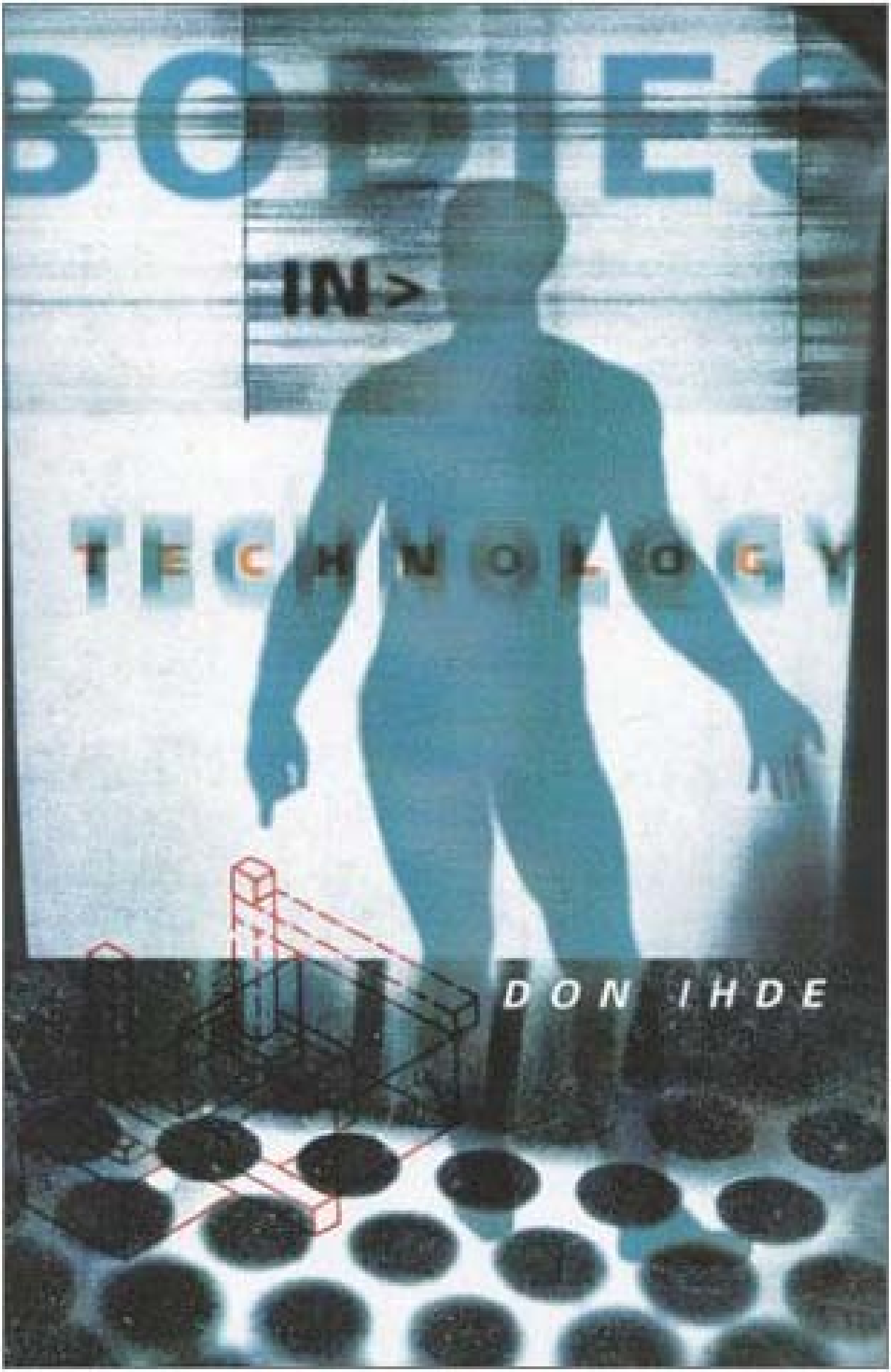
BODIES
IN>
TECHNOLOGY
DON IHDE

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For Lael, Rylan, and Barrett

Contents

Introduction

Bodies in Technology

Bodies, bodies everywhere. Philosophy, feminist thought, cultural studies, science studies, all seem to have rediscovered bodies. In part this may be because we have had to do some reflection upon being embodied in relation to the various new technologies that we are encountering in the twenty-first century. Our "reach" has extended now to global sites through the Internet, our experiences have been transformed, we are able to enter cyberspace through the primitive virtual reality engines of the present, and we are tempted to think we can transcend our bodies by the disembodiments of simulation. This book is about bodies in technology. I will investigate several senses of body in relation to our experiences of being embodied. We *are* our body in the sense in which phenomenology understands our motile, perceptual, and emotive being-in-the-world. This sense of being a body I call *body one*. But we are also bodies in a social and cultural sense, and we experience that, too. For most of those reared in western traditions, the female breast is an erotic zone, whereas for many from Asian traditions the nape of the neck is equally or more strongly such a zone. These locations are not biological but culturally constructed, although they are located upon us as part of our bodily experience. I call this zone of bodily significance *body two*. Traversing both body one and body two is a third dimension, the dimension of the technological. In the past perhaps the most familiar role within which we experienced and reexperienced being a body was what I have often called an embodiment relation, that is, the relation of experiencing something in the world through an artifact, a technology. Such human-technology relations are often simple—seeing through eyeglasses, nailing with hammers (Heidegger), negotiating doorways while wearing long-feathered hats (Merleau-Ponty). Perhaps we have forgotten that these simple extensions of the sense of our bodies once posed a problem for our self-identification, and that the new questions raised by virtual reality and intelligent machines have been taken up in earlier eras. Yet few of us today would bemoan the way in which the ditch-digging

machine has replaced the muscles of the spade-bearing digger of the nineteenth century. Nor are our occasional encounters with changed technologies encounters only with muscles or bodily might; they are encounters with much wider and deeper notions of who we are. They include the full range of our desires and imaginations.

Technofantasies can begin quite young. My wife, Linda, teaches English as a second language to five- to eleven-year-old children in the Three Village School District. One of the exercises she invented came out of an "R is for _____" question, to which kindergarten boys responded, "Robot!" The girls in the class didn't want this to be the "R" example until Linda indicated that there could be girl robots just as well as boy robots. The first year, the drawings of girl robots were in full color (pink and yellow) with pigtails and tutus, and the boy robots were (black and white) transformer-toy-looking robots with bionic arms sprouting weapons and bodies wearing armor. These technofantasies already reflected social gender-role identifications. As the exercise developed, it became more sophisticated. This year's task was to draw robots that could do something the child would like to have a robot do. This time there were robots that could brush teeth, protect little brother from bad dogs, help with baseball practice, wash the dishes, and clean the floors. The technofantasies assigned to the robots tasks that the children either could not do or did not like to do—robots to the rescue!

On a more adult level, a few years ago I was engaged in a series of e-mail and telephone conversations with one of the editors of *Wired Magazine*.[1] He wanted to know what I thought of the people who seriously expressed the desire to be permanently wired into their computers. At first, I was somewhat incredulous about his claim—who could want such a thing? But there are actual people who desire this symbiosis of computer and body. The persons described who wanted this cyborg existence turned out to have either debilitated social skills or disabled-body-related reasons for the desire. In the case of the social cyborgs, the humans were extreme nerds in the sense that they found negotiating the social intricacies of courtship in an Asian matriarchal society beyond their ability; in the case of the body cyborgs, some extreme physical disability was involved that made a computer synthesis seem preferable to the actual, limited body.

In both examples the technofantasy was based upon the intersection of technologies and human desires in both bodily and social dimensions. Those technologies are still fantasy—imagine the technical difficulties in designing a toothbrushing robot for a wiggly kid, or one programmed to negotiate grandmother's and mother's approval for a bride. The real robot technologies possible today at best approximate insect motion or remain in fixed, closed-system assembly lines, and are indefinitely far from toothbrushing or bride-pricing capacities. Yet these fantasies are actually mild ones compared to the bodily social fantasies now being promoted by techno-utopians. The hype claims that eventually virtual reality (VR) will be better than real life (RL). These stronger fantasies revolve around the notions of hyperreality, virtuality, and virtual bodies and are expressed in the sometimes heard undergraduate statement, "Reality isn't enough anymore."

These examples illustrate how we can "read" or "see" ourselves by means of, through, or with our artifacts. We can—in technological culture—fantasize ways in which we get beyond our physical limitations or our social problems by means of technologies created in utopian imaginations. In this mode of technofantasy, our technologies become our idols and overcome our finitude. But here I seem to be taking a direction that I do not want to take and that I have not taken in earlier works. Unlike our forefathers in philosophy of technology, I am not a dystopian (nor am I a utopian), so I must move carefully in my thinking about technofantasies.

A commonplace temptation might be to associate technofantasy with the genre of science fiction. I am not sure where or when science fiction began—it might have a European origin in the work of Roger Bacon in the thirteenth century. Bacon fantasized marvelous, imaginary machines:

> It's possible to build vessels for navigating without oarsmen so that very big river and maritime boats can travel guided by a solitary helmsman much more swiftly than they would if they were full of men. It's also possible to build wagons which move without horses by means of a miraculous force. . . . It's also possible to construct machines for flight built so that a man in the middle of one can manoeuver it using some kind of device that makes the specially built wings beat the air the way birds do when they fly. And similarly it's also

possible to build a small winch capable of raising and lowering infinitely heavy weights.[2]

What is remarkable about these thirteenth-century technofantasies is not that then technologically impossible achievements were imagined, but rather that these fantasies should take technological form at all. Flying, lifting of infinite weights, motion at a distance, had all been fantasized previously, but usually through some spirit or demon or witch-like agency rather than a material agency such as technology. One must remember, however, that in the thirteenth century clocks were beginning to pervade European monasteries and cities, trade along ocean- and riverfronts was moved by large customs house cranes, cathedrals were being built by machines utilizing simple physics (although still powered by horses and donkeys), and even the heavens were likened to a clockwork with the first extension of the mechanical metaphors that would dominate early modern science some four centuries later. Technological fantasies about extended possibilities actually well preceded what we much later called early modern science. Leonardo da Vinci, the Renaissance man par excellence, based his visualizations of imagined machines precisely upon Bacon's previously literarily described machines.[3]

Technofantasies are not modern at all, but they take a particular shape in late modernity or postmodernity. That shape is often that of a projected *virtual reality* (an oxymoron) or that which takes place in cyberspace, terms that relate to fantasies about our postmechanical, electronic, and computer technologies of the present. Contemporary technohype sometimes wants to extrapolate, Bacon- or Vinci-like, electronic machines that can take us into these hyper- or virtual realities, well beyond the mundane reality that dominates daily life. I am addressing this contemporary phenomenon in this book.

First, however, I should set some context and give some perspective. My own philosophical career began in what today I would call a generic Continental fashion, that is, as a scholar of European philosophy (or philosophers—I wrote articles about the "classical" European phenomenologists, Heidegger, Merleau-Ponty, and more important and with my first book, Paul Ricoeur). Writing about phenomenology and its related hermeneutic dimensions is not the same as doing philosophy in this style of criticism and analysis. But from my other early analytic side, I remained dissatisfied with exposition, commentary, and even critique. I soon turned to an interest in perception that clearly entails bodies. *Listening and Voice: A Phenomenology of Sound* (Athens: Ohio University Press, 1976) and *Experimental Phenomenology* (New York: G. P. Putnam, 1977), phenomenologies of auditory and visual experience, were my first tries at doing such analyses. What I did not explicitly realize then was that my interest in bodily perception was already linked to a parallel interest in technologies, more exactly instrumentation. My first excursus into philosophy of technology was close behind, *Technics and Praxis: A Philosophy of Technology* (Dordrecht: Reidel Publishing, 1979). What this early history shows is that my taste for materiality and concreteness was already there. I have sometimes called myself a phenomenological materialist. This persistent tendency will be noted here as well.

Perception, bodies, technologies continued to be important interests all through the seventies and eighties—paralleled by interest in technology. But by the nineties the role of science began to capture more of my interest. *Instrumental Realism* (Bloomington: Indiana University Press, 1991) tried to reframe the understanding of science in terms of its late modern technological embodiment in instrumentation, its material incarnation. My take upon science was to try to recall that in addition to mathematizing, modeling, and formalizing a world, science also *perceives* its worlds, albeit through instruments, and that is where very contemporary science meets the above-stated themes of bodies and technofantasies. In the chapters included here on science instrumentation, I show that these technologies proceed from early and simple mechanical and optical devices toward contemporary computer-assisted modeling and, in effect, virtual reality devices. It might seem that popular culture technofantasies concerning hyper- and virtual realities, and the simulation and tomographically constructed science imaging, are convergent trajectories. There is a small echo of precisely this still implicit convergence within the battles of the "science wars."

In a series of books counterattacking postmodernists, feminists, and relativists, the science warriors express worries about science being taken as socially constructed or developing only relative truth or the destruction of objectivity.[4] These worries, however, are often expressed without the slightest self-reflection about how late modern

(or postmodern?) science produces or constructs its own imagery, particularly in the state-of-the-art compound instrumentation made possible by contemporary technologies. Has science become virtual without itself knowing it? These, too, are questions that I address in this book.

I became aware of this convergence through a set of serendipitous coincidences. My interest in science instrumentation has been a long one, originally springing from the phenomenologically based insight that bodily perceptions can be embodied through instruments. This partial synthesis between body and instrument makes possible, within phenomenological history, a way to overcome the classical phenomenologists' apparent strong distinctions between a *lifeworld* and separate "worlds of science." A technologically embodied science never leaves the lifeworld. Beginning with what I then termed, and still call, embodiment relations, one can account for a graded set of perceptual magnifications and transformations by following a simple, optical trajectory. Eyeglasses "correct" vision, magnifying glasses (later microscopes and telescopes) enhance vision, and, once this trajectory is followed, an ever stronger set of possibilities for instrument-enhanced vision is opened. Magnification, however, is but a very small part of this story—spatiality, apparent distance, magnification of not only visual objects but reflexively bodily motion occurs, and on and on if one does a truly detailed phenomenology of this phenomenon. One will see echoes of some of this work in the following chapters.

Then a few years ago, my longtime colleague E. Ann Kaplan, director of the Humanities Institute and a film theorist, organized what became known as the Stony Brook Imaging Group. Put simply, we gathered faculty who were interested in related imaging processes—film, television, radiology, computer modeling—to meet occasionally and share working papers on our research. This first round made me recognize that each disciplinary approach, while sophisticated in its use of instrumental techniques and a hermeneutics of reading focal phenomena within the discipline, also was accompanied by areas of virtually blind naïveté about other imaging possibilities. Humanists could not "read" an MRI scan with a brain tumor, even if it were right before their eyes. But neither could the scientists believe, as the Bill Moyers series on truth in television broadcasting showed, that even news broadcasts could be so well spun through the manipulations of the press by President Reagan's spin doctors.

The next year I organized an interdisciplinary graduate seminar, "Imaging Technologies," the first of what has become a progression of these. I spent the first few sessions going into what philosophy of science had to offer for this process (not much), and then brought in skilled image makers and users over the next several weeks. I began with science (an astronomer and a radiologist), then media (a film theorist and a television theorist), and finally several computer modelers. They each had two hours to demonstrate their results, to describe what they thought they were doing, and to answer our questions about the productions they had displayed. Then in the final hour, after our guests were gone, we critiqued and analyzed what we thought had transpired. Not unexpectedly, the scientists turned out to be what I call instrumental realists in the sense that however they manipulated or tinkered with their instrumentation, they were quite sure they were getting what was out there, external reality. By contrast, one might want to say that the film and television theorists were extreme social constructionists in the sense that they thought they were creating a "reality" that they knew to be fictitious or an invention that did not necessarily represent anything external. The computer modelers were hybrids—they knew that the heuristic programs they built into the models were inventions and could be tinkered with, even improved upon; they also hoped that in this process they could get close to some kind of reality. One of the truly ironic twists for the modelers lay in the notion that they could build in degrees of reality, which usually meant higher degrees of ambiguity—the more ambiguous, the more "real."

Much more of interest came out of this seminar, but there was also an overarching unifier: *all image user communities used basically the same techniques to produce their results* in spite of the radically different interpretation of what these results were. Images are produced, constructed. They are made. And to get a good image the maker had to tinker with, tune, the instrument. With contemporary processes, this entails much more than simple focus or light manipulation. It often deals with complicated ways to get contrast and enhancement (one can have straight MRI, MRI with enhancement, or fMRI these days).

It may go as far as producing false color or degrees of exaggeration. The seminar participants saw how each community practiced this, but the users still maintained that they had gotten external reality, or fictional fantasy, or a degree of model realism. We are once again detecting a convergence phenomenon, but from a different perspective.

With this background noted, it is time now to introduce the moves that I make in this collection. I begin with bodies. Chapter 1, "Bodies, Virtual Bodies, and Technology," thematizes some of the observations just made. It is a phenomenology of embodiment and disembodiment, analyzing the ways in which we experience being a body—and of being a virtual body. I try to show that these two experiences are different and then how this difference may be manifest in various ways as we live within our technologically textured lifeworld. Embodiment is a complex phenomenon that envelops both what I term body one, the located, perceiving active body I am, and body two, which is body one permeated with the cultural significances that are also experienced. I debated for quite some time about including what stands here as chapter 2, "The Tall and the Short of It: Male Sports Bodies," in this collection. This chapter is simultaneously highly personal and yet also, as I know from discussions with those who have previously read it, highly generic. It describes some features of what it is like to live out a certain kind of embodiment. Together, these phenomenologically informed chapters set the tone for the rest.

Part II is a conversation within areas of the philosophy of science. Chapters 3 and 4 turn to how science produces its evidence. "Visualism in Science" argues that the practices of producing evidence have, particularly in the West, been cast in a largely visualist mode. I suggest that this is a culturally sedimented practice that in itself is not necessary—and I have received some objection to this claim. But if the "choice" of visualizing is an option, it has been an extremely productive one in that science has found ways to produce an intensely sophisticated visual hermeneutics of things. "Perceptual Reasoning: Hermeneutics and Perception" follows this same strand of thought but introduces the trajectory toward virtuality that I hold is taking place in the contemporary practices of science.

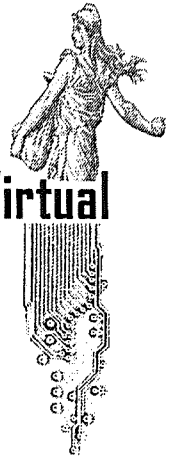
In a slightly broader context, examinations of instrumentation are examinations of material technologies, of the interactions and interrelations of humans with material being. And if, when I began in the seventies, philosophers of science had little to say about this, by the eighties they did. My *Instrumental Realism* tries to make the case that the thinkers included do just that—they look at science practice by taking account of how instruments are employed and how these mutually affect outcomes. While I became acquainted with the work of people like Bruno Latour, Peter Galison, Ian Hacking, and Robert Ackermann because they stood in some degree within philosophical parameters, I did not then realize that a similar strand of materially sensitive sociologists had set out on parallel tracks (in the mid-eighties). Shapin and Schaffer's *Leviathan and the Air Pump* was, of course, the landmark work, wherein the air pump became a crucial "actant" in the formation of the "experimental life."[5] Once I started to read these sympaths, I realized that materiality was breaking out all over. Andrew Pickering deals with "material agency," Bruno Latour with the "non-humans" (door openers and speed bumps), and most radically of all, Donna Haraway with "cyborgs," literal human-animal-technology hybrids.

So by the nineties I found myself engaged in and part of a new conversation, as Richard Rorty terms these things. Part III is a conversation with principals in what today is usually called science studies. Chapters 5 and 6 are friendly debates with Donna Haraway, Andrew Pickering, and Bruno Latour. As I entered this new "discussion group," I realized that the other participants practiced a style of analysis that differed from mine—they all expressed allegiance to some form of symmetry, which, in turn, related to different styles of semiotic analyses. In "You Can't Have It Both Ways: Situated or Symmetrical," originally given at a Danish conference with Donna Haraway and Andrew Pickering, I reflect on these differences and find, once again, that bodies make the difference. Bodies are necessarily situated, which is not to say that one cannot take account of interactions between (my) body and materiality. I come down in these issues with a weighted preference for bodily situatedness. I push this a little further with "Failure of the Nonhumans," which focuses a bit more on the powerful role played by Bruno Latour in all these conversations.

Philosophy of technology reemerges with Part IV. Chapters 7 and 8 are based upon reflective worries on my part, worries about what used to be called rational control. I guess I have to admit that I believe not only that one cannot rationally control technological development,

but that framing the question in that way misconstrues the very phenomenon of technologies. Rather, one can enter into the situations, and I argue that the entry ought to be at the research and development stages as well as with the later applied ethics stages, and make nudges and inclinations.

Finally, in the epilogue on technoscience, a term that today has become widely used and could be taken to subsume both science and technology studies, I write about "Technoscience and 'Constructed Perceptions,'" which renews a reflection on the convergence I have noted. This convergence of popular and scientific virtualities is looked at from the perspective of historical and epistemological developments.



Bodies, from Real to Virtual

Part I

Chapter 4

Perceptual Reasoning

Hermeneutics and Perception

A so-called hermeneutic philosophy of science is, within English-speaking contexts, both a recent and a minoritarian tradition. Its roots are more deeply Euro-American than Anglo-American, and the latter developments remain, even today, dominant in those contexts. Yet today there is a certain strength to be found in a generation of philosophers both appreciative of science and tutored in the Continental European traditions of philosophy.

This is not to say that a European philosophy of science itself became distinctive out of those same Continental traditions. For while Heidegger and Gadamer in the German context, and Bachelard and Merleau-Ponty in the French, had things to say about science and were applied by some to scientific practice, it is hard to point to any organized or unified tradition in a phenomenological-hermeneutic (hereafter P-H) philosophy of science per se. Historically there were at least two reasons why such a tradition remained marginal. First, the relationship between the principals in the P-H tradition and practicing science was frequently perceived as a critical one. Unlike its contestants, the positivists, the P-H philosophers never valorized science nor saw it as the utopian answer within the history of rationality. Contrarily, they tended to see science as both a derivative and limited enterprise in relation to deeper lifeworld, historical, and cultural tendencies. Second, the principals often tended to interpret science, in spite of its ranking as a derivative practice, much more precisely in positivist terms than was warranted by what should have been a more penetrating P-H analysis of science itself. That is to say, what positivism had to say about science as primarily a hypothetical-deductive and largely theoretical enterprise tended to be taken as correct by the P-H philosophers as well. One can perhaps see, retrospectively, that these two tendencies reinforce each other. If science is thought to be more theoretical-conceptual than it is or was, then it clearly is more unlike a praxical, sensory, and bodily immersed lifeworld than is daily life. Thus while there remained more familiarity in Continental Europe

with P-H traditions, and perhaps more appreciation, both by virtue of perceived criticism and a too-narrow and too-conceptual view of science by the principals, P-H philosophy of science remained more latent than not.

Since the sixties, however, much has changed. In the Anglo-American world of philosophy of science, the overthrow of positivist philosophy of science has been fairly obvious. From Kuhn, Feyerabend, Popper, and Lakatos on, the gradual reinterpretation of science in much more praxical, historical, and, more recently, sociological terms has proceeded apace. Today philosophers characterizing science no longer depict it as primarily a theoretical-conceptual exercise, a utopian expansion of a unified knowledge, or a value-neutral and exceptional human sociocultural activity. Instead, science is seen as both more pragmatic, finite and limited, and socially-culturally constituted, even up to and including possible deep gender biases and Eurocentric features.

Moreover, there is no such thing as the philosophy of science; there are only many perspectival philosophies of science. This proliferation, from a field occupied by only a small number of philosophers worldwide, remains more than usually productive in terms of books and articles published and cited.

I have taken the trouble to rehearse this very brief sketch of recent philosophy of science directions to locate more precisely what I shall attempt here. I want to focus on the minoritarian P-H traditions within philosophy of science, particularly those that have appeared in English-language contexts, and take account of some special features and particular controversies within this tradition, which nevertheless have ramifications for the wider spectrum of philosophies of science.

Were I to try to isolate three main contributions to contemporary philosophy of science where P-H traditions have made impact I would list the following: (1) the "strong program," (2) the political movement, and (3) hermeneutic philosophers.

One of the strongest traditions in the reinterpretation of science has come from the philosophically minded sociologists sometimes associated with the so-called strong program. In its most radical form, the social constructionists view science as no different in principle than any other social institution or practice and claim—with admittedly very different degrees of radicality—that the products of

science are socially constituted. At the least this is to see science as a particular form of social praxis, to understand it as an institution (implicitly as open to and prone to fallibility and values as any other institution). Science no longer is then essentially a theory-concept-producing factory with special privilege within the fields of knowledge.

It may be noted in passing that one of the principals in this movement is Andrew Pickering, whose *Constructing Quarks* is a high-level example of this kind of sociologically oriented P-H analysis.[1] In other words, while not all of the sociology of science is driven by P-H insights, significant borrowings do reemerge in the programs of this quasi-philosophical tradition and today are prominent in the discussion.

Related to the sociological analysis that reinterprets science as an institution is the movement to see institutional science as intrinsically political. Here the movement is even farther away from metaphysical, conceptual, theoretical interpretations and moves into both critical theory (Habermas) and knowledge-power (Foucault) applications to science-as-institution. Joseph Rouse's *Knowledge as Power*[2] is a good example, but also included here is the newly emergent field of feminist critics who have put a particular gender perspective upon the same subtle political dimension of science. Sandra Harding's *The Science Question in Feminism* is a foremost example of this reinterpretation.[3]

The third group of philosophers from P-H traditions to make a contribution are sometimes called the hermeneutic philosophers of science—although I am uncomfortable with that term for reasons that will emerge below. And while this group continues the understanding of science as an institution, as those above, its attention has been more specifically on the epistemological praxes of science itself.

There are at least two broad areas of consensus among these philosophers. In contrast to the classical P-H giants (Heidegger-Gadamer or Merleau-Ponty-Bachelard), the contemporary P-H philosophers deny a strong difference between the lifeworld and the scientific world, although the forms of constraint and specialized objectives to be attained may be differentiated. And the mediation between a lifeworld and a scientific world is to be located particularly in what I call a praxis-perception model of constituted knowledge. The mediation focuses upon a particularly material aspect of science, its technologies or instrumentarium. Put in simplest terms, bodily insertion in an environment in which the interrelation is praxical and perceptual is expanded and modified by a technological instrumentarium. It is through instruments that transformed perceptions occur and new "worlds" emerge, but any new world is itself a modification of lifeworld processes. Science, in this view, becomes more a product of bodily relativistic perspectives enhanced through a concrete and material instrumentarium.

Nor are the P-H philosophers alone today on this issue. I have argued in *Instrumental Realism* that the Euro-Americans no longer stand alone in this emphasis, but are today joined by other philosophers of science more usually associated with Anglo-American traditions.[4] Thus if Hubert Dreyfus, Robert Crease, and I might be recognized as Euro-American, Ian Hacking and Robert Ackermann—to whom we might add certain aspects of Peter Galison and Bruno Latour—fill out a field of praxis-oriented philosophers who appreciate what I shall call the role of "perceptual reasoning," which takes its shape through an instrumentarium.

Perception in Reason

Regarding science, philosophers interpreting it from whatever persuasion would have to agree in some sense that science is observational; observation entails perception; and perception-observation is often, perhaps always, mediated and constituted instrumentally/experimentally. What philosophers of science might disagree about relates to what direction knowledge takes. Does one first theorize and only later go on to deal with some predicted result in an observational context? Or does some newly observed phenomenon lead to theorizing? Or is there an interaction? They also might disagree about how theory-laden or purely given an observation-perception might be, or even about what counts as perception as contrasted with sensation, judgment, etc. And within the minoritarian P-H traditions, one finds disagreement about how perceptual a hermeneutic process might be as contrasted with how hermeneutic perception itself is. I shall not outline here the variant positions taken by the philosophers mentioned

above, but instead turn to much more direct examples of perceptual reasoning in the context of instrument use.

Eyeballs and Instruments

Historically, the sciences that have taken dominant place in the interests of philosophers of science—physics and astronomy—were early related to an optical instrumentarium. Galileo, the chief symbolic figure in early modern science (and in Husserl's interpretation of it as well), was a technologist who developed and perfected some one hundred telescopes in his career, but he was also the physicist-astronomer who first brought to Europe's attention new perceptions mediated through the telescope such as mountains on the Moon, the rings of Saturn, and satellites of Jupiter. But Galileo's visualist science, in which vision was extolled over all other senses, took its position within an overall Renaissance celebration of the visual. Perception as visual correlated with optics as the instrumentarium.

This vision, of course, was not only the dominant form of perception, it was a vision in which eyeballs and instruments interacted in particular ways. Motions, shapes, and measurements were the selective features that claimed center attention. In this respect, one could say that early modern science, in its perceiving, doubly reduced plenary perception was both a reduction to vision and a reduction of vision. It was this forgetfulness of the plenary or whole-body perception that Husserl called the forgetfulness of science in the "Origin of Geometry,"[5] and this forgetfulness led him to claim that the primal and plenary perception of the lifeworld was far from the abstractness of science.

This visualist trajectory, set in motion in early modern science, continues unabated in many of the sciences most related to original physics and astronomy. This is so much the case that many of the instruments in the contemporary instrumentarium could well be called visual translation instruments. For example, interplanetary probes—say of Venus—take instruments that use radar "sound" probes to map the surface through the constant cloud cover. The data are digitally transmitted to the master station, but however constructed and transmitted, the "translation" machine is designed to produce a photograph-like visual display of the surface features that shows rifts, valleys and mountains, and lava flows—a visual display. "To see is [still] to believe" in this setting. Similarly, while early sonar in submarine contexts was both conducted and interpreted auditorily (the observer became trained to detect location and direction by the ping sound and time spans), more recent perfection of the instrument yields, again, a visual display where the target is figured against a topographical ground. In short, the near distance of ordinary vision, where the perceptual "noema" is what is seen on the screen, is presumably the lifeworld reference space for "seeing the world."

Today the range of imaging technologies, in which an ever-expanding set of probe technologies produce a visual display, is indeed most impressive. We are even able now to image an atom (and it is probably highly indicative of the state of corporate technoscience that the first published image of a set of atoms was produced by IBM with the company logo "IBM" spelled out in manipulated atoms). I shall return to some of these.

Here, however, I want to take a different and more specifically phenomenological reexamination of lifeworld instrument processes in order to analyze aspects of what I call perceptual reasoning. Husserl's claim that science distances itself from the lifeworld by "forgetting" the plenary qualities of lifeworld primary bodily perception has a point if and only if one takes scientific self-interpretation as given. If one were to take it so, one might think that early modern science was monosensory in its visualism, whether speaking of ordinary vision or of instrument-mediated or instrumental vision.

To anticipate now one of the two dimensions of the reexamination I am going to undertake, one might also note that even earlier than Galileo the drive to create a visual and thus primarily monosensory science was also highly developed by Leonardo da Vinci. Long before Vesalius developed his explicit anatomy, da Vinci had already taken the task of analytically and descriptively showing interiors of the human body in visual form. His exploded diagram drawings of a fetus, musculature and internal organs, etc., all anticipated later scientific anatomies. Leonardo's engineering vision of the three-dimensional exploded diagram, still strikingly modern, was a universal vision for him and applied equally to corpses and machines. His imaginative (and usually unworkable) technologies of pumps, flying machines, and war machines were, like the fetuses and muscles, stylistically the same as analytical-Euclidian exploded diagrams.

What I have sketched above is a science that perceives and represents. It does so through a preferred visual form of observation that is often, at least implicitly, taken to be monosensory. Its ideal observer is, moreover, placed in as high or godlike a position as possible and is motionless, the point of view from which any world may be seen. But this is still early modern science and today, even within science, must be taken to be an archaic mode of seeing. To overcome this view, I shall now take two phenomenologically guided forays into the practices of sciences that will show something quite different.

Husserl's critique of the early modern trajectory of Galileo and Descartes contains the observation that such science "forgets" the plenary perceptual and bodily base of the lifeworld. At one level Husserl perhaps is correct—but at another he is wrong and overlooks the way in which instruments as technological embodiments of science function to relate scientific praxis to the lifeworld in all its plenary richness. I shall now try to show both how early modern science's forgetfulness and then later Husserl's forgetfulness may be reinterpreted.

My first foray is quasi-historical. What if the science that would have drawn philosophy of science's primary interest had been medicine instead of physics-astronomy? Interestingly, the practice of medicine, at least insofar as its primary object of interest remained and remains the living body (in a medical sense), has a different constraint system placed upon its investigations. It can intrude upon the living body only with the danger that the intrusion itself may deletriously injure precisely what the doctor wishes to preserve or cure.

This is why, in a particularly telling way, in early modernity the developed Renaissance interest in pathology, anatomy, and, in short, the examination of dead rather than living bodies is instructive. Here the probe or intrusion no longer threatened the integrity of the living body, but the object of knowledge was itself dead and thus in some unknown (and still unknown) way different from its live counterpart.

As an aside, it is interesting to note that most anatomy in da Vinci's time reflected more precisely the practice of the pathologist and precisely in the multisensory modes of plenary perception. Anatomical descriptions included, often predominantly, the olfactory, tactile, kinesthetic dimensions perceived in the examination of the corpse—how it or its parts smelled, felt in terms of hardness or softness or textures, the resistance or lack thereof of the organs—all entered into the description. What da Vinci did, and his trajectory was largely followed by Vesalius, was to make prominent, virtually to exclusivity, the visual depiction of the body; anatomy becomes visualizable anatomy in early modern science. Ever more minutely dissected later, the microfeatures of the body were investigated through microscopic developments; scientific anatomy followed the already noted visualist trajectory.

But this was never the whole of therapeutic medicine. For example, were we to jump all the way to the nineteenth century, the examination of a living patient is undertaken by a whole series of hands-on practices: palpation, finger probes (males are aware of the way a prostate exam is conducted), and, in a technologically mediated way, auscultation through the stethoscope, in which the highly trained perceiver uses his or her ears to sonically probe the interior of the living body. In one sense, then, one can say that therapeutic medicine, in practice, did not forget or abandon the lifeworld plenary-bodily mode of engaged knowledge. To the contrary, the highly honed skills of the surgeon who must feel as much as see the making of an incision remains very close—although in a specific and acquired set of bodily skills—to precisely the lifeworld of primary perception.

But does the science that gets favored, physics-astronomy, forget the lifeworld? My second foray again begins historically and reinterprets another of the early modern science praxes precisely at its most visual moments.

I have already noted Galileo's fascination with his instrumentarium, primarily his telescope. What he was able to see with his telescope is what stood foremost in his interest. He couldn't wait to publicize his artificial revelation in his self-published *Heavenly Messenger*, in which he announced his various discoveries. But, like most science publications today, what gets publicized are the ultimate results, not the processes by which these are attained. In today's revolutionary or new philosophies of science—for example, with Kuhn and much more markedly with Latour—it is the process, including its failures, its movement from ambiguity to clarity, and its experimental development, which takes center stage. Phenomenologically, one can do the same with Galileo.

Derek de Solla Price, who sees much of the development of science in terms of its craft, the skills needed by the instrument maker, notes that Galileo's primitive compound telescope had such a narrow field of vision that to spot a mountain on the Moon was akin to seeing a faraway object by looking through two keyholes lined up a yard apart. What Galileo was interested in, of course, was the celestial phenomenon out there. His epistemology was externally oriented. And the optical mediation of the telescope dramatically modified what could be seen.

If we were to focus on the observational situation in terms of sheer visual and spatial aspects, we might note that the magnification of the Moon so that its mountains could be seen transformed much in relation to the eyeball observations heretofore possible. We could say the Moon became larger, magnified. But it was also displaced—telescopically it was taken out of the night sky and relocated within the field of telescopic vision. It lost its place in the expanse of the heavens and became a more focal, particularized object, now apparently close up.

But here already we can no longer remain merely visual in our analysis, because the apparent distance transformation via the telescope implies a change in apparent bodily position. We are, as it were, closer to the Moon, and it makes no difference whether we describe this as the Moon closer to us or us closer to the Moon. Indeed, the quasi-space of telescopic vision is itself a strangely transformed space. And it entails the phenomenological mutual correlation of thing seen with mode of seeing, now in the instrumental context.

The thing seen is, simultaneously, the same as anything seen without the telescope in that it occupies the same location in central vision and the same size of optimum visual distance (through focusing the instrument), and yet it is radically different from eyeball vision without the telescope. This phenomenon is today a virtual constant of more than visual experience. The technological near distance of the communications technologies (telephone, e-mail, televisual communication, conference calls) is a familiar new near-distant space.

What the story often neglects to tell us is that Galileo noted that he had to both tune his eyes to the instrument and instruct the unlearned how to use it (albeit he often put this in terms of treating his body as a quasi-machine itself). For the phenomenon of magnification is not monodirectional, but reflexive. Our two-keyholes-a-yard-apart description, however, shows this. The crude telescope, still lacking a motion-fixing machine that would eliminate or dampen the earth's and the body's motion and thus "fix" the object to be seen in stasis, magnified Galileo's own minute bodily movement just as much as it did the Moon object. Galileo had to learn to compensate for this by using a tripod, and by careful, and sometimes consciously developed, bodily motion. What the telescope magnified was thus that which was out there and that which was here, and the object seen and the way of seeing through one's kinesthetic body yield both a sense of the technological transformation of vision and of the reflexive correlation of seen-seeing. Moreover, one cannot speak here of anything like a monosensory phenomenon, but one must speak of a plenary one. Present at the first sighting of the Moon was the full, but now transformed, lifeworld of body-world correlations. What mediated and constituted the transformation was the instrument, the embodied technology of science. But that part of the actual praxis of science seldom enters the story and is forgotten as well by Husserl.

However self-interpreted, science in this praxis was fully multisensory and embodied in its observation, even though its observation was not direct, but mediated instrumentally. I have called this essential activity the instrumental realism of science. It is this instrumental mediation that links the body and thus the lifeworld to what is perceived by science.

Early modern science, of course, did not learn all these lessons nor follow what could be described as the double trajectory opened up by the magnification phenomenon. Instead, it remained largely extroverted and interested almost solely in the out-there. What if other directions had been taken?

Detour: Late Modern Science

What I have been describing, particularly with the historical asides to early modern science, omits a series of very drastic shifts from within science itself. Again returning to the favored sciences close to physics and cosmological astronomy, what has preceded has been without reference to the rise of relativistic and quantum physics. This I shall call late modern science.

What is of epistemological interest in late modern science is the shift from a kind of naive objectivism to an almost quasi-phenomenological relativity. By this I mean that the act of observation gets reinterpreted. And it gets reinterpreted in such a way that at least part of the body-world correlation gets taken account of—the observer's action must be considered.

Einstein's famous moving train example is one illustration of this reflexive switch. If one is in a car of one train, looking out the window at another, the illusion of motion that can occur sometimes confuses one over which train is in motion: is it mine or the neighboring train? Einstein's point, of course, is that all observed motion is relative to the position of the observer, and all that can be measured is the relative motion between the observer's position and that motion out there. In principle, while this is a quasi-phenomenological advance over any absolute and thus naive physics of space and time (such as Newton's), it could still be monosensorily visualist and thus still partially forgetful of the plenary embodiment of the observer.

In the actual experience, the illusion that can lead me to think my train is moving rather than the one out the window is almost instantly corrected by the more complete kinesthetic experience correcting the illusion. Were the experience solely visual, this correction might not occur.

Similarly, in relativistic and quantum considerations, the embodied action and instrument must be taken into account. To place a thermometer in a liquid does not simply record the absolute temperature of the liquid—it changes it by whatever the difference is between the two objects now conjoined, even if the effect is on the magnitude of a butterfly effect. Both relativistic and quantum physics are thus reflexively correlational in an approximation to phenomenology. A wider retro-extrapolation of this perspective could thus find a relativistic Galileo learning as much about embodiment as about the celestial world that interested him.

Imaging Technologies and Virtual Reality

We are now finally in a position to approach the most contemporary development of new instrumentation, in particular the proliferation of imaging technologies and of virtual reality developments as they bear upon science.

The imaging technologies are the most highly developed. I have already referred to some of the very sophisticated imaging technologies used in space instrumentation. The Venus probe radar scans are, of course, supplemented by a whole spectrum of other satellite and deep space instruments, most of which yield, again, visual displays. But some of these are particularly phenomenologically interesting.

Most imaging technologies are designed to retain what could be called perceptual isomorphism, that is, the display shows spatial and topographical features that, although often in black and white, still look like what one would see were one in the apparent position of the picture taker. Thus one can easily spot in the usual visual gestalt way the patterns that are craters or mountains or volcanoes. Perceptual reasoning includes this pattern recognition within the skill and experience levels appropriate to such identifications.

But isomorphism can be varied, minimally in one sense by image enhancement (usually through computers), which highlights contrasts, exaggerates certain features, etc. This might be considered a phenomenological variation, but note it is very like literary development as well.

The introduction of color—usually false color—further varies the perceptual gestalt of imaging technologies. In some cases the features that emerge are not available to eyeball perception at all, not by virtue of spatial distance but by position on the color spectrum. Infrared photography that highlights organic matter lets the observer "see" where vegetation is even from satellite distance. Stretching the variation farther, heat or light enhancement techniques provide yet other usually invisible features—the exhaust shadow of a recently exited jet on a runway is one example, and the ability to see in the night is another.

Even further away from isomorphism is the use of such deliberately variant optical imaging as spectrographs to determine the chemical composition of stars or other celestial entities in deep space. Here the rainbow configuration of lines is "read" by the observer, and any isomorphic shape disappears entirely.

One could expand upon the variants of imaging technologies in late modern science, yet as radical as these instruments are, they obviously continue both the preferred visualism of early modern science and the display of two- or three-dimensional patterns of early mod-

ern representation. In medical imaging in which finally an invasion into a living body can be made without serious danger or damage, the use of CAT, MRI, sonographic, and other imaging yields a look into the body itself, often in real time but usually in the thin depth of most optical instrumental displays.

Supplementing sophisticated imaging technologies today are the virtual reality developments in simulation. These developments are particularly interesting because the as-yet-undelivered claim is that the experience will be a plenary one, a whole-body experience parallel to real life. To be sure, this development is not yet fully formed, but could virtual reality instrumentation transform scientific instrumentation?

Let us note a few examples and their phenomenological implications. Perhaps the most sophisticated imaging technologies today are virtual reality simulators used by the military and aircraft industry, particularly for flight training and testing. My daughter-in-law flies Boeing 747s and annually has to undergo simulator training with lifelike situations of extremity one would not like to actually face. Pilots, even knowing it is a simulation, come forth sweating. Here the "realism" is multisensory and a higher quality virtual reality than most games.

In more recent times, the sheer speeds and complexity of supersonic fighter planes made very explicit the embodiment of pilots who were not merely visualizers but displayed very finite and limited powers as controllers of these high technology airplanes.

Epilogue

The itinerary I have taken not only follows what comes from embodied, perceptualist phenomenology, but identifies it within the context of an instrumental realism that links the lifeworld of embodiment with the farthest reaches of the micro- and macrophenomena that interest science. This trajectory is not the only one in which science gets at its phenomena, for I have not examined a much more hermeneutic route that often parallels the perceptualist one I have taken.

"Reading" instruments that yield nonisomorphic results, for example, data in the form of numbers, is obviously more hermeneutic in form. Its referentiality is more textlike than the direction I have taken. And yet both trajectories are ultimately complementary, as variations upon the things themselves. I have returned to one of the most basic origins of scientific knowledge that, through instrumental embodiment, brings back the lifeworld right at the center of frontier research.

Bodies in Science Studies

Part III

Chapter 5

You Can't Have It Both Ways

Situated or Symmetrical

Today's world is one in which we are frequently reinventing ourselves. I first invented myself as a philosopher of technology, then, finding that the nexus between philosophy of technology and philosophy of science might well revolve around science's technologies, instruments in particular, I began to move into philosophy of science. There I met, in reading and later in person, Bruno Latour and Donna Haraway and, a little later, Andrew Pickering. Popularly, they are frequently identified with what is today called *science studies*.

What was appealing was the way each seemed to have a sensitivity for the concrete, the material, which I found usually lacking in philosophy of science. But on closer reading, it soon became apparent that there were some issues that seemed to me to be incompatible—I phrase these for this chapter as a tension between *situatedness* and *symmetry*. I will look at that tension in science studies, in terms of the types and styles of ways in which the material world is dealt with, through various versions of hybrids, in this chapter focusing on cyborgs (Haraway) and machinic agency (Pickering) and my analysis of human-technology relations. A major issue that I see deals with the ways in which the analyses can proceed. On the one hand, this postmodern era is one in which the emergence of situated knowledge has become prominent and self-conscious; on the other hand, there has been an affirmation of various symmetries that purport to equalize the accounts of the nonhuman and/or material agencies in culture and especially technoscience. I shall look at both of these directions and argue that one cannot simultaneously be situated and symmetrical. In this context I will develop a thesis about what can be had, that is, I want to turn to some considerations of how one can responsibly deal with the material dimensions of culture and technoscience.

Postmodern Knowledges

To use the plural for knowledge, "knowledges," initially sounds a bit strange to anglophone ears. But it is more accurate today to describe

what once was "Knowledge" as "knowledges" since one of the features of postmodernity has been the deconstruction of transcendentals and foundations, and replacement by local knowledges and particularized knowledge practices. Admittedly, this is not without contestation as the "science wars" arguments amply illustrate, particularly in North American contexts. Even from the bowels of my computer there is contestation, since whenever I type out "knowledges" the red-underlined misspelling warning appears in my text!

What has led to this change from Knowledge to knowledges? One factor relates to a major theme of my title, "situated" knowledges. Knowledges in the lowercase are *situated.* But what is it to be situated? My answer will be in the form of a narrative from my preferred philosophical framing practice of existential and hermeneutic phenomenology. In this tradition, to be situated entails that the knower is always *embodied,* located, *is a body,* and this must be accounted for in any analysis of knowledge. On one level this might seem almost too obvious—except for the fact that so much of the history of epistemology is one of different attempts to *disembody* the knower or to hide his or her embodiment. In my narrative I shall attempt to show not only the invariant role of embodiment in situated knowledges, but how "the body" is merely hidden in those epistemologies that attempt disembodiment. Then, in a second sense, one is also situated by cultural particularities which "mark" one's embodiment. These, too, must be taken into account.

On a second level, the knower is presumably working within some notion of the postmodern or amodern context that presumes overthrowing, surpassing, or moving beyond the modern. And historically, epistemologically, this is certainly the case—there has been in this century a variety of attempted overthrows of Cartesianism, which is often taken as emblematic of the modern. Indeed, both versions of the situated and later of symmetries are variations upon this rebellion. With respect to anti-Cartesianism, I shall follow the phenomenological revolt that deconstructs what Haraway calls "god-tricks" by recognizing the role of embodiment.

The third level or factor is the new, unique one, the role of the material: machinic agency, cyborgs, or human-technology relations, all attempt to incorporate material and nonhuman entities and the animal into the situation. There is a long story here that is about how the material world has also been left out of accounts of knowledge. The group discussed here, Donna Haraway, Andrew Pickering, and I, each try to reincorporate this dimension of existence, and my account must deal with this level as well.

So now, with respect to situated knowledges, the task will be to combine all these dimensions, levels, and factors into some kind of exemplar that can produce a gestalt. The devices I shall use are those that bring human knowers into intimate relations with technologies or machinic agencies through which some defined model of what is taken as knowledge is produced—I shall describe *epistemology engines.* My devices will be particular machines or technologies, which provide the paradigmatic metaphors for knowledges themselves. And through these narratives, I shall trace the visible and invisible roles of bodies.

Bodies

Donna Haraway has identified herself as one "who breathes Darwin and Foucault in with each breath." I shall duplicate this breathing by doing it with Merleau-Ponty and Foucault. Earlier I referred to body one and body two, twinned senses of bodies that owe their core significations to these two authors respectively. Body one is the existential body of living, here-located bodily experience, the sense of body elicited by Husserl as *Leib,* but much better descriptively developed by Merleau-Ponty as the *corps vécu.* Body one is the perceiving, active, oriented being-a-body from which we experience the world around us. It is the experience-as-body that is a constant of all our experiencings. (Body one is *not* the object-body subsumed under the mechanical metaphors of Cartesian early modernity—more of that later.) But, and I note this only in passing for now, this meaning of body is not directly or introspectively grasped—rather, it is interactively grasped by way of and in relation to the experienced environment or environing world. Its sense must be *reflexively* recovered. Phenomenologically one does not immediately apprehend that one's vision is perspectival, rather, one's invariant perspective on the world is reflexively realized by noting the ways in which that world "points back" to the null point of one's bodily position. In this sense, I learn my embodiment by actively being in a world. Body one is the necessary condition of all situated knowledges—but it is not the sufficient condition.

Body two is what could be called, out of context, the cultural or socially constructed body. It is the body of the condemned in Foucault, the body upon which is written or signified the various possible meanings of politics, culture, the socius. And it is the body that can have markers. It is the body that can be female, of a certain age, from a certain culture, of a certain class, and thus have a *cultural perspective* as the embodied and enculturated particular being we are. One can recognize here an aspect of Donna Haraway's version of situated knowledges. Yet I will reaffirm that for there to be a marked cultural body, or body two, there must be a body one that is markable.

What could be missed is the doubled deconstruction of modern epistemology that arose from both of these body discourses. A first deconstruction arose from the anti-Cartesian, embodied versions of knowledge developed in phenomenology. Husserl's presumed forgetfulness of the lifeworld by modern epistemology is a forgetfulness that ignores or overrides plenary perception, the sensory opening to the world from which all subsequent constructions are the second orders; the same goes for Merleau-Ponty's primacy of perception that is the originary opening to the world. In both cases the secret of body one is the clue to the deconstruction of Knowledge. For humans there can be no god perspective, only variations upon embodied perspectives.

The second deconstruction, although not limited to postmodern feminism, perhaps has its most virulent form there. One direction in this genre is to follow an almost total body two direction, but I shall not go that way. Rather, there is another strand that recaptures the phenomenological sense of body one while also accounting for body two results, for example, the group of American feminists such as Iris Young, Susan Bordo, Carol Bigwood, and others, who explicitly have drawn from Merleau-Ponty and the phenomenological sense of embodiment. Young's trilogy, "Throwing Like a Girl," "On Pregnant Subjectivity," and "Breasted Being" is a model development that recognizes both dimensions of bodies one and two.[1] Bodily motion, pregnancy, and breasts are real in both bodily-physical senses and the sociocultural senses that situate these phenomena. In one of my favorite Haraway essays, "Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective," she does what I recognize as an excellent phenomenology of instrumental embodied vision. While deconstructing the god-tricks of the views from nowhere and everywhere, she shows how "the 'eyes' made available in modern technological sciences shatter any idea of passive vision; these prosthetic devices show us that all eyes, including our own organic ones, are active perceptual systems, building in translations and specific *ways* of seeing, that is, ways of life."[2] Here is the crossing of bodies one and two, in the nonneutral position of situated knowledges. Both body one and body two underline situatedness.

What the body discourses contribute to situated knowledges is both deconstructive and reconstructive. What is deconstructed is the disembodied, nonperspectival, god-trick epistemology of early modernity. What is reconstructed is the sense of located, perspectival, embodied, and enculturated knowledge that is a praxis and action within and in relation to the surrounding world.

Epistemology Engine I: The Camera Obscura

I shall now turn to a dramatic example that links bodies, technologies, and their interactions such that an epistemology is invented in Foucault's sense of an episteme. This set of practices revolves around the paradigmatic role of the camera obscura in early modernity. "Camera obscura" literally means "dark room"; it is a device that captures an optical effect:

> This "dark room" has a small opening on one side and a blank (preferably white) wall on the other. When the lighting outside is proper, an inverted image of objects or scenes outside the camera are cast upon the blank wall. This inverted image phenomenon may have been known to Euclid, but it was an effect deliberately employed and described by Alhazen, the Islamic thinker, who used it to observe eclipses and who described it—along with an analogy between the *camera* and the eye, in 1038.[3]

It was rediscovered in the Renaissance and became one of the favorite technological toys of this vision-obsessed period. Leon Battista Alberti (ca. 1450) used a "camera" to produce "wonderfully painted pictures of great verisimilitude."[4] Here was one of the first draw-by-the-lines techniques and one of the techno-elements involved in the Renaissance rediscovery of three-dimensional perspective drawing. While other devices were also used, the camera was one of the best to

"automatically" reduce three-dimensional objects to two-dimensional images.

Leonardo da Vinci (ca. 1450) was also fascinated by this toy and he reinvented the camera/eye analogue:

> When the images of illuminated bodies pass through a small round hole into a very dark room, if you receive them on a piece of white paper placed vertically in the room at some distance from the aperture, you will see on the paper all those bodies in their natural shapes and colors, but they will appear upside down and smaller.... the same happens inside the pupil of the eye.[5]

This optical toy continued to be of use into early modernity. Galileo used a variation of it to discover sunspots (1630)—a telescope plus a helioscope. But what could be missed is that the camera obscura played a very explicit role in the modeling of modern epistemology itself. It was explicitly used by both Descartes (for the Continental rationalists) and by Locke (for the British empiricists). In *La Dioptrique*, Descartes notes:

> If a room is quite shut up apart from a single hole, and a glass lens is put in front of the hole, and behind that, some distance away, a white cloth, then the light coming from external objects forms images on the cloth. Now it is said that this room represents the eye; the hole the pupil; the lens, the crystalline humor—or rather, all the refracting parts of the eye; and the cloth, the lining membrane, composed of the optic nerve-endings.[6]

But what Descartes adds is another analogue: the mind or mental substance—the modern *subject* who, as we will see, is now inside the *camera*. Lee Bailey points this out in a very important article, "Skull's Darkroom":

> The *camera obscura* began as an experimental model for the eye and became a ruling metaphor for the mind. By offering a way of picturing the Cartesian inside *cogito* with a sensory channel admitting pictures from the outside *extensio*, the image of skull's darkroom shifted from a suggestive experimental analogy to a concealed methodological paradigm.[7]

In short, the modern subject is the homoculus inside the camera obscura. What comes from the outside are the impressions from the *res extensa* that are cast inside the box or body upon its receptor, the eye (retina) analogue where *images* form that *represent* the external world. So here, at a stroke, we have invented early modern epistemology with its (a) individualized subject (b) enclosed in an object-body, (c) thus creating a body/mind dualism (d) with no direct knowledge of the external world, but a representational one by way of images.

Nor is this early modern model of knowledge limited to Descartes; it is even more explicit in Locke:

> *Dark Room*—I pretend not to teach, but to inquire, and therefore cannot but confess here again, that external and internal sensation are the only passages I can find of knowledge to the understanding. These alone, as far as I can discover, are the windows by which light is let into this dark room: for methinks the understanding is not much unlike a closet wholly shut out from light, with only some little opening left, to let in external visible resemblances, or ideas [images] of things without: would the pictures coming into a dark room but stay there, and lie so orderly as to be found upon occasion, it would very much resemble the understanding of a man, in reference to all objects of sight and the ideas of them.[8]

Once again we have the camera as the explicit model for knowledge with the equivalence now of Locke's famous tabula rasa as the white screen upon which are cast the representations of things in the external world. The camera model belongs to both sides of the English Channel in early modernity. The subject (self inside the camera) can only directly be aware of the images (representations) of the external world cast upon the white surface inside the camera. Herein lies the "invention" of the modern subject or cogito.

It is this subject that is said to have disappeared from postmodernity. (I shall show you, shortly, that it has not disappeared, particularly within the cognitive and neurosciences of the present that still operate in the modern, but more of that below.) If the modern subject has disappeared, what caused its demise? My story now returns to the phenomenological deconstruction performed upon the cogito.

What I left out of the camera-modeled epistemological frame was the problem it created for its inventors. If all we can know (directly) is the image or representation of the external *(res extensa)* world outside, how can we know that there is an accurate correspondence be-

tween image and thing? And we all know Descartes's answer: it is the epistemological god who guarantees this correspondence.

Here, then, is the early modern invention of the god-trick, the nonperspectival perspective of the ideal observer who rides above the world. God sees, but because of being god, his view is presumed nonperspectival. I will not bore you with the centuries of debate about this, but I will pull a simple existential phenomenological trick to deconstruct this picture of knowledge: *where is Descartes when he makes the claims about knowledge that he makes?* The answer is outside the camera, viewing it from both the outside and the inside. Descartes himself is the "secret" of the god-trick since in his nonspoken, privileged position he can "see" if there is correspondence or not. Descartes is using what today in computer games is called a cheat code. He already knows the answers from his privileged position or perspective.

Nor shall I here take you through all the complicated steps Husserl took to show precisely this, but jump to the conclusion: Descartes's "cheat code" position is not *transcendental*, but embodied. It is the "here" from which both camera and homoculus, and its external world, is seen. Phenomenology takes the subject out of the box and places him or her *in the world*—but as embodied and in a perspective. Merleau-Ponty makes the point more succinctly: "Truth does not 'inhabit the inner man,' or more accurately, there is no inner man, man is in the world, and only in the world does he know himself."[9] I am the situated "where" from which I see—experience—the world. "The world is there before any possible analysis of mine,"[10] but this primacy of the world is simultaneous with the positionality that I am as body: "I am conscious of my body *via* the world.... I am conscious of the world through the medium of my body. I am already outside myself, in the world."[11] Thus phenomenology takes the cogito out of the camera and finds it, embodied, in a world. This reframes the entire context of the camera. But one must also note that the price for this liberation is one that now entails the perspectivalism of embodiment rather than the nonperspectivalism of the god-trick. Surely this is a situated knowledge.

The tactic that I have just displayed utilizes an artifact (a machinic agency) that was taken as a paradigm for the human activity of making knowledge (a cyborg activity), to produce a picture and thus self-understanding of that activity. And, albeit in too simple a way, I used the invariant of embodiment to both construct and deconstruct this invention of modernity. I underline only two points in this example: (1) By taking the subject out of the camera and finding him or her *in the world*, one simultaneously has deconstructed the god-trick of early modernity and established an embodied situated knowledge. This post-Cartesian embodied being, with perceptual perspectivity, is an invariant of such situated knowledge. (2) Then, retrospectively, we can also see that the cogito or homoculus-subject in the camera was a "machinic fantasy," an artifact of the device used to model knowledge.

We have now rearrived at the postmodern or amodern that has proclaimed the cogito dead or never existent. But this "post" position remains contested because in the contemporary world, and most particularly in the neuro- and cognitive sciences, the camera model still holds sway and has even renewed itself.

What we have here is simply the latest version of the camera. The fMRI imaging has moved the location of the mind's image from the pupil (da Vinci) and the retina (Descartes) to deeper inside the body-box to neural brain activity. The subject still reports as the privileged homoculus inside the camera. In short, the science wars are not yet over.

Semiotics and Symmetries

I now turn to the second postmodern revolt against modern epistemology, semiotics, and the symmetries that result; within science studies this issue has taken on something of a life of its own. Pickering's book *Science as Practice and Culture*[12] contained the infamous chicken debate. This debate, which still reverberates, was a battle between the UK-based sociologists of science from the strong program and Bath school of interpreters of science, and the Continental, mostly French, "actor network" thinkers arising from the work of Michel Callon and Bruno Latour. The UK sociologists held that there is a priority to the subject, a sort of anthropomorphic centeredness, that could not be overcome. The actor network people held to a stronger symmetry based upon semiotic principles that, in effect, saw both

humans and nonhumans as "actants." The chicken debate was about the escalation of symmetries that are found in various forms of the sociology of scientific knowledge (SSK—anglophone) and science studies or sometimes the study of science and technology (STS—francophone) and in between. The weak symmetries of the strong program and Bath school were largely framing symmetries that rejected distinguishing "true" science from "false" science in advance and instead concentrated upon how one socially produces agreed-upon results. Its weakness, according to Pickering, is the absence of machinic agency. But this debate itself recognizes stronger symmetries that arise out of Continental *semiotic and structuralist* traditions, associated more with actor network theory approaches—but also now claimed to some degree by Haraway and Pickering. I shall focus upon this stronger version of symmetries and relate them to the move into the postmodern or amodern.

Semiotics originates in a general theory of signs, and as Collins points out, ultimately it "treats the whole world as a system of signs... [and] where there are no differences except differences between words there are no surprises left."[13] But how does this relate to symmetry? Semiotics, historically and philosophically, belongs to the family relations of structuralism, general linguistics, and semiotics, as noted. This is the family of theory framing that immediately preceded poststructuralism, postmodernism, and deconstruction. Its ghosts and its poltergeists still haunt the current rage of francophone-influenced contemporary thought.

To understand what is involved, I shall look at semiotic ancestry. The crucial point of origin was Ferdinand de Saussure and his theory of general linguistics. At its core was a distinction between *langue* [language] and *parole* [speech]. *Langue,* or the system of language, was conceived to be a system of signs, finite in number, but infinitely combinable to make up the range of linguistic meanings. Included in this concept are two modeling ideas. In the first, language becomes a system, closed and finite with respect to units, an object (or object of study). This is a framing device, and all theories do something of this sort—one never studies a naked object, but frames it and places it into a manageable context. This is what Galileo did to motion by framing it onto inclined planes or dropping objects off the Tower of Pisa. But to frame is also to *transform,* or in today's language, to *construct.*

The second modeling idea is one in which *writing,* even better, *alphabetic* or *phonetic* writing, is secretly imported into *langue.* For linguists, words are constructed of phonemes, which, while not identical with alphabetic letters, are still sound bits and finite in number, thus subsumable under the notion of system above. This move accomplishes two things simultaneously—it "deconstructs" speech into units, and it "subsumes" living speech into a position within language-as-object. Speech becomes, simply, the set of possible moves within language, and thus language becomes the "transcendental" dimension of all possible signification. This doubled systems notion of language grandfathers semiotics, structuralism, and poststructuralist deconstruction.

I shall not trace out developments in structuralism and later in poststructuralism, but turn immediately to the moves that help establish the framing tactics for *symmetries* of the strong variety.

First, structural linguistics-cum-semiotics makes possible a different version of the deconstruction of the subject. In the weak sense, speaking subjects are seen from this frame as simply the instantiators or operators of some set of linguistic or semiotic possibilities. Whatever can be said, can be said meaningfully only within the system of language. And while this move deconstructs—as did phenomenology earlier—the Cartesian spectator consciousness, it now drives whatever vestige of subjectivity there could be in the direction of linguistic-like signifying activity. Thus, from my emphasis upon an active, perceiving embodiment, this is now a non-Cartesian form of disembodiment.

Second, a structural semiotics makes possible the leveling of dichotomies and distinctions, or a radical symmetry. All significations are ultimately merely the transformations of signifier-signified. In the contemporary debates there are some interesting kinship lines here. For example, Derrida takes his poststructuralist direction into the realm of texts and inscriptions—the moves of radical symmetry horizontalizes texts, with margins, glosses, footnotes, and even the blankness of the pages symmetrized. Or, with our absent Latour, one can have actants, whether human or nonhuman, move equivalently within the structural system. One can study these transformations, of course, but in a sense, they simply occur. As with the non-Cartesian equivalent of disembodiment, this radical symmetry reintroduces a new,

non-Cartesian equivalent of the "view from nowhere." Who describes the symmetries?

Third, semiotics—one can say positively—"textualizes" the world. But, negatively, this is also to *reduce* the world to a language-like being. There is something of an inversion here from the "world of the text" into the "text as world." From this perspective, if one wants to maintain an emphasis upon practice, action, and production, then one sees the actions being performed as those that produce *inscriptions*. We are again in a non-Cartesian mode, but a mode in which there reemerges another version of the reduced world of the *res extensa*. The semiotic version of the *res extensa* is this world-as-text read by an invisible reader.

I wish to make one final observation about semiotic methods. While these are usually associated with the postmodern, there is also something quite premodern about them. As Foucault and others have noted, one of the changes between the premodern and modern epistemes (epistemes are discrete periods of knowledge formation, according to Foucault, and are chronological versions of the knowledges that have been discussed above) consisted of the change from all meaning being essentially found in language to meaning found through perception—Foucault goes so far as to claim perception is invented by modernity. But with the linguistic turn of semiotics, we return to this dimension of premodernity. Of course, there is a difference: semiotics is a code more than a language, and its applicability to everything from computers to genetics draws upon this trope.

I now have situated the contraries between situated knowledges and symmetries, and, as my title claims, I must show why "you can't have it both ways."

Slippery Symmetries

Semiotic-based symmetries have historically taken a number of directions. The early Derrida moved to invert what he took to be the phenomenological primacy of speech over writing or inscription; this move could be seen as a simple variant upon structuralist linguistics. The once faddish structural anthropology of Lévi-Strauss in particular—far more than the "modernity which never was" for Latour—escalated the nature/culture distinctions (the raw and the cooked, etc.) that were semiotically interpreted in terms of a binary set of codes enclosed within "primitive" myths. But in our context, the symmetries that are relevant are those that place into a neosemiotic system humans, machines or technologies, and animals as well. While I shall continue to affirm—and join—the attempts to incorporate and take into account the nonhuman agencies with which we interact and which are integral to understanding the contemporary world. I begin with a short critique of symmetry strategies and what I take to be their weaknesses.

If one places on a continuum a number of varieties of symmetry strategies, what one finds is that old-fashioned, modernist reductionism is a type of symmetry. It employs uniform rhetorical and linguistic descriptions. Its voice is the well-known anonymous voice of technical writing that (a) employs rigorous avoidance of all anthropomorphisms, (b) is usually cast in terms of formal or abstract or, even better, mathematical formulations, and (c) reduces all entities to variables within its system. Its usual form is that of physicalism, illustrated above in the brain states fMRI example I gave.

At the extreme opposite of this continuum, one finds what I shall call a new social-anthropomorphic rhetoric and reduction. Michel Callon's infamous study of the scallops of St. Brieuc Bay are illustrative. Here we indeed find the scallops as actants or agents in the project, but as agents, they are described in social-anthropomorphic terms. The scallops take on quasi-intentionality and actions. Once again, we have a uniform ontology, which while now anthropomorphized is nevertheless simply an inversion of physicalism. Note that with both physicalist and anthromorphist strategies, one has a uniform ontology that easily lets all the actants operate within this now united system of variables. What could be called uniform ontology symmetries can easily have substitutable variables, but at the price of a reduction in ontological variety.

In between are the symmetries that might be called composite or hybrid symmetries—and here is where I place Pickering and Haraway. These hybrid symmetries want to have it both ways. Although much more complex than I shall describe it here, Haraway's strategy is to string whole groups of heterogeneous elements into a single, complex unity—"seed, chip, gene, data-base, bomb, fetus, race, brain and ecosystem" united under the coined hybrid term "cyborg" or cyborg figure. This rhetorical device presumably allows the complexity of

contemporary relations to be shown while not reducing the elements to a singular ontology. The other element of Haraway's neosemiotics is not reductionism, but boundary blurring. OncoMouse is simultaneously nature/culture, constructed/born, human/animal. This "both/and" rather than "either/or" is a mark of postmodernity. What should be noted here is that the power of this device draws simultaneously from ordinary meanings and from systemic transfers, i.e., having it both ways.

Pickering's approach is one that is subsumed under his metaphor of the mangle, which, like the old machines that ironed the laundry, combines together humans and machines in practices or performances. There is a richness of performance analysis in the mangle, with human agency coming up against resistances and accommodations in a dance of agency. But while extolling symmetry, Pickering hedges his bets by retaining intentionality only for human agents, although allowing that machinic agency and human agency are in some ways interchangeable in the mangle—again, having it both ways.[14]

I argue, of course, that such symmetries revert to functional equivalents of precisely the Cartesian modernism that postmodernity wishes overthrown in that (a) the perspective from which the symmetry is drawn is unknown, (b) the absence or transcendence of the narrator again creates a god-trick of nonsituatedness, and (c) the question of for whom the system operates also hides the politics of semiotic systems. With my neosemiotic colleagues, there are weak attempts to address this. Haraway, in her first-person narrative, inserts herself as situated within the cyborg context—she admits her motives and marks and speaks these out as part of her political program.[15] Pickering, still in the quasi-anonymous third person, keeps situatedness within the mangle by retaining intentionality as planned and motivated actions with the humans. Thus, I conclude that neither Haraway nor Pickering are fully or genuinely symmetrists but are, at most, quasi-symmetrists.

So, what do we have?

Epistemology Engine 2: Cyborg-Cyberspace Technologies

Imagine now a new machinic context, this one more complicated—in keeping with our postmodern situation—than the camera of early modernity. I am going to use here a series of related technologies that incorporate computers, networking, and multimedia taken to virtual reality developments to invent a new episteme. From these *epistemology engines*, as with the camera, I shall analyze a postmodern or amodern subject who may or may not be cyborgean.

Variation I: Video and Computer Games

My first example comes from video and computer games. Here our human is seated before a screen and *interacts* with it in terms of a joystick. There is even a superficial similarity to our previous camera in that the action displayed is on the screen (or, for cybernauts, through the screen). But there is also something radically different here—there is no question of a correspondence between the screen imaging and the real world. The world-on-the-screen is a fictive world that is constructed, not copied. And while it may mimic the medieval, the animal, more likely the science fictional, it is the imaginative invention of the absent programmer. In my earlier human-technology relations terminology, this is an *alterity relation* in which the machinic entity becomes a quasi-other or quasi-world with which the human actor relates.

My adolescent son (thirteen years old) gets obsessed with each new computer game: "Awesome graphics, Dad!" And for some period of time, until all the levels are mastered, all the lives lived, and the ultimate enemy faced—"Diablo, at last"—the game remains a fantasy enchantment. Here is one secret to this new device—it has a *fantasy trajectory* by its *virtuality*. I watch him play at his request, and with boredom I wonder how he can be so enchanted when the varieties of chase-and-kill are simply those of being a warrior with a sword or, in a new graphic, a soldier with a machine-pistol, or a science-fiction hero with a phaser. The genres are limited as well, to puzzle games where secrets must be revealed (usually with cheat code books), hunt-and-chase, or construction "sim" games.

Of course, as soon as he walks away, the virtuality is turned off, and while there may be a carryover (the cheat code and manual follow him to the breakfast table), he is more fully motile than the previous eye-hand coordination action, and there is not here the contemporary slide from RL to VR. But there is one preliminary background

note about the perspective that is worth note: many of the games come with alternative perspectives built in. In Flight Simulator one can fly the virtual airplane from the perspective of the pilot. Or one can switch to the third-person perspective and see oneself as a quasi-object in the airplane now over there approaching the runway, the building, or whatever. There is an easy switching of perspectives, made equivalent and thus only quasi-embodied in the game.

Variation 2: Computers and the Internet

I now switch to another interactive device, the computer networked through e-mail. We now have at least two persons wired in a connection. This time, the focal mediation is textlike and the screen shows print messages. In my example, I take a mediated communication between two persons who have not actually met face-to-face. This is a *virtual* meeting and communication. It falls under what I have earlier called a *hermeneutic human-technology relation* in that the machinic mediation presumably refers to a real other of some sort and becomes in this case a kind of language-analog mediation. But again, we are no longer in the Cartesian camera situation because while one can raise the question of the correspondent reality of the other, this mediation is one that remains virtual in context.

In ordinary social contexts, the bulk of such connections probably remain mundane and do not tempt one to raise critical questions about virtuality. But increasingly there are e-contexts in which the *virtuality trajectory* does take place. *Science* describes a new study on the Turing Game, a game in which the interlocutors interact and try to infer the real identities of each other, but only at the end of the game do the interlocutors "confess" these identities. How do I know the other is male? female? young? old? heterosexual? gay? white? of color?[16] Virtuality here plays a masking role or, at the very least, a self-selecting role. This fantasy game, showing the fantasy trajectory noted above, can go in other directions as well—for example, journalists have become fascinated with the growing phenomenon of the e-romance. In this variation, our interlocutors become virtually romantically enchanted. The ultimate results of such virtual romances have sometimes been those of disenchantment upon real meetings or even real divorces based upon virtual adulteries. Again, the new devices enhance the possibilities of fantasy and virtuality. These are not primarily correspondence epistemologies.

Variation 3: Multimedia and Virtual Reality Technologies

The previous machines are obviously reductively limited—in the first case the eye-hand coordination, supplemented by audio sounds, still restricts full bodily movement and perceptual richness. In the second case, the silent texts of e-correspondence, while allowing all the imaginative expansion and variation that any literary vehicle can develop, remains even less embodied, although it, too, can be enhanced. The contemporary technologies in this variation are degrees of such enhancements.

Let us return to our e-lovers. As they become more enchanted with each other, the fantasy desires that e-communication enhances can be adumbrated with, for example, voice messages and digital photographs. And while, maximally, these could be just as selective or even false, they are likely to be at least minimally self-flattering. Our e-lovers do not send each other nonflattering digital photos. (Here I take a small detour to show the same effect. In a paper by Philip Brey there was a description of the Dutch Philips Corporation's attempt to invent technologies that would preserve or enhance quality-of-life devices.[17] For example, one idea was to provide children with "emotion sending beepers," beepers that, if the parent knew an exam was to be taken, could send a message of encouragement by making the beeper become warm—warm beeper equals warm feelings. But one puzzle that Philips Corporation encountered was why the audiovisual telephone had not caught on. Their market researchers found that many potential customers disliked the idea of a visual phone catching them unawares—for example, on the toilet, or not made up, or unshaved. Philips proposed to counter this by building into the technology a selection of avatars, that is, self-selected flattering images. When you ring and I pick up, the audiovisual phone projects me sitting comfortably in my study, all made up with proper hair and a nice turtleneck. So here we are, back to virtuality.)

What is the epistemology of these styles of virtuality? It clearly is not Cartesian since the design is one that enhances masking, fantasy, and a certain kind of construction. One could also call it a highly ac-

tive and, to play upon one of Pickering's terms playfully, a performance epistemology. But this kind of performance is more theatrical than realistic and with interesting implications for the subject. Our subject is obviously not the Cartesian cogito at all, although Descartes's concern about whether or not we could be fooled by a very cleverly contrived automaton does reemerge here in another form.

Rather, our new subject is one who in the *dance of new agency* can and does become a multiple-roled *actor*. In an earlier work I suggested that yet another variant upon these technologies, the multiscreen display, is suggestive. We enter into, in practice, so many variations upon virtuality that we can, reflexively, begin to *edit ourselves in terms of multiple roles*. We can choose, as it were, from the videogame perspectives—were it not for our lived bodies—and enter any number of social and cultural roles that, bricolage-style, we can pick and choose, even in terms of culture bits, to edit our style of life, a multimedia style if you will. It is an editing or fashion style of existence.[18]

But we have one more step—the one that is so popular, the slippage from RL to VR. This existential fantasy is—and I have a hard time believing this—sometimes taken literally. At its extreme, it consists of those who want to be "downloaded" into their computers or have their bodies "hardwired" into their computers—but if I am right about embodiment, the result would be a major shock. Short of becoming our favorite machine, there is the lesser step of the styles of virtual reality machines that move from today's limited audiovisual technologies toward whole-body technologies that ideally would incorporate the full sensory spectrum, especially tactile and motile virtual phenomena. (I have to say that those that I have experienced remain quite primitive and disappointing. The feedback from smashing tennis balls, the quasi-vertigo from free falls, indeed, the weirdly unreal sense one gets from these various enclosures, for me, enhances the strangeness rather than the presumed possible slide into permanent VR. Have you ever eaten a virtual McDonald's burger? Or better yet, imagine the fulfillment of VR sex—it is rightfully described as neither hetero nor gay; the internal trajectory of VR fantasies may best be seen here since VR sex is necessarily masturbatory and narcissistic.) These machinic developments, of course, remain on precisely the trajectory I noted from our first example, a trajectory into the totally constructed, virtual world of the Total Machine. In this sense, we remain precisely on the larger trajectory of modernity in its later guise, toward another variation upon totality, now modified into a *virtual totality*.

Postmodernity as Another Machinic Fantasy

By now my very tone has given me away. I obviously believe that our current enchantment with this family of virtual trajectoried machines is just as much an enchantment with a machinic fantasy as early modernity found itself enchanted with its own epistemology machine, the camera obscura. Yet if we were to take my computer-cyberspace machines as epistemological engines, one could see what kind of subject they would have.

The virtual subject is multiple, not identical. As the avatar example indicates, there are many roles and personalities that the wired subject can take. Every new situation provides new relations and new possible identities. Cyborg identities are thus more like the multiscreen images in news rooms, and as individuals we can "edit" our beings by switching from one screen to another.

Positionality, which is a feature of embodiment, can in cyberspace be one of alternation in perspectives—this is already built into computer games, and the player can choose whether to be in the active-role position of the null-point player or take a more overhead position and be in a quasi-out-there location, taking the self-position as quasi-other.

As the fantasy element of cyberspace is amplified, one can choose to be anything one can imagine. So here the elements of fantasized cultural bodies come into play as a kind of instant machinic theatrical role. Boys become instant hunks and girls instant models, or, as movies such as *Lawnmower Man* fantasize, one can become anything imaginable in virtual space.

And the ultimate fantasy, of course, is to take the slippery slope of projecting RL into VR, the ultimate machinic fantasy. In the most literal sense, this fantasy is already desired with those who wish to be permanently wired, downloaded into their computers, becoming their machines—the ultimate techno-narcissism.

While my playful epistemology engines have suggested forms of being, I remain skeptical and distant from this too-easy way to model knowledges upon the nonhuman machines we invent. I have suggested that I take both the subject of the early modern camera and of its postmodern equivalent in cyberspace machines as machinic fantasies. And while I am hopeful we can avoid the centuries-long captivity the modern subject had in its camera-box and find escape from the cyberbox we are now constructing for ourselves, there is something deeper lurking in these human-machinic encounters.

Descartes both saw himself and did not see himself in his camera, and I suggest we do the same with our cybertechnologies. It is my contention that machines, the animal, or border objects such as OncoMice and Asian eels do not show themselves nor do we show ourselves directly as representations or images or pure objects. Rather, it is in the interactions, in the mutual questioning and interacting of the world and ourselves, in the changing patterns of the lifeworld that things become clear. In early modernity, the camera—and the other visualizing technologies in the interaction of humans and nonhumans—produced in action the then new way of seeing that became interpreted as modern epistemology. It was the action in the complex and changing *life*world that allowed this way of seeing to become stabilized. Similarly, in postmodernity, with a new set of "toys," cyberspace and computer toys, we are taking shape in a new set of relations such that both world and self take on different dimensions. But whatever these new realities are, they will emerge from the dance, the interrogation, the "foldings of the flesh" that Merleau-Ponty talked about in his late works, and they may be located by looking at the practices and in giving account of our bodily engagements and embodiments in that world. These are the directions that a critical phenomenological and ontological investigation of knowledges might take.

I am suggesting that while one can directly seem to take account of such features of the machinic as its technical properties, this is itself merely one interactive variant upon the material. Another, the line I have developed, shows the current machines to be fantasy-enhancing devices as at least another trajectory of their human-nonhuman relational being. In short, both human and nonhuman agencies get revealed indirectly, through the critical examination of the patterns of lifeworlds that indeed contain humans and nonhumans, even cyborgs. In this interconnection of embodied being and environing world, what happens in the interface is what is important. At least that is the way a phenomenological perspective takes shape. This theory of relations is one valid way of taking into account humans and nonhumans, but one that eschews ontological reductions, both naturalistic and semiotic.