vision itself*:

> By programming limited segments of nature, thus opening an access to the invisible, and by recording this invisibility in the collected time of natural vision, such images show that the computer image proposes the following paradox: a virtual analogy. In other words, an image that becomes actual and therefore real for eyesight to the extent that it is, above all, real for the spirit, in an optics which, in the long run, is fairly close to what happened when perspective was invented, unless it is precisely the optics that is relativized. The eye becomes secondary with respect to the spirit that contemplates it and asks the eye to believe it. But it is also because, in order for the image to be simulated, as well as to be seen (that is its function as a spectacle, which remains), it has to be touched and handled (that is its properly interactive feature). [185]

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of artistic divergence must come from outside the technical history of the image: that is, from a reinvestment in the human basis of imaging.

26. Not surprisingly, this supplementary aesthetic dimension of the computer image derives from a similar dimension in the video image, which, Bellour states, "is still connected, even in its digital transformations, with the analogy of the world . . ." [182]. However radical its incorporation of the image, the video image (and its digital remediation) remains bound by what now must be thought of as the predominantly aesthetic (rather than technical) function of analogy, following two possible trajectories: "either the image is transported and immediately reaches the level of a mental analogy . . . ; or the digital carries the analogical inside itself, even if it is as the divergence between what the image designates and what it becomes . . ." [183].

Viewed in relation to digital art production of the last decade, Bellour's stress on a "spiritual" vision and a tactile interface can only appear (retrospectively[27]) prophetic, announcing what have now clearly established themselves as the two fundamental characteristics of contemporary mediations of the image: on the one hand, the passage from interactivity to dynamic coupling with the image, and on the other hand, a fundamental shift in the "economy" of perception from vision to bodily affectivity.

And with the more general notion of an aesthetic supplement, Bellour grasps precisely how the computer image calls the body into play in a manner unprecedented in the history of art in the age of technical reproducibility. Now that the "image" has achieved total flexibility (any point within the image, as Deleuze reminds us, forming the potential point of linkage for the next image), what serves to enframe information into the form of the image can no longer be understood to be a function built into the technical interface. Computers, as we have been saying all along, do not perceive images; they calculate data. In Bellour's terms, this situation necessitates a fundamental shift in how we situate the operation of analogy (artistic divergence): no longer a function directly linked with the specificity of a particular technical frame, analogy must instead be derived from the embodied user-participant's interaction with the work. Such a supplementary connection of the image with the form-giving potential of human embodiment has, in sum, become a *necessary* dimension of our experience of contemporary media: with the total flexibility of information (Kittler's "digital convergence") in today's global telecommunications networks, it is now only the *reaction* of the embodied human user— or more bluntly, the constraint of human embodiment—that gives form to information. That is why we must follow the lead of new media artists in reinvesting the body as the very origin of the image in all its forms.

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27. *Bellour's essay originally appeared in 1991.*

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