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Creatures of artifice : Rodney Brooks and the bioethics of animated machines

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by

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Abstract

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Renowned robotics engineer Rodney Brooks has built a career engineering behaviourally intelligent machines for scientific research, military-industrial application, and domestic service. Drawing lessons from biology and ethology, Brooks designs embodied, responsive robots that he provocatively calls "artificial creatures." He has also been vocal about the broad implications his research carries for the future, making bold predictions about a technological society increasingly shaped by ecologies of animated machines.

This dissertation examines a number of popular and academic texts in which Brooks discusses his artificial creatures, his design methodology, and his futurological speculations. Focusing on key moments from these texts, I discuss how he constructs a rhetorical and narrative framework through which he ascribes a sense of "life" to his robots in order to probe the distinction between the living and the nonliving and deliberately unsettle the bounds of the biological and the technological. As he highlights the lifelike qualities of his robots that raise them to the status of creatures, he simultaneously emphasizes the machine-like qualities of human beings, leading him to charge people with "overanthropomorphizing" themselves. I argue that these contrapuntal shifts call into question models of subjectivity derived from modern liberal

humanism, insofar as they destabilize traditional relations between machines, animals, and human beings.

In order to develop the broader theoretical implications of Brooks' work, I engage in comparative readings that place him in dialogue with philosophers such as Martin Heidegger, Bernard Stiegler, Jacques Derrida, and René Descartes, early cyberneticists Norbert Wiener and W. Grey Walter, and an offbeat video game called *Chibi Robo!* These readings afford opportunities to challenge modes of thinking and acting that assume human mastery over nature and technology, and subsequently to reevaluate our intimate connections to nonhuman beings that make human life livable in the first place. Ultimately, I endeavour to lay the groundwork for a bioethics that is responsive to redefinitions of life by technological means, one that eschews anthropocentrism in order to suggest a concern for different ways of living and belonging between humans and nonhumans, rather than for the lives of human beings alone.

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Dedication

To my son, Isaac. His birth has renewed my belief in the world.

Table of Contents

Author's Declaration ii

Abstract iii

Acknowledgements v

Dedication vi

Inscription viii

Introduction When things come alive 1

PART 1

Chapter 1 Curious lives 27

Chapter 2 Ways of living 48

PART 2

Chapter 3 Steering to other ends; or, Modern encounters 73

Chapter 4 More humanist than human 100

PART 3

Chapter 5 Anaesthetic animals and animated machines: That lifelike feeling 126

Chapter 6 Cybernetic organisms; or, The tortoise and the pussycat 156

Chapter 7 Unhomely at home: Dwelling with domestic robots 194

Conclusion Ethical robotics? 215

Works Cited 225

The electric things have their lives, too. Paltry as those lives are.

—PHILIP K. DICK, *Do Androids Dream of Electric Sheep?*

Introduction

When things come alive

Fuzzy

In 2002, the "first practical and affordable home robot" made its way into North American living rooms.[1] Roomba, the autonomous floor vacuum cleaner, is a thirteen-inch disc that bumbles around the house, sucking up dust and dirt and navigating the obstacles in its path. Though this product might be unremarkable, even banal, its launch signaled the beginning of the mainstream domestication of robotic technologies. More than this, Roomba's introduction to millions of carpets worldwide marked the appearance of a new species of life in the home, the simple little robot displaying a peculiar vitality that the traditional upright simply cannot manage. As is often the case, the nonhuman creatures in people's homes are the first to realize something odd is happening. One needs only spend a few minutes on YouTube to find countless videos featuring family dogs, cats, and other creatures attacking and fleeing Roombas as the robots diligently attempt to fulfill their purpose. Yet such detections of life in the nonliving are not simply happening to gullible household pets. These machines also compel people to ascribe a certain liveliness to them, which is borne out in the language they use to describe them.

For instance, in a recent review of the Roomba 562 Pet Series on cnet.com, the reviewer begins by telling the reader that the device just tried to eat his sneaker: "I found it hunched over a threshold with the laces coiled around its brushes, looking like a

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1. For a concise history of iRobot's achievements, see the timeline on iRobot's "About iRobot" page at <http://www.irobot.com/ uk/about_irobot_at_glance.cfm> (last accessed 11 Feb. 2011).

slightly guilty puppy" (Hornyak). The simile then evolves into an extended metaphor. After dislodging the shoe, the reviewer writes that he set about "sicking" the robot "on the dust bunnies under [the] bed," which it heartily devoured: "Unleashing it regularly made my 90-year-old apartment that much more livable." While there is an obvious play of rhetoric at work here, the ease with which this author depicts his Roomba in terms that make it seem like another household pet—a pet, strangely enough, whose function is to clean up after the other pets—suggests that there is something to this humble machine that blurs the boundary between the machine and the animal at the level of everyday apprehension. The slippage between the alive and the merely lively becomes more provocative when one considers the fact that the same sort of rhetorical turn is central to the discourse that its putative "inventor" employs to describe his research in robotics engineering, a discourse whose genealogy can be traced to the figurative, philosophical, and techno-scientific traditions that produce the discursive elision of the machine and the animal.

Rodney Brooks, one of North America's most prominent robotics engineers, is the co-founder and chair of the Technical Advisory Board for iRobot, the company that manufactures the Roomba and its various cousins—including the Scooba wet floor scrubber, Dirt Dog shop sweeper, Verro pool-cleaner, Looj gutter router, and ConnectR virtual visitor. Now an emeritus professor at the Massachusetts Institute of Technology, Brooks served as director of MIT's Artificial Intelligence Laboratory and then the Computer Science and Artificial Intelligence Laboratory (CSAIL) from 1997 to 2007. Brooks spearheaded something of a paradigm shift in Artificial Intelligence in the mid-to-late-1980s and early-1990s. He felt that the approach taken by traditional AI, which

adhered to cognitivist paradigm that sought to emulate a model of intelligence defined by symbolic reasoning and formalized logic, was foundering on its own assumptions. Researchers were building machines that could work through complex mathematical problems and play sophisticated games like chess, but simple activities like navigating a room or distinguishing a specific object amidst a group of objects—things that, as Brooks repeatedly stresses, any small child can do effectively—were proving the most intractable problems to address with any success. Brooks turned instead to a biologically inspired model of intelligence, implementing a behaviour-based approach that begins with immediate reactions to sensory input and builds to complexity. Roomba exemplifies this sort of "bottom-up" engineering, which Brooks has employed to obvious academic, institutional, and commercial success. It is also the basis upon which the limits of life and what it means to be alive become a little less assured for him, as the machines he builds exhibit a spontaneous interactivity with the world that makes them appear sensitive to their environment, and even somewhat intentional in their behaviour.

Brooks situates his research and engineering within the context of a perennial adventure he denominates, "The Quest for an Artificial Creature." The peregrinations of this quest have led, with Brooks, to a brand of robotics inspired by animal behaviour, evolutionary theory, and other biological processes. I would argue that his project is one of exploring artificial life more than intelligence in the strictest sense, even if he does retain the term "intelligence" to describe the capacities of his robots.[2] Indeed, Brooks envisions a near future increasingly inhabited by "living, breathing robots," which

2. Throughout my discussion, I capitalize Artificial Intelligence and Artificial Life or use the acronyms, AI and ALife, where I refer to the institutional fields of study. I use the non-capitalized forms, artificial intelligence and artificial life, where I refer to the objects of these fields.

promise to take on productive roles in homes and workplaces, and, eventually, cooperative partnerships within human communities.[3] As Brooks explains:

> I am interested in what it is that makes us. I am interested in the nature of life—what it is, why things are living. What is the difference between living and nonliving? It's all still pretty fuzzy. I am interested in all of those sorts of things. I have worked on pieces of these questions; I am not just building robots for the robots' sake. Although, building robots sure is fun [laughter]. (Menzel and D'Alusio 64-65)

The practice of robotic engineering, clearly a joyful endeavour for Brooks, is a matter of serious play along the "fuzzy" boundaries of living and nonliving. As he quests and questions after "what it is that makes us," an "us" that appears to encompass living "things" in general, life and the beings that instantiate it become artifacts, things built and made, whose vital nature Brooks pursues through the pleasures of his own building and making.

In his popular text, *Flesh and Machines*, Brooks speculates into the larger significance of building artificial creatures and releasing them into human communities. In the course of the text, Brooks argues that the obscure divide between living and nonliving, between biology and technology, points toward a "merger of flesh and machines" (x), of which the payoff is a fundamental extension of our capacities for self-building and self-making. On the first page of the prologue, he declares that "humankind has embarked on an irreversible journey of technological manipulation of our bodies" (ix). On the last page of the final chapter, he comes full circle to promise that this

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3. While at MIT, Brooks was head of the Living Breathing Robots Initiative. See <http://groups.csail.mit.edu/lbr/> (last accessed 11 Feb. 2011).

journey will culminate with "the power to manipulate our own bodies in the way we currently manipulate the design of machines" (236). As such, he writes, "We will change ourselves from being purely the product of our genetic heritage to a more Lamarckian sort of species wherein we will be the product also of our own technology" (232).[4] This is a familiar techo-humanist dream in which the human species becomes not just an exquisite artifact, but the ultimate living testament to the powers of human artifice.

Brooks asserts that the "quest for an artificial creature" and the "irreversible journey of bodily manipulation" have each reached the point of a revolutionary turning point. "The *robotics* revolution is in its nascent stage," he writes, "set to burst over us in the early part of the twenty-first century. Mankind's centuries-long quest to build artificial creatures is bearing fruit" (10-11; original italics). Not to be mistaken, Brooks reiterates only a few lines later that the revolutionary robots he himself is helping to bring into everyday society "are not just robots. They are artificial creatures" (11). As his repetitive insistence on the creaturely quality of these new robots undoubtedly attests, autonomous machines have reached a threshold in their development, beyond which they will exceed the merely mechanical. This turn from the mechanical to the creaturely heralds a contrapuntal twist in human living, since it stands to change how we relate to the technologies with which (and through which) we live. This twist is the outcome of a "biotechnology revolution," whose radical nature Brooks feels we have so far only dimly glimpsed. "It will transform the technology not just of our own bodies," he promises, "but also that of our machines" (11). For Brooks, these two adventures are not parallel to

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4. The reference to Lamarck is somewhat ironic since, as Evelyn Fox Keller points out, Lamarck's proposal to demarcate a new "science of life" at the beginning of the nineteenth century was prompted by his "advocacy of a new ontology—one that emphasized the commonality of the forms of animal and plant life and stressed their distinctiveness in relation to the 'non-living'" (Keller 15).

one another but rather convergent, their revolutionary outcomes feeding into one another: "Our machines will become much more like us, and we will become much more like our machines" (11). As technoscientific advancement questions after and intervenes in the bounds of the living and the nonliving, the distinction between the two, which has always been tenuous, promises to give way entirely, leaving behind only the paradoxes of artificial life and biotechnology to populate the world with artificial creatures and fleshly machines.

If the difference between what lives and what does not, between the animal and the inanimate, is conceptually indeterminate, even obsolete, how can we figure the lived relations between humans, animals, and machines, all of which must now be construed, to varying degrees, as instances of biotechnology? What ontological and ethical lessons, lessons about what can be and what can be done, might we glean from examining what resides in the interstices of life and nonlife, and from taking part in those precarious pleasures that the cross-breeding of artifice and life arouses with such insistence and imaginative force? What is at stake for me is the tentative cultivation of a bioethics that is responsive to redefinitions of life by technological means, one that stretches beyond the anthropocentric model, especially ascendant in the medical sciences, which is based on a discourse of human rights specific to modern Western culture. If roboticists like Brooks are hard at work probing and reformulating the constituents and limits of life, it seems to me an invitation to reimagine the ways in which we comport ourselves toward the lives we share with all the organic and inorganic others in our midst.

There is definitely something troubling in the pursuit of Brooks' "merger," since it taps into cultural anxieties about the ethics of manipulating life and the ends to which

such manipulations may be directed. Most disconcerting for me is the liberal humanism buried in his prediction of a technologically produced human evolution, which bespeaks of a possessive individualism operating at the level of biological functioning. This is a humanism that understands the world and what it contains at each turn solely in terms of its meaning for humanity, a humanity that consolidates and stabilizes its self-image through the proliferation of its productions and interventions. Occupying a space at the edges of the animal and the machine, Brooks' artificial creatures recall that our lives are made "that much more livable," not only through the invention and deployment of machines, but also through the mechanized employment and processing of animal life. Yet, as productions that trouble the bounds of the biological and the technological, the living and the nonliving, these robots also serve to illuminate our own liminality. Animated machines do not arouse suspicions simply because they threaten to cross into the realm of living things, interlopers among a class of beings to which we somehow rightfully and properly belong; they also threaten to awaken in us a sense of our own machine-like qualities, the alien automaticity of the soma and psyche that subverts our subjective autonomy and prevents us from fully coinciding with ourselves. Moreover, Brooks' artificial creatures evoke the autonomy of the nonhuman, calling attention to the ways in which the things of the world, even those things of human design, persistently overtake our best attempts at control. A creative engagement with contemporary robotics, AI, and ALife, with Brooks as my principle representative, will thus allow me to pursue an interrogation of the human-in-itself and -for-itself, and to make steps toward revaluing the intimate connections to nonhuman beings that make our lives livable in the first place.

Things!

> We know that our current robots are not as alive as real living creatures.
>
> —RODNEY BROOKS, *Flesh and Machines*, 181

> The promise of alife is that something is always about to happen...
>
> —RICHARD DOYLE, *Wetwares*, 30

Midway through *Flesh and Machines*, Brooks constructs an elaborate vision for the future of automated housecleaning, sketching out a complex "ecology" of busy machines in which a prototype for what would become the Roomba is just one species among "hordes" of others. "Our houses will become menageries of little cleaning robots" he writes. "A symbiosis will develop between people and the artificial creatures whose only role in life is to keep the house clean" (122). This shift to a biological or zoological register is characteristic of the rhetoric he employs as he describes his robots and speculates into the lively technological future they herald. Just as characteristically, however, the artificial creatures of this menagerie are marked with a deep ambiguity: "They will be new *almost life-forms* that coinhabit our houses" (121; original italics). Alive, but not as alive as real creatures; life forms, but only almost. These robots are verging on life, are more than "mere" machines; yet they remain on the far side of an ambiguous border. Such vacillations speak not only to reflections on animated machines, but more generally to technoscientific practices that concern themselves with the promiscuous crosses of biology and technology: prosthetics and biomechatronics, biomedical engineering, genetic engineering, and so on. A sense of disorientation arises when one attempts to evaluate the status of the new cohabitants such crosses produce and promise to produce; an uncanny feeling is palpable as the entanglements of humans,

machines, and animals multiply, as they become more intricate and uncertain.

Ernst Jentsch argues that the uncanny, as an affect that "appears to express that someone . . . is not quite 'at home' or 'at ease' in the situation concerned," suggests first and foremost "that a *lack of orientation* is bound up with the impression of the uncanniness of a thing or incident" (Jentsch 8; original italics). Where intellectual mastery gives way to "psychical uncertainty," when something familiar suddenly becomes an object of grave doubt, there and then does the uncanny manifest. For Jentsch, what disorients more than anything is a dubiety about life: "Among all the psychical uncertainties that can become an original cause of the uncanny feeling, there is one in particular that is able to develop a fairly regular, powerful and very general effect: namely, *doubt as to whether an apparently living being is animate and, conversely, doubt as to whether a lifeless object may not in fact be animate*" (Jentsch 11; original italics).[5] Brooks may not doubt the status of his artificial creatures, but he does deliberately foster an ambivalence between the living and the nonliving that frequently causes his discourse to lose its bearings, a momentary disorientation that prompts him to reassert what he knows, rationally, about the liveliness of machines.

We appear to live at a time when such reassertions and reassurances are oddly necessary to keep one's bearings. W.J.T. Mitchell offers an incisive characterization of our uncanny moment when he writes:

> The dangerous aesthetic pleasure of our time is not mass destruction but the mass creation of new, ever more vital and virulent images and life-forms. . . . The

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5. Freud quotes this very passage (Freud 226); however, he ultimately dismisses the Jentsch's idea that the uncanny could arise from uncertainty as to what is animate and what is not. Through his well-known reading of E.T.A. Hoffmann's "The Sandman," he simply inscribes this peculiar "class of the frightening" within the Oedipal complex by way of castration anxiety.

> epithet for our times, then, is not the modernist saying, 'things fall apart,' but an even more ominous slogan: 'things come alive.' Artists, technicians, and scientists have always been united in the imitation of life, the production of images and mechanisms that have, as we say, 'lives of their own.' (335)

Things come alive is a slogan that is spoken at the edges of modernism as a particular style of expression and the edges of modernity as a particular style of thought. It suggests how one might orient oneself toward a world that has become strangely disoriented. It exhorts a shift in the attitude one adopts to cope with uncertainty: when things fall apart, a progressivist strategy toward rectification is the most reasonable response; when things come alive, however, the possibilities of response are proliferate and obscure.

Part of the story that I am trying to tell, with Brooks as my unwitting guide, has to do with an encounter between, on the one hand, modern modes of thinking and acting with regard to technology and, on the other, modes of thinking and acting with which we are not quite "at home." In this respect, I take Michel Foucault's cue to conceive "modernity" as a particular "attitude" or "*ēthos*," by which he means, "a mode of relating to contemporary reality; a voluntary choice made by certain people; in the end, a way of thinking and feeling; a way, too, of acting and behaving that at one and the same time marks a relation of belonging and presents itself as a task" ("What Is Enlightenment?" 309). Foucault's designation of modernity, not as a historical period, but rather as a "voluntary choice" among various ways of thinking, feeling, acting, and behaving, means that modernity cannot be considered at all totalizing in its effects. This openness to resistance speaks, of course, to his philosophical and historiographical project more

broadly, in which he seeks not "to distinguish the 'modern era' from the 'premodern' or 'postmodern,'" but to suggest instead "how the attitude of modernity, ever since its formation, has found itself struggling with attitudes of 'countermodernity'" (309-10). For me, reading Brooks reveals tensions between a modern *ēthos* and certain attitudes that counter and encounter it, thoughts and feelings that respond to, qualify, and challenge modernity at those *topoi* where life and technoscience intersect. To explore the characteristics of these tensions will be vital toward assessing the "relations of belonging" among forms of life of all sorts in the twenty-first century, and toward feeling out possible steps toward the task of reimagining how human beings belong, not just within the world, but to the world as well.

Of course, it is beyond the scope and purpose of my discussion to characterize in an exhaustive fashion what "the attitude of modernity" entails. At this early stage, I would like to state that for me this attitude stems from what Bruno Latour refers to as the "modern Constitution," which is his shorthand for the conceptual establishment of an insuperable gap between people and things, society and nature—a gap, moreover, that guarantees that the nonhuman half of the pairing remains the neutral, dehistoricized substrate of human knowledge and meaning (*We Have Never Been Modern*). *Things come alive* is a slogan that threatens to undermine the relations of belonging established by this philosophical and epistemological "purification," as Latour calls it, revealing to our apprehension a paradox that being modern has always struggled with, i.e., "the more we forbid ourselves to conceive of hybrids, the more possible their interbreeding becomes" (12). It becomes especially difficult to maintain the notion that there is something like a human-in-itself or a strictly human society when the things that are

ostensibly of human design begin to behave in ways that seem to overflow human intention.

Things come alive, could very well be the slogan for the "revolutions" in robotic engineering and biotechnology that Brooks promises. The promises of such technological revolutions seem always unfulfilled, however, which may nevertheless be a symptom of how we relate to contemporary reality. "We live in a time that is best described as a limbo of continually deferred expectations and anxieties," Mitchell writes. "Everything is about to happen, or perhaps it has already happened without our noticing" (321-22). The machine life Brooks engages with on a daily basis resides in this untimely limbo, at once a phantasm of a perpetually anticipated future and a reality that is largely nondescript. Roomba, for instance, is on the one hand a household appliance whose presence in the home is meant to go unnoticed. Brooks writes that all the robots of his proposed housecleaning ecology "will be robots that their users set to work and then forget" (*Flesh and Machines* 121). On the other hand, Roomba is imbued with a science fiction fantasy that Brooks has been attempting to actualize throughout his career.

In what follows, I read Brooks first and foremost as an imaginative writer, thinker, and practitioner, whose material inventions and the texts that surround them construct a science fiction narrative that dramatizes modern attitudes toward a nonhuman world that seems increasingly animate. While science fiction so often invites us to reflect upon our world at a remove from our own time and place, it is by no means a flight of fancy or an escape from the realities of history, but rather a tactic of defamiliarization singularly preoccupied with the realities of the present moment, both in its actualities as well as the virtualities awaiting the conditions for their disclosure. The imaginative

potential of such a tactic is compelling from a methodological standpoint, especially as it challenges us to think through the strange events and products of our present with a mind to the active roles of nonhumans as well as humans in the constitution of so many shifting cultures and ecologies. It also mobilizes a curiosity that is willing to scrutinize what is most unfamiliar about the present, to experiment with modes of thought, to speculate upon the possible—surely necessities when interrogating the inventions of technoscientific endeavours like robotic engineering, Artificial Intelligence, and Artificial Life, which seem always about to happen, and which presage a future whose ambivalent allure lies in the suspicion that it cannot be said to belong entirely to "us."

Technological life; or,
How I learned to stop worrying and love the robot

Popular representations of artificial life and intelligence attest to the ambivalent feelings we hold toward the figure of the robot and, in a wider sense, our own intimacy with and reliance upon technological systems. Brooks himself refers to the opposing narratives of "salvation" and "damnation" that dramatize this ambivalence, and comments upon the eschatological tenor inherent in the literature of robots and intelligent machines, including that produced by scientists and researchers. The salvation narrative entails a utopian hope that fully automated labour will free humans from the bonds of material necessity to pursue more fulfilled, more "human" lives. This parable often has to do with scrapping the obsolete machinery of organic bodies in favour of a post-biological, posthuman, or transhuman future of pure (digital) intelligence, an intelligence that is immaculately "spiritual" because of its purity. Digital computing in particular becomes the prospective means for human evolution, one no longer bound to the painfully slow,

largely aleatory (and therefore unbankable) processes of Darwinian variation, selection, and descent.

Entrepreneur and technology guru Ray Kurzweil and Carnegie Mellon University roboticist Hans Moravec are the most outspoken and much maligned proponents of such "extropian" or "singularitarian" speculations, their popular writing verging on a caricature of faith in technological progress. Both Kurzweil and Moravec foretell of a near future in which an individual will be able to upload her consciousness into a sufficiently powerful computer and live immaterially and immortally in an ethereal cyberspace—an ecstatic blend of Cartesian dualism and social Darwinism in which the embodied are displaced, dismissed, and finally squeezed out of existence according to a Mathusian economics of competition for limited resources (Kurzweil, *The Age of Spiritual Machines*, *The Singularity Is Near*; Moravec, *MIND Children*, *Robot*). As with Brooks' "Lamarckian" vision, a technocratic possessive individualism saturates Kurzweil's and Moravec's narratives, each of which culminates in an apocalyptic vision that recruits AI and ALife in the promotion of a self-interested anthropocentrism at the expense of all else.

As for the narrative of damnation, Brooks refers to this as "the Hollywood 'robots take over the world' scenario" (199): that time-worn story in which robots obtainin self-awareness, only to stage a revolt that threatens to wipe out humanity. In this narrative, the survivability of the human species is placed in doubt when machines suddenly awaken to a world governed by the survival of the fittest, a technological revolution that becomes an evolutionary struggle for life. Of course, mainstream Hollywood fare usually resolves the threat through a reassertion of liberal humanist models of subjectivity, more

often than not tinged with a sentimentality as to the power of emotion and the illogical creativity of the "human spirit," whether it manifests in a human champion, whose enduring hope and courageous self-sacrifice save the day, or even a heroic robot, whose estimable loyalty mean that he is human after all, or close enough to it. At base, these eschatological narratives differ very little. Presented as two contrasting ends to the human, they envision the completion of humanism by means other than the human. The same anthropocentric, instrumental conception of technology is the catalyst for each end, precipitating an extraordinary violence toward the nonhuman—including that which is most nonhuman about the humanist subject, its organic body. The morality tale that accompanies the appearance of the robot often casts technology as a means whose end is the continuation of one form of life at the expense of another.

Brooks bookends *Flesh and Machines* with a response to the pop-culture, sci-fi anxiety that robots could start a rebellion once their intelligence meets or surpasses our own, assuring the reader that he has "recently come to the conclusion that this will never happen" (ix). Why it took him until the turn of the millennium to come to this conclusion, and what his former thoughts were, he does not say. (He does hold a wistful nostalgia for *2001: A Space Odyssey*, which involves an unsettling admiration for HAL 9000. He writes, "I still cannot watch it without my heart quickening and tears coming to my eyes often. . . . HAL turns out to be a murdering psychopath, but for me there was little to regret in that" [64].) Whatever his previous sentiments on the matter, he goes to some lengths late in the text to refute the assumptions behind the "Hollywood script" that outlines the machine uprising (200). Invoking his authority as a leading roboticist, he discusses four of the main prerequisites for a robot uprising—sufficient autonomy from

human creators, a capacity for self-reproduction, an instinct for self-preservation, and a testy emotional disposition— and casts them in terms of practical engineering concerns that make any such threat seem unlikely (198-204).

But the ultimate reason why Brooks concludes that there is no need for us to worry about a potential machine uprising has to do with his revolutionary merger of flesh and machines. In the final chapters of the book, he maintains an optimistic vision of technological progress that remains fairly secular, predicting a thoroughgoing alteration to our bodies and our world that will nevertheless neither save nor damn us. Doing away with this dualist eschatology, however, does not prevent Brooks from falling into a different equivocation regarding the status of the human. The mergers of biology and technology ensue in a contradictory conceit in which the human disappears into technology in order to reclaim the fullness of its humanity. Brooks writes, "we are about to *become* our machines during the first part of this millennium," forecasting an non-anthropomorphic future in which "those of us alive today, over the course of our lifetimes, will morph ourselves into machines" (212; original italics).

It is this elision of human and machine that stands to safeguard us from Hollywood's robotic takeover, because "there won't be any us (people) for them (pure robots) to take over from" (ix). The loss of "us" is only temporary, however, for on the following page Brooks asserts, "We will have the best that machineness has to offer, but we will also have our bioheritage to augment whatever level of machine technology we have so far developed" (x). An autonomous "we" will endure despite its mechanical metamorphosis, secured by voluntary adaptation and self-manipulation. Brooks ultimately puts his trust in a paradigm of technological advancement that will make

certain that a self-possessed group of individuals is always in command of its technological achievements, including those that are manipulations of the embodied self. The leitmotif of "us and them" leads at last to a reassuring conceit: "We need not fear our machines because we, the man-machines, will always be a step ahead of them, the machine-machines" (212). Despite Brooks' suggestion that there is a developing "symbiosis" between human beings and increasingly lively, autonomous machines, he finally argues, humanity is—and will continue to be—secure in its position, always a step ahead of its own productions.

Nonhuman pedagogy

> And—here is a thought not too pleasing—as the external world becomes more animate, we may find that we—the so-called humans—are becoming, and may to a great extent always have been, inanimate in the sense that *we* are led, directed by built-in tropisms, rather than leading. So we and our elaborately evolving computers may meet each other half way.
>
> —PHILIP K. DICK, "The Android and the Human," 187

As Brooks tangles with all the twists, turns, mergers, and morphings that his speculations present to him, he comes to express a cultural attitude as excited by the new vitality and intelligence of machines as it is apprehensive about what it means for a human being that suddenly seems all-too-human. Donna Haraway sums up this attitude in a well-known passage from her "Cyborg Manifesto," marking a qualitative shift in the perception of machines in the wake of cybernetics:

> Pre-cybernetic machines could be haunted; there was always the spectre of the ghost in the machine. . . . But basically machines were not self-moving, self-designing, autonomous. They could not achieve man's dream, only mock it. They were not man, an author to himself, but only a caricature of that masculinist

> reproductive dream. To think that they were otherwise was paranoid. Now we are not so sure. Late twentieth-century machines have made thoroughly ambiguous the difference between natural and artificial, mind and body, self-developing and externally designed, and many other distinctions that used to apply to organisms and machines. Our machines are disturbingly lively, and we ourselves frightfully inert. (*Simians, Cyborgs, and Women* 152)

Brooks most obviously conveys our frightful inertia when his musings serve only to shore up the liberal humanist subject, positing an "us" whose material makeup may undergo a disruptive change, but whose core values and prevailing mentalities remain unchanged about the role of technology as a means for human living. For all his revolutionary rhetoric, his conclusion that "we will always be a step ahead of them" is ultimately reactionary, responding to the paranoia that arises in the face of lively machines with a moral appeal that normalizes human mastery over its own productions and self-production.

The cyborg as a conceptual figure has lost much of the radical irony Haraway ascribed to it in her call for an emancipatory feminism empowered by a worldly alliance with late twentieth-century technoscience. Indeed, Haraway herself has abandoned the cyborg as a catalyst for critical inquiry in favour of dogs, chickens, and other "companion species," perhaps because the former never ceased to be an emblem for the morality of technologically driven self-authorship. The cyborg, of course, was born of this very dream. Manfred E. Clynes and Nathan S. Kline coined the term in 1960 to describe a set of technological strategies intended to meet the challenge of manned space-travel, not only ensuring the astronauts' survival, but liberating them for their creative, intellectual,

and spiritual pursuits in the name of the human race.[6] Brooks participates in this dream with his vision of biotechnological "man-machines" that he claims goes "beyond cyborgs," beyond augmentations of "silicon and steel," to more thoroughgoing manipulations of our biological machinery (*Flesh and Machines* 232). But one must not forget that from its very inception, the cyborg did not simply denote a coupling of man and machine. Indeed, some of the first cyborgs that Clynes and Kline cite are rabbits and rats with osmotic pressure pumps inserted under their skin, which allowed for the continuous administration of drugs and other chemicals (Clynes and Kline 74). Thinking about machines in the wake of cybernetics highlights a crucial notion that, in Western philosophical tradition, thoughts on technology have always been haunted by thoughts on animals.

What Haraway has always foregrounded in her writing, and what I am grappling with in this project, is not a strictly human-machine or human-computer interface. While the cyborg's critical force may have eroded some time ago, I would like to propose that

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6. In "Cyborgs and Space," published in the September 1960 issue of *Astronautics*, Clynes and Kline suggest that the extreme "field of operation" humans would encounter in space might be met with technical manipulations of the human body that would establish homeostatic relations between it and the conditions it was expected to encounter (Clynes and Kline 26). There is an overt spiritual dimension that the authors maintain throughout the article. They open with the suggestion that "Space travel challenges mankind not only technologically, but also spiritually, in that it invites man to take an active part in his own biological evolution" (26). Cybernetic technology is eminently enabling for this process. Because adaptations to external (and internal) conditions could occur as a matter of feedback and thus "unconsciously," the human is liberated from what would quickly become the overwhelming technical challenge of merely surviving. An astronaut becomes no more than "a slave to the machine" if he has to constantly fiddle with the things that keep him alive: "The purpose of the Cyborg . . . is to provide an organizational system in which such robot-like problems are taken care of automatically and unconsciously, leaving man free to explore, to create, to think, and to feel" (27). The cyborg, for Clynes and Kline, is thus a self-creative being in its plasticity and capacity for adaptation. It is, in addition, a thoroughly environmental being, in a relationship with the physical conditions within which it is inextricably embedded. On the one hand, there is a certain decentering of the humanist subject here, as the body engages in a becoming relative to its environment without the conscious control of the individual. There is an acknowledgment of the forces, operating quite apart from the subject, that enfold the body in its natural and technical surrounding. On the other hand, the liberal humanist subject is shored up in that technology remains only a tool through which man can undertake his self-interested endeavours, unhampered by the most extreme of conditions and untroubled by the needs of his body or the stresses placed upon it.

the *cybernetic organism* could shed light on the significance of the increasingly lively technologies emerging from laboratories of institutions like MIT and corporations like iRobot. The cybernetic organism is biotechnological in the widest sense, a miscegenation of *bios* and *technē*, artifice and life, that holds these ontological categories in a disorienting tension. It signifies promiscuous connections and communications between animals and machines, the vitality of which traditional humanism can only ineloquently address. Brooks' artificial creatures, as prominent examples of cybernetic organisms, offer compelling opportunities to become fruitfully "not so sure" about the status of animals as well as machines.

Brooks' language of revolutions and evolutions is, on one register, a blunt rhetorical tactic deployed in the interests of legitimizing and promoting the particular brand of Artificial Intelligence in which he holds a life-long stake. A techno-utopian hype definitely clings to statements he makes about changes to the "fundamental nature" of human beings and human society (*Flesh and Machines* 11). But to separate the putative reality of his scientific achievements from the language he uses to describe them is not at all my intention. Indeed, if there is something revolutionary in Brooks' science fiction that sparks my intellectual interest, it lies precisely in a *rhetorical* turn. Though he smuggles Man back into the picture during the course of his speculations, his particular approach to robot building and the ways in which he develops the implications it holds for probing the "fuzzy" boundaries of life and nonlife suggests a figurative *détournement* that upturns the analogy between organisms and machines in the Western philosophical tradition.

The organism-as-machine is a dominant and dominating figure in the particular

attitude or *ēthos* we have inherited through the modern philosophical tradition. The unmistakable problem with this analogical connection lies in its tendency to slip from comparison to identification: from saying animals are *like* machines to simply saying they *are* machines. Yet the copula of the metaphor (arguably, of any metaphor) indicates a vector as much as an equivalence. As Richard Doyle points out, "The conclusion of most of the metaphorical crossovers between machines and organisms was that organisms were machines, not that machines were organisms" (*On Beyond Living* 116). Correlative to the organism-machine trope is a governing tropism, a particular direction the metaphor turns in response to questions humans pursue with regard to the general nature of "the" animal, animality, and animal life. The Cartesian descent of this tropism has proven powerful for making analytical sense of living beings and the processes of life, from comparisons to clockwork systems through to the computational imagery that helps articulate contemporary discourse within the life sciences. This metaphorical link has also been vital for defining what constitutes the human in modern thought. What Jacques Derrida calls into question as the philosophical "autobiography" of the human species, by which we as human beings grant *ourselves* the privilege and right to describe the "proper" bounds of our own life and being, in many ways has its foundations in the knowledge that animals are machines (*The Animal that Therefore I Am*). The "question of the animal" and the "question concerning technology" are the triangulation points that philosophers and scientists repeatedly use to survey and delineate the contours of what is uniquely human.

How do cybernetic organisms and artificial creatures shed light on the significance of the metaphorical crossover between animals and machines? On the one

hand, they recapitulate the self-same tropism that figures animals to be mechanical in nature. In this sense, the cybernetic machine is simply a model that explains certain machinery that constitutes the organism and the mechanics that govern its functioning. On the other hand, my hypothesis is that the lively machines that emerge after the advent of cybernetics reveal the potential reversal in the inflection of this trope, making it possible to say that machines are organisms of a sort. As a particularly faithful inheritor of the early cybernetic project, Brooks stages this reversibility. In his statements about his methodological approach to robotic engineering, his narratives about the future of robots beyond the laboratory, and the conjectures he makes about the incorporation of intelligent technologies into the human body, machines turn into animals just as often as animals turn into machines, creating an disorienting vacillation that is, for me, part of his uncanny charm. When this foundational metaphor is upended in this way, what becomes of our conception of the human and the autobiographical narrative of the mode of being peculiar to that species.

I propose that the feeling of our frightful inertia, the thought that we are becoming, and may always have been, inanimate (as Dick suggests in the epigraph to this section) is a fundamentally ethical condition; the reversibility of the trope that turns between artifacts and organisms suggests we reimagine how we comport ourselves toward the nonhuman. In many ways, Brooks takes up a task that Andrew Pickering claims was fundamental to the early cybernetic project, that is, "to figure out how to get along in a world . . . that could not be subjugated to human designs—how to build machines and construct systems that could adapt performatively to whatever happened to come their way" (32). The machines and systems that arise in the wake of cybernetics

are not so much devices built and placed into the world to be observed in themselves; they are theses about the world. Cybernetic organisms and artificial creatures are thought devices that foreground the world's contingency and unpredictability, its resistance to human subjugation. They reveal that the dynamic activity of an environment occurs by virtue of the complex dance of communication and control that involves each entity with its cohabitants. This is a world where figuring out "how to get along" demands the ability to respond.

Encountering a world where *things come alive* highlights our inability, as long as we adhere to a particularly modern attitude, to respond to the nonhuman. We are oriented in our modes of thinking and acting by a liberal-humanist model of the subject that is privatized, anthropomorphic, and anthropocentric. The broad ethical values we have inherited from the Enlightenment position human life and human rights as privileged ends-in-themselves, and anything not human, whether living or nonliving, as so many means to those ends. My hope is that the disorientation that arises from an imaginative engagement with the uncertain liveliness of cybernetic organisms and artificial creatures, as well as the recalcitrant, but intensely communicative world they posit, will invite us to consider Haraway's ironic proposal that "we can learn from our fusions with animals and machines how not to be Man, the embodiment of Western logos" (*Simians, Cyborgs, and Women* 173). It is through such a nonhuman pedagogy that I hope to place into question the relation of machines and animals to the human, and to suggest a concern for different ways of living together rather than for the lives of human beings alone.

Creatures of Artifice is divided into three parts. The first part serves as a more

detailed introduction to Brooks and his particular approach to robotic engineering, and outlines the theoretical stakes his work presents to me. In chapter 1, I discuss his deviation from and polemic against the traditional paradigm of AI research, the crux of which is a model of intelligence that does away with symbolic reasoning and centralized cognition, emphasizing instead low-level interactions with the surrounding environment that emerge into complexity, an emphasis that in many ways aligns his creature-building with the agenda of Artificial Life. As I light upon some of the major criticisms of ALife's discursive practices, I also take the opportunity to address some of my own methodological considerations and argue for a mode of critique that is motivated first and foremost by imagination and curiosity, rather than normative judgments. Chapter 2 takes a close look at the design methodology by which Brooks constructs his artificial creatures and the analogy to biological evolution that informs it. What is most important for me in this chapter is the way in which Brooks extends insights he has gleaned from building robots to a radically decentered conception of the human, even going so far as to charge us with "overanthropomorphizing" ourselves.

In the second part, I interrogate the ways in which Brooks' speculations into the revolutionary future of robotics and biotechnology speak to the struggle between attitudes of modernity and counter-modernity with respect to the relation of human subjects to technology. In chapter 3 I discuss Martin Heidegger's and Bernard Stiegler's philosophies of technicity, both of which offer powerful critiques not of technology or technoscientific development as such, but of a modern humanist conception of the function of technology in modern Western thought. Their ontological interpretations of the human in its relations to technology suggest the dangerous ends of an anthropocentric

mode of being whose principle object is the advancement of human existence, and reveal a defamiliarized conception of the human whose very essence lies outside of itself, in the things of the world that gather around it. Chapter 4 is the most critical of Brooks, as it questions certain crucial elements of his speculations on the future of robotic and biotechnological engineering in connection with a neoliberal drive toward innovation and a biopolitical agenda of optimizing life itself. Here I examine how formulations of human subjects as various species of biotechnological and economic machines play into a moral economy of enhancement and immunization at the same time as they struggle with the experiences of vulnerability and finitude that undermine the dream of Man's sovereign self-mastery.

The third part takes a specific interest in artificial creatures, exploring what it could mean when the analogical comparison that posits that animals are machines, a figurative link in many ways intrinsic to the tradition of philosophy and science in the West, takes on a conceptual reversibility. Chapter 5 begins with an intriguing claim Brooks makes about his "most satisfying robot," which, to him and his colleagues, "felt like a creature" (*Flesh and Machines* 46). Taking this cue, I examine the progenitor of the cybernetic organism in Descartes' *bête-machine* in a way that foregrounds the feeling of vitality that inheres in the machinery of the body. The question here is not so much what it means to say that animals and animal life may be analyzed and comprehended along the same lines as machines, but instead what it means to say that a certain machine *feels like* a creature, and thus to sense that machines are creatures after a fashion. While the reversibility of the organism-machine trope already haunts Descartes' mechanist philosophy and its ménage of beasts and automata, it is explicitly thematized, I argue, in

what Pickering calls the "form of life" of cybernetics (*The Cybernetic Brain*). In Chapter 6, I turn to the cybernetic organism itself in a discussion of Norbert Wiener and W. Grey Walter, the latter of whom is an especially important inspiration for Brooks. What is compelling to me about cybernetics has to do with the indeterminacy it breeds with regard to the definition of life and what constitutes an organism. There is also a discomfiting familiarity that this indeterminacy draws between human, animal, and mechanical lives that hints at the possibility of uncanny kinships between the human and the nonhuman. Chapter 7 picks up on the notion of the uncanny in the context of "domotics," or the technological dream of home automation. Here I return to the Roomba and the fantastic menagerie of artificial creatures that Brooks imagines will scurry around our homes doing household chores. Reading this fantasy alongside the video-game adventures of Nintendo's adorably minuscule housekeeper, Chibi Robo, I argue that the promise of domotics is at once an expression of biopolitical control and a quasi-animistic vision of extended belonging within an active nonhuman world.

PART 1

Chapter 1

Curious lives

"The sense of life, almost"

When Rodney Brooks is introduced in Errol Morris' 1996 documentary, *Fast, Cheap, and out of Control*, he reflects upon the formation of his relationship to machines, confessing, quite simply, "I like to build stuff." As with any good genesis story, he begins at the beginning, reminiscing about his "childhood days" to tell a brief story about a curious boy who was fascinated by electronics: "I used to try and build electronic things in a little tin shed in the backyard. . . . I just had this tremendous feeling of satisfaction when I'd switch the things on, the lights flashed, and the machine came to life." In a later interview, it becomes clear that he drew his satisfaction precisely from the sense of life of the electronic things he built: "I just liked being able to switch these things on and have them operate autonomously . . . the sense of life, almost, of these things, and that creation of that sense of life" ("Does Artificial Life Have a Mind?"). Having given a plenary presentation just days before at the Eighth International Conference on the Simulation and Synthesis of Living Systems, or ALife VIII, Brooks describes in this statement not only a nostalgic sentiment of his particular childhood, but also the attitude of an entire field of research and engineering. To give a "sense of life" to technological artifacts, to build things that are at least persuasively lifelike, is the primary objective of Artificial Life as well as the variety of Artificial Intelligence that Brooks helped to pioneer.

In this chapter, I outline Brooks' approach to robot building and the challenge its

behaviour-based and biologically inspired models of intelligence posed to the Artificial Intelligence community. I am particularly interested to present his research an endeavour concerned, first and foremost, with engineering a "sense of life, almost." Taking this "sense" as my primary frame of reference for interpreting his work reveals his break from traditional AI to stem as much from aesthetic and rhetorical concerns as conceptual and technical ones. From an epistemological perspective, the aesthetic and rhetorical "software," to use Richard Doyle's terminology, that accompanies Brooks' robotic "hardware" is quite problematic, coming dangerously close to mistaking representations of life for life itself, to confusing simulation with reality.[1] What is epistemologically troublesome, however, can be figuratively illuminating. With this in mind, the latter sections of the chapter address my own methodological considerations, making a case for an interpretive critique rooted in curiosity and a feeling for what may be unfamiliar about contemporary reality.

Brooks received his PhD in computer science from Stanford University in 1981, working on computer vision systems at the Stanford Artificial Intelligence Laboratory, which was one of the major AI hubs from the mid 1960s through 1980, when it merged with the Computer Science Department. After "a little odyssey" of research and faculty positions at Stanford, Carnegie Mellon, and MIT, he finally became a faculty member at MIT's Artificial Intelligence Laboratory in 1984. He eventually served as director of the Lab from 1997 to 2003 (perhaps not coincidentally, the years during which he garnered a good deal of attention in the media and other popular science venues), and then as director of the newly integrated Computer Science and Artificial Intelligence Laboratory

1. On Doyle's notion of "rhetorical software" as a means of analyzing the textual emergence of scientific knowledge and practice, see *On Beyond Living* (6-8).

(CSAIL) from 2003 to 2007. Yet the methodological approach he adopted by the mid-1980s was very much at odds with the historical agenda of AI. Brooks pursued a very different form of "intelligence" from linguistic and representational models, the sort of abstract mimesis of humanist intellectualism first proposed by Alan Turing and his famous "imitation game."[2]

The first paragraph of "Intelligence without Representation," one of the earliest comprehensive statements of his overall engineering methodology, sums up the original teleology of AI in a single, plain-spoken sentence: "Artificial intelligence started as a field whose goal was to replicate human level intelligence in a machine" (139). Brooks wrote and circulated this formative paper in the mid-1980s and, though it was repeatedly rejected for publication, he claims it enjoyed a certain underground cachet during the years before its formal appearance in 1991 among the pages of the field's foremost journal, *Artificial Intelligence*.[3] His manifesto for a new and more promising paradigm, it is perhaps unsurprising that the article opens with such a blunt reduction of what came to be known as "good-old-fashioned-AI" (GOFAI), boiling it down to one overreaching ambition. The matter-of-fact delivery of this first line almost conveys an air of honourable nostalgia to the intrepid origins of the field. Elsewhere, Brooks refers to this originary goal as a matter of "revealing the secrets of the holy grail of AI," lending a chivalric cast to adventuring after "general purpose human level intelligence equivalence" ("Elephants Don't Play Chess" 4).

There is, however, a certain irony at work in the tone Brooks employs here, as he

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2. For a full account of Turing's imitation game, see his "Computing Machinery and Intelligence."

3. Brooks' anecdotal history of this paper appears in the prefatory note to its reprinting in *Cambrian Intelligence* (79).

immediately brings into view the quixotic excesses of GOFAI's grail quest:

> Early hopes diminished as the magnitude and difficulty of that goal was appreciated. Slow progress was made over the next 25 years in demonstrating isolated aspects of intelligence. Recent work has tended to concentrate on commercializable aspects of 'intelligent assistants' for human workers. ("Intelligence without Representation" 139).

The sorry regression from romantic aspirations for divine creation to workaday concerns for commercial saleability led to an unspoken taboo on the old dream: "No one talks about replicating the full gamut of human intelligence anymore" (140). This grand mystery was subsequently decomposed into "specialized subproblems, such as ways to represent knowledge, natural language understanding," planning, and so on (140). Nonetheless, Brooks asserts that a feeling still abides among the GOFAI faithful that "one day all these pieces will fall into place and we will see 'truly' intelligent systems emerge" (140). It is to such "delusions" held by "dreamers" and the "self-deceived" that he directs his polemic. To hold out hopes that *beginning* with the faculties of human intelligence, however isolated and specialized they may be, will yield profitable results is, put simply, to proceed in the wrong direction:

> I, and others, believe that human level intelligence is too complex and little understood to be correctly decomposed into the right subpieces at the moment and that even if we knew the subpieces we still wouldn't know the right interfaces between them. Furthermore, we will never understand how to decompose human level intelligence until we've had a lot of practice with simpler level intelligence. (140)

The belief held by Brooks and the unnamed "others" meant a radical detour from the GOFAI dream, toward a less immediately anthropological pursuit.

Brooks claims that it was a logic of negation that catalyzed the paradigm shift for which he was calling. Indeed, in *Flesh and Machines*, he insists that the negation of tacit assumptions lay behind the majority of his successes as an engineer. "I would look at how everyone else was tackling a certain problem," he writes, "and find the core central thing that they all agreed on so much that they never ever talked about it. Then I would negate the central implicit belief and see where it led" (37). One need only glance at the titles of his more prominent papers on the philosophy of behaviour-based design to note the importance of the negative as an organizing principle for his methodology: "Intelligence without Representation," "Intelligence without Reason," "Elephants Don't Play Chess." For Brooks, the question of building autonomous mobile agents has to do with what can be done without. In order to design a machine that does something, it is equally important, if not more so, to build into the design those things it does *not* do. While artificial intelligence remained the order of the day for Brooks, the issue at stake was the *style* of intelligence he was designing—an aesthetic consideration.

The "core central thing" Brooks negated was a style of intelligence distinguished by an intentional and reflexive "life of mind"—that is, a cognitivist mode of thought grounded in symbolic representation. In other words, the aesthetic of his artificial intelligence design has been antithetical to modern liberal humanist models of reason. Instead, his behaviour-based approach to building robots focuses primarily on low-level perceptual and locomotive capabilities possessed of even the most primitive life forms. In "Intelligence without Representation," Brooks argues that what he seeks to emulate

with his mobile autonomous agents, or "mobots," is simply the "essence of being and reacting" (81). What he calls his "favourite" creature exemplifies this essence at its most basic: it "avoids hitting things" (88). At a more conceptual level, this biologically, ethologically, and evolutionarily inspired paradigm brackets off human-level intelligence in favour of more animalistic acuities: "the ability to move around in a dynamic environment, sensing the surroundings to a degree sufficient to achieve the necessary maintenance of life and reproduction" (81). This focus on the perception of and spontaneous interactivity with the immediate surround comes down to a bare impulse for survival. When Brooks claims that his interests lie in the nature of life and living beings, it would appear that his primary concern is with life at its most primordial.

It is telling that Brooks insists on the term "intelligence" for what would perhaps more fittingly be dubbed "instinct." Working from within the tradition of Artificial Intelligence research, his adherence to the term implies a reconsideration of the definition of the field's fundamental term, rather than a wholesale repudiation of its objectives. When Brooks argues that the basic stimulus-response behaviour that his mobots perform is "intelligence," he also suggests that such responsive engagement with the material world is not unrelated to the intellectual life human beings attribute to themselves as that which distinguishes them from nonhuman animals. While he is critical of GOFAI and its grail quest, it is the process, and not the prize, that is the major focus of his criticism. His foray into humanoid robotics with the Cog project in the 1990s, as well as his earnest speculations into the future of intelligent, emotional, and socially competent robots in *Flesh and Machines*, attest to his conviction that engineering something matching human intelligence in degree is certainly possible (if only after a long process of development

and experimentation that is unlikely to be fulfilled in the near future).

Midway through "Intelligence without Representation," Brooks relates his particular interests and "intellectual motivations" in a paragraph that outlines what his motivations are *not* just as much as what they *are*:

> I wish to build completely autonomous mobile agents that co-exist in the world with humans, and are seen as intelligent beings in their own right. I will call such agents *Creatures*. This is my intellectual motivation. I have no particular interest in demonstrating how human beings work, although humans, like other animals, are interesting objects of study in this endeavor as they are successful autonomous agents. I have no particular interest in applications; it seems clear to me that if my goals can be met then the range of applications for such Creatures will be limited only by our (or their) imagination. I have no particular interest in the philosophical implications of Creatures, although clearly there will be significant implications. (145; original italics)

Note that as he raises his mobots to the status of creatures, he decenters and dehumanizes human beings. Humans become another brand of "autonomous agents," another sort of intelligent robotic apparatuses. They are not, however, central to his concerns, being neither something he wishes to understand better through modelling, nor model entities to replicate. Humankind may be interesting to his project in a proximal way, but only as one proof-of-concept for the creatures he does wish to build. They are "like other animals" in this regard, simply interesting examples of successful autonomous agents. Pulled into this triangulation of beings, we find ourselves less than special—just another animal, another autonomous system.

While Brooks' claim to be uninterested in applications and philosophical implications may be disingenuous, it does highlight the notion that his primary interest is to bring things to life. Only a few lines after this paragraph, the last entry in a list outlining "some of the requirements for our Creatures" asserts, "A Creature should do *something* in the world; it should have some purpose in being" (86; original italics). Yet the purpose of his creatures is left to the imagination, even to that of the creatures themselves. Their reason for being is potentially intrinsic, apart from strict utility and perhaps, for this reason, beyond a totalizing instrumentality. They are to co-exist with us, cohabitants of a world that will become livelier as we become less exceptional. His project stands as a probe into the indeterminacy of life itself, a probe that takes the form of populating the world with artificial creatures, of increasing the bounds and varieties of artificial life.

Putting living things together

Artificial Life as a specified field of study has to do with modelling the logic and mechanics of living processes in artificial media. The digital computer is the primary medium in which ALife researchers model living systems and their behaviour, though in other branches of the field, practitioners turn to robotics and even engineered biochemicals to fulfill its broad agenda. In more conceptual terms, ALife is concerned with pressing the bounds of life itself through technoscientific rearticulations of the limits that differentiate the living from the nonliving. Indeed, the very term unites a contradiction between artifice and life that subverts traditional understandings of life and invokes potentials for new kinds of living as a matter of synthesis. Christopher Langton, the outspoken computer scientist who spearheaded the field and helped solidify its

institutional legitimacy by hosting the First International Conference on the Synthesis and Simulation of Living Systems at Los Alamos National Laboratories in 1987, insists that synthesis is ALife's governing principle. In "Artificial Life," the paper he delivered at this conference, Langton positions its methodology against an analytic approach, traditional to the biological sciences, that moves from the top down, "decomposing a living organism into organs, tissues, cells, organelles, and finally molecules" (39). Langton admits that, through this approach, which treats the living organism as the mechanical sum of its isolable component parts, "biology has provided us with a broad picture of the mechanics of life on Earth" (40). That said, the point he wishes to emphasize is that "there is more to life than mechanics—there is also dynamics" (40). Life occurs according to a continuing process of self-organization contingent upon the non-linear interactivity between the parts of an organism.

Taking this insight into account, the organism becomes something much more than the sum of its parts; its organization is a series of emergent, autopoietic events. Langton wishes to focus on this something "more" in the non-linear dynamics of life, a task for which the analytic method of decomposition is ultimately inadequate: "Rather, non-linear phenomena are most appropriately treated by a *synthetic* approach. . . . In non-linear systems, the parts must be treated in each other's presence, rather than independently from one another, because they behave very differently in each other's presence than we would expect from a study of the parts in isolation" (40; original italics). Langton finds that it is the relation—the communicative activity that arises at the interface of different parts as they react to each other's presence—that makes the difference. Synthesis is the key principle underpinning Langton's understanding of

ALife as a particular variety of life science: "*Artificial Life is simply the synthetic approach to biology: rather than take living things apart, Artificial Life attempts to put living things together*" (40; original italics). What this synthetic agenda indicates is that ALife is an engineering concern more than a matter of scientific inquiry.

Without attempting to place under erasure the suspicions or anxieties roused by the idea of subjecting life itself to a logic of engineering, I would like to draw out a peculiar meaning at the etymological root of the term "engineering." In contemporary English usage, "engine" corresponds more or less to "motor," a usage inherited from the nineteenth century when the prevailing sense of the term was equivalent to "steam-engine." As outlined in the *OED*, however, "engine" can be traced through Middle English and Old French forms back to the Latin *ingenium*, which denotes an inborn character or talent, as well as a capacity for cleverness and invention. Indeed, from the late medieval period through the Renaissance, "engine" described an aspect of what we might call one's "inner nature," whether in terms of character (one's disposition or temperament) or of intellect (one's wit or, as the morphological similarity suggests, ingenuity). To take another step back, *ingenium* derives from the root of *gignere*, "to beget," whose Indo-European base is shared by words like genesis, generation, and genetics. It is this reproductive nuance that I wish to sound out, by which engineering can be construed as an activity of engendering, a practice that brings new apparatuses, structures, and machines into the world. It is about organizing and reorganizing matter to beget different ways of living in the world as a matter of artifice.

As an engineering practice, then, ALife engenders ways of living. It does not seek to represent life as a unified phenomenon as much as it designs, builds, and makes

life of different kinds. This orientation of proliferation is what draws out the field's utopian tenor. For Langton's hope is that, through clever engineering, a synthetic evolution might produce a "biology of possible life," which he expects will "lead us not only to, but quite often *beyond*, known biological phenomena: beyond *life-as-we-know-it* into the realm of *life-as-it-could-be*" (40; original italics). In this announcement made at the inaugural meeting of ALife researchers, Langton's primary concern was one of agenda-setting for ALife as a burgeoning field, cohering it around the task of engendering things, by way of human technical practices, that display properties of what one could legitimately designate as life. My interest here, however, has to do with an ethical question that seems to me correlative to the pursuit of "life-as-it-could-be" in a broader sense, one that apprehends artificial life forms as an opportunity for creative speculation and that questions what life could be.

One pitfall to the approaches taken by technoscientific endeavours such as ALife is that they generally represent themselves according to Western cultural norms in order to promote the coherence and legitimacy of their methods, goals, and outcomes. Stefan Helmreich's *Silicon Second Nature* is one of the most prominent critiques of the underlying narratives informing the ALife project in the mould Langton cast for it. Through an extensive ethnographic study of ALife researchers he conducted in the mid- to late-199s, Helmreich demonstrates that the language and ideas that characterize his subjects' research reproduce and reinscribe Judeo-Christian mythologies, heteronormative sexuality, xenophobia, capitalist ideology, and workplace inequalities endemic to universities and other research institutions. In addition, he points to the proximity many instantiations of ALife have to a neo-Darwinism that assumes a model of

life governed entirely by competitive self-interest. For Helmreich, it is patent that ALife is largely conservative, that "constructions of *life-as-it-could-be* are built from culturally specific visions of *life-as-we-know-it*" (13).

In its strong social constructivism, such a critique sees the entirety of ALife's significance derived solely from its practitioners, who impose familiar ideologies, tropes, and mythologies onto their research and the artifacts they produce in order to render them legible to the wider scientific and academic community as well as to the non-academic public. I wish to consider technoscientific artifacts, however, not simply as plastic substrates for the imprint of human intentionality, but as meaningful, performative links in a network of material practices.[4] To question after the active role of such artifacts is essential toward the cultivation of a nonhumanist bioethics, whose primary task might be to articulate "the ways in which a persistent anthropomorphism negates its troublesome differences and normalizes its own production through the apparently contingent mutability of technologies" (Mackenzie 43). In other words, the security of what designates being human and living a human life is epistemologically and ontologically assured in the characterization of technology as neutral means to the human ends that give it substance and significance.

While ALife as a technoscientific discourse and practice most certainly relies on iterations of common cultural narratives for its legibility and legitimacy, the very iterativity of those narratives means that the stories the engineers of artificial life forms tell, always in concert with their creations, cannot simply be repetitions without

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4. Arguments for the "active" role of nonhumans in the sciences and beyond has been the focus of actor-network theory and the species of science studies especially influenced by Bruno Latour. For one of Latour's most recent discussions of ANT, see *Reassembling the Social*. For a lucid case study that is very much indebted to Latour's approach, see Andrew Pickering, "The Mangle of Practice."

difference. I wish ultimately to remain uncertain about how the rapprochements of artifice and life engender new conceptions of what life could be, and synthesize new narratives about what it means for humans to share a life with increasingly lively technologies. Which is why Rodney Brooks so piques my curiosity, since for all that is disappointingly familiar about the stories he tells, there are many aspects of his vision that are decidedly unfamiliar, and worth engaging creatively and imaginatively. This is not to champion blindly the innovations of science and engineering, but to meet the ethical demand Catherine Waldby suggests is placed upon us by any technoscientific creation, a demand that we engage each creation in its specificities and recognize that "each possible creation represents a possible world of experience, feeling, embodiment, and desire. Each possible creation introduces new possibilities for relationship, and shifts the terms of human ontology in unexpected ways" (Waldby 36). Those things engendered from the crossovers that turn life and artifice, biology and technology, each into the other, call upon us to interrogate what might be unfamiliar and unforeseen in the shifts in feeling, belonging, and becoming they invoke. The ethics of such a questioning is about attending, with curiosity and respect, to how living and nonliving things, humans and nonhumans, are *put together* in surprising ways.

Agalmatophilia

Theoretical biologist Claus Emmeche, in *The Garden in the Machine*, defines organic life as fundamentally surprising, always in a process of reinvention, standing "in a permanent nondeterministic pragmatic relation to its environment" (154). Such a "slimy affair," as he puts it, remains "computationally unpleasant": resistant to full description, measurement, and calculation. This is a slippery situation in which we discover the

impossibility of accounting for "all the flexibility necessitated by an unstable environment and by the impossibility . . . of fully controlling the relationship to the environment" (154). It is from this perspective that Emmeche criticizes the project of Artificial Life and its variant in the sort of mobile robotics for which Brooks is known, charging the practitioners in these fields with succumbing to the representational ailment he calls "Pygmalion syndrome." Emmeche is most concerned to arraign the "strong" version of Artificial Life, that is, "the version of the research program that stresses the idea that life is a medium-independent phenomenon and asserts that when, by program-governed computation, emergent lifelike properties appear, we are in fact speaking of a realization of new forms of life (in another medium), and not simply a simulation of life" (145-46). The claim that a computational simulation of life is, in point of fact, life itself easily slips into a circular epistemology where the instantiation of theoretical models becomes the basis upon which to substantiate those models. A very general example, and one for which Brooks would certainly be indicted, would be to argue for a mechanistic theory of biological processes, then engineer machines that purportedly demonstrate such a biology in action. At best, this is bad science; at worst it is, as the allusion to the classical myth suggests, a touch of delusion.

One rejoinder to the charge of Pygmalionism and its representational fallacy can be made on epistemological grounds with reference to Foucault's argument, from *The Order of Things*, that life as a concept is a relatively recent invention: "Up until the end of the eighteenth century, in fact, life does not exist: only living beings" (160). Life is not strictly a natural, objective phenomenon; it is the discursive product of a specific time and place, emergent from a constellation of knowledge-making practices that made a life

science, biology as such, possible. Recalling Foucault's thesis leads Evelyn Fox Keller to the opinion that, while it may seem absurd at the moment to lend credence to the thought that synthetic creatures of the robotic or computer-generated varieties might be genuinely alive, it does not mean that the contours of what counts as living are necessarily fixed and immutable:

> It only means that the question 'What is life?' is a historical question, answerable only in terms of the categories by which we as human actors choose to abide, the differences that we as human actors choose to honor, and not in either logical, scientific, or technical terms. It is in this sense that the category of life is a human rather than a natural kind. (294)

Instead of dismissing outright the type of argument that would posit an autonomous mobile system to be a creature, Keller appeals to the historical contingencies of knowledge production and the human imagination to suggest the open-ended possibility for such a reinvention of life. That said, Keller's argument, in order to stake a claim for the historicity of scientific truth, relies on a constructivist stance that grants sovereign agency to "human actors," who freely exercise a choice to abide by and honour certain meanings or not.

We might then ask if such an epistemological rebuttal in fact escapes the fallacy of Emmeche's charge. Does it not simply replace one Pygmalion with another: one who does not so much see life where there is none, but who can only see in an object the stamp of his own creative power? After all, one quite valid interpretation of the myth has less to do with Pygmalion's foolishness or hapless delusion than with his solipsistic self-obsession. A purely representational or epistemological response to the questions and

challenges Artificial Life poses is severely limiting if one is compelled to make a choice between stark forms of constructivism and positivism. To say that life is a category of a human rather than a natural kind or vice versa is to occlude the convoluted negotiations and mediations between the human and the natural world that make representation possible in the first place.[5]

What of the imaginatively unsettling possibilities held out by a world that is animate and meaningful of its own accord? The unique aspect of Brooks' robotic engineering lies in the sense it carries that the technologies animating human life do so on account of their own vitality and lively production of meaning. This suggestion positions the human as merely one species among countless varieties of beast-machines, whose existence and whose world is engendered in a dynamic community of, and communication among, significant others. In other words, I wish to suggest that human beings only appear, only happen, *heteronomously*, as a synthesis of the organic and inorganic, the living and lively. The ontological and ethical stakes of technological life thus turn on the communicative relations (taken in the broadest sense) that emerge from such a synthesis of diverse entities and realities.

Curiosity: Animating critique

In what follows, I read Brooks' creature-building using a comparative literary and rhetorical approach. Establishing a dialogue between the roboticist and various philosophical, literary, and popular texts allows me to unfold the implications his science

5. Latour contends that the forced choice between positivism and constructivism has "cheapened critique," which has become all too often a means of simple debunking. This argument arises in a number of his texts, but is the central theme of "What is Iconoclash?" and "Why Has Critique Run out of Steam?" On the role of mediation in scientific representation, see also *Pandora's Hope*.

carries as a seriously playful science *fiction*, and to take certain concepts he only hints at, notions he leaves undeveloped, ambiguous, or problematic, and push them toward the cultivation of a concern for all species and forms of life—as it is and as it could be. Part of my motivation to consider Brooks by way of a comparative methodology that takes its cues from literary studies, continental philosophy, and rhetorical analysis, rather than a history or sociology of science approach, has to do with an attempt to circumvent the double bind of constructivist or positivist approaches attendant to a strictly representational metaphysic.

My primary concern is with the figuration of lively technologies. Haraway regularly insists that her own investigations into contemporary technoscience and its impact upon human and nonhuman bodies alike has always emphasized figurations, which she calls "performative images that can be inhabited" as well as "condensed maps of contestable worlds" (*Modest_Witness* 11; cf. *When Species Meet* 4). The weight she gives to performativity and contestability indicates a consideration for more than just language-games, more than just questions of representation and epistemology. Figuration deals with all types of reifications and fabrications; it pertains to an expanded notion of constructivism that involves mediating, assembling, and gathering together material things with immaterial concepts and feelings in order to express reality as the dynamic work of countless actors. Latour suggests that attending to figuration can be a powerful approach to perceiving matters of concern in place of matters of fact, thereby dramatizing the conditions of possibility for creative action:

> Because they deal with fiction, literary theorists have been much freer in their enquiries about figuration than any social scientist, especially when they have

> used semiotics or the various narrative sciences. . . . Novels, plays, and films from classical tragedy to comics provide a vast playground to rehearse accounts of what makes us act. (*Reassembling the Social* 54-55)[6]

In other words, the study of figurations is an ethical exploration: it is about experimenting with and inquiring after the possibilities of doing and making do, of inhabitation and habitude.

The figure of the robot is one that has proven virulent enough to reproduce itself again and again in so many different contexts (popular narrative, scientific research, philosophical inquiry, industrial development), and provocative enough to encourage the massive organizations of matter, energy, and capital required to produce life (or at the very least a sense of something lifelike) by technological means. There is a compelling rhetoric at work in the trope of artificial life, a persuasiveness that exceeds human intention. The seductive quality of artificial life highlights "the fact that humans do not simply choose rhetorical practices; rather, they are persuaded by and respond to them." (Doyle, *Wetwares* 30). The object of a rhetorical critique, then, is to ask after the ways in which humans respond to the figurations that steer their thoughts and actions.

My engagement with Brooks is motivated first and foremost by curiosity. Curiosity is a primary ethical disposition if one takes it to mean, as it once did, to be careful and attentive toward things. It appeals to a care that lies at the basis of an affirmative style of critique Foucault once dreamt "would try not to judge but to bring an

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6. In *The Practice of Everyday Life*, Michel de Certeau argues that "*a theory of narration is indissociable from a theory of practices*" (78; original italics). Narrative, for de Certeau, is a resource for creating memories that await new opportunities for actualization. He writes that narration "belongs to the art of making a coup: it is a detour by way of a past ('the other day,' 'in olden days') or by way of a quotation (a 'saying,' a proverb) made in order to take advantage of an occasion and to modify an equilibrium by taking it by surprise" (79). In this way, "The story does not express a practice. It does not limit itself to telling about a movement. It *makes* it" (81; original italics).

oeuvre, a book a sentence, an idea to life. . . . It would multiply not judgements but signs of existence. . . . Perhaps it would invent them sometimes—all the better" ("The Masked Philosopher" 323). For Foucault, curiosity

> evokes the care one takes of what exists and what might exist; a sharpened sense of reality, but one that is never immobilized before it; a readiness to find what surrounds us strange and odd; a certain determination to throw off familiar ways of thought and look at the same things in a different way; a passion for seizing what is happening now and what is disappearing; a lack of respect for the traditional hierarchies of what is important and fundamental. (325)

To sense and seize in new ways the realities around us, as much as it may be disrespectful of certain traditions of thought, can encourage renewed respect for species of thinking and being that may be held in disregard.

Haraway writes that curiosity is "one of the first obligations and deepest pleasures" of encountering the infinite host of nonhuman species with which we share the Earth (*When Species Meet* 7). Through the obligation to encounter the nonhuman with the solicitude curiosity entails, one may develop a sense of respect and responsibility toward what she calls the material-semiotic entanglements of "becoming-with" and "mortal world-making" (4). She recalls that respect, from the Latin *respecere*, is about seeing again, looking back. It is an act of regard that is also about being in touch and responding: "Touch, regard, looking back, becoming with—all these make us responsible in unpredictable ways for which worlds take shape" (*When Species Meet* 36). Prompting surprising responses and unforeseen responsibilities, curiosity calls us to take account of our involvement in the world we engender with so many significant others—human and

nonhuman, living and nonliving, corporeal and incorporeal.

Ultimately, I am calling for species of ethics that we need to develop in order to address the ecological crises that arise more frequently and desperately every day. As Félix Guattari insists, ecological crisis is not simply a question of disasters in the realm of so-called "nature," but is more generally one of ongoing crises in social, political, and existential mentalities. The difficulties we face have to do in the main with the irresponsibility humans have adopted toward the world of nonhuman beings. Beneath the oftentimes bewildering constructions of thought Guattari calls "ecosophy" and the "ethico-aesthetic paradigm" that frames it lies a straightforward and sincere question about the wisdom of dwelling with other species:

> [H]ow do we change mentalities, how do we reinvent social practices that would give back to humanity—if it ever had it—a sense of responsibility, not only for its own survival, but equally for the future of all life on the planet, for animal and vegetable species, likewise for incorporeal species such as music, the arts, cinema, the relation with time, love and compassion for others, the feeling of fusion at the heart of the cosmos? (119)

The stakes in this question have to do, to use the words of Isabelle Stengers, with "one's *capacity to feel*," in other words, "the capacity to be affected by the world, not in a mode of subjected interaction, but rather in a double creation of meaning, of oneself and the world" (Stengers 148; original italics). This is an ethics and an aesthetics that posits the human and the cultural to be radically ecological, synthesized in manifold, shifting relations among nonhuman beings.

Reading Brooks and his artificial creatures prompts serious questions about the

vitality of technology and what it means for us to contemplate the future of artificial life forms, even as we struggle with our capacity to care for, even to care about, the nonhuman life forms that exist in the world right now. What might the future of all life on the planet encompass in light of the technical capacity we as human beings exercise with little discrimination, a capacity whose products appear, in increasingly literal terms, to take on lives of their own? If an artifact can act in such a way as to inspire a sense of lively being, how might this move us to look back upon our relations to both animal and technological life? At the very least, such considerations might unsettle the ascendant modes by which we think about and question after "technology" and "the animal," those grand generalizations summoned by a certain tradition of modern Western thought in order to supervise the limits of human living.

Chapter 2

Ways of living

Ways of doing

> A well respected professor from Germany said, 'How do you tell the robot what to do?' And my only answer was: I don't tell the robot what to do. I switch it on, and it does what is in its nature.
>
> —RODNEY BROOKS in *Fast, Cheap, and Out of Control*

In Errol Morris', *Fast, Cheap, and Out of Control*, Rodney Brooks appears alongside naked-mole-rat specialist Ray Mendez, circus animal trainer Dave Hoover, and topiary gardener George Mendonça—four "obsessed eccentrics," as the DVD packaging calls them, whose personal accounts of passionate obsession Morris intertwines with footage of their respective objects of fascination and workplace settings, old movie serials, and other filmic detritus. What begins as a character study of four curious misfits eventually grows into an existential meditation on otherness and finitude, prompted by the intimate relationship each of these men has with the nonhuman. Speaking directly into the camera, each interviewee describes his personal link to beings on the fringes of human knowledge and control: Mendonça's privet, yew, and boxwood beasts residing at the Green Animals Topiary Garden in Rhode Island; Hoover's tenuously tamed lions, tigers, and bears performing in the Clyde Beatty Circus; Mendez's strangely insectile, eusocial rodents burrowing beneath the deserts of Eastern Africa; and Brooks' strangely insectile artificial creatures scurrying about the halls and offices of MIT's Artificial Intelligence Laboratory. The liminal life forms that populate the backdrop against which each man speaks evoke a world enlivened by strange and occasionally violent interactions among

animals, machines, humans, and plants. And while in the case of each of these experts there is a definite command over their objects of invention, intervention, and inquiry, there is at the same time a persistent otherness in each case that outstrips human mastery. Ray Mendez sums up this sense of the alien with regard to his naked mole rats, which intrigue him precisely because they open an encounter with otherness: "The exploring and finding of animals that had absolutely nothing to do with any control that we as a person would have; that feeling that you are in the presence of life that exists irrelevant of yourself. That's the 'other.'"

In what sense can the artificial creatures Brooks engineers be the products of human ingenuity, and yet at the same time unrecognizably other in this way? How might we interpret his ethologically inspired robots to be both devices for human use as well as entities for whom human beings are irrelevant? What are the consequences of casting ourselves into such irrelevance? In a remarkable sequence near the end of the film, Brooks explains one of the reasons why he calls his robots "artificial creatures": "I like to think of them as prototypes towards entities that exist in the world and live in the world in the same way that animals live in the world." Creaturely as they may be, they are still prototypical, preliminary models toward a kind of existing and living that resembles animal life. Over and over again, Brooks brushes up against the conceptual limits of life, nudging these limits, worrying them, occasionally stepping across them, only to backpedal with more reasonable qualifications. His artificial creatures approach life, but they still have some evolving to do. Much more pressing for me is the question of how they resemble animal being. What constitutes the way animals exist and live in the world for Brooks? What is in the nature of his artificial creatures that approaches that of more

natural ones?

The most obvious answer has to do with autonomy and control. Brooks perennially speaks about relinquishing control over his robots, removing human manipulation and decision-making out of the operational loop. Beyond power-up, a creature is to be "let loose" into the "real world" ("Intelligence without Representation" 140), operating according to wilful activity Brooks describes across his various texts, as aimless "wandering," ungainly "bumbling" and "scrambling," or furtive "creeping" and "sneaking." One could object that, as the products of painstaking design and engineering, Brooks' robots remain very much in control, and that any references to their "nature" or characterizations that creaturize their activities are a bit of self-indulgence or knowing irony. To underscore the species of curious critique I spoke about in the previous chapter, however, I wish to be a little more ingenuous and interpret such depictions as a seriously playful provocation to consider how strange certain modes and limits of thinking and categorizing become when robots are let loose on the scene. Taking this line of interpretation might lead to some novel insight into the late-modern imbrication of nature and culture so well trod in critical studies of technology, ecocriticism, and cultural theory in general.

At the outset of the section of Morris' film to which I refer, Brooks once again addresses the distinction between "what is alive and what is a machine," speculating that such a distinction might become more difficult to ascertain, to the point where "that boundary may start to become meaningless." But he immediately hesitates, remarking, "On the other hand, there may still be some distinction." Grappling with this uncertainty, he falls back on one of his favourite analogies to compare mechanical flight to that of

birds (cf. *Flesh and Machines* 158-59). Of course, birds and aeroplanes do not fly in quite the same way, but it makes no sense to say one does so more authentically than the other. Nor would it be fair to suggest, in absolute terms, that one kind of flight is better or worse than the other. Such an evaluation would be entirely contextual: "Well it depends on what you're trying to do," Brooks states. Applying this lesson to the ambiguous matter of artificial life, he remarks, "They're just different ways of living."

It is at this point that Brooks tells the viewer that his robots are prototypes toward entities that live in the same way as animals, following which he muses that they "may still be useful to us," just as a chicken in a chicken coop lays an egg everyday simply by doing what is in its nature. In the span of a minute or so, Brooks presages that the boundaries between living things and machines, animals and robots, might become meaningless but might yet remain, arguing that these entities signal ways of living that are at once different and potentially the same. To illustrate, he wrangles two representatives of animal life: a bird in flight and a cooped-up chicken. While his argumentation may be a tad wobbly, the vacillations at the edge of his vision do not indicate clumsy thinking so much as a fundamental indeterminacy at the heart of questioning after life. The roboticist's confrontation with the limits of these concepts cannot but result in recurrent equivocal shifts as those limits are traced, erased, and retraced with each address.

Yet another twist in this confusion lies in the film footage. As Brooks begins to speak about artificial creatures, the documentary cuts to a leashed bear cub being led through a series of somersaults on a balance beam. What does it mean to be invited to think of robotic creatures living the same way animals do at the same time we are shown

a circus animal going through a routine of tumbling tricks? As with the egg-laying chicken, there is an implication here that animal living is in many cases already artificial living, involving arts or techniques of existence that are then turned toward the caprice of human ends. Indeed, the ways in which a great many animals live in the contemporary world is subject to the ways we as humans frame their living.

What I find compelling in Brooks' comments is how they challenge a representational paradigm that seeks to evaluate the truth or reality of things in an epistemological sense. For Brooks, what is at stake is a matter of "doing." This makes things difficult for modes of critique rooted in representation and for a particular attitude or orientation captured under the term "modernity" that derives its ethics from an epistemological ontology, turning out moral imperatives from fixed and calculable forms of knowledge. To counter this, I wish to call upon what Andrew Pickering refers to as a performative ontology, in which an interpretation of the "real" focuses on processes and events, ways of becoming rather than states of being, where knowledge of something "depends on what you're trying to do." Pickering considers the unique manner in which cybernetics construes the notion of "design" according to such an ontology:

> If our usual notion of design entails the formulation of a plan which is then imposed upon matter, the cybernetic approach entailed instead a continuing interaction with materials, human and nonhuman, to explore what might be achieved—what one might call an *evolutionary* approach to design, that necessarily entailed a degree of *respect* for the other. (32; original italics)

From this perspective, design is both an aesthetic and an ethical consideration, where the nature of things is contingent upon what is being or may be done. Thus the respect

Pickering mentions comes from a sense of being "in the thick of things, plunged into a lively world that we cannot control and that will always surprise us" (382). If the artificial creatures Brooks builds have something to offer, it is this openness to the dynamic, material exigencies that call for different ways of living.

Boys and their toys

Pickering's notion of an "evolutionary approach to design" in cybernetics is interesting to consider in light of the explicit appeal Brooks makes to evolution as an inspiration for his own approach to robotic engineering. Evolution, "or an approximation thereof," stands for Brooks as a model to "recapitulate" in terms of an overall "design methodology" for building artificial creatures ("From Earwigs to Humans" 291). This recapitulation of evolutionary mechanics takes place on two levels, each of which encompasses a critique of traditional methodologies in AI as well as the field's anthropomorphism. At a disciplinary level, Brooks refers to evolution in order to legitimize his call for serious attention to ostensibly "primitive," animal-like forms of intelligence. On the level of the robots themselves, evolutionary accretion is hypostatized in what Brooks calls "subsumption architecture," where complex activity is built in "layers" from the most basic abilities, each successive layer introducing another twist in behaviour that inhibits or subsumes previous ones.

After the introductory polemic of "Intelligence without Representation," in which Brooks criticizes the delusions of GOFAI and its pipe dream of replicating human-level intelligence, the robot engineer casts his attention to what he says may prove an instructive reflection on the evolution of intelligence. In the space of a paragraph he moves from the single-cell organisms that "arose out of the primordial soup roughly 3.5

billion years ago," through to photosynthetic plants a billon years later, fish and vertebrates a billion and a half years after that, and then insects, which arose half-a-billion years ago. "Then things started moving fast," he states. Reptiles, dinosaurs, and mammals appear, followed by the first primates and, eventually, "Man . . . in roughly his present form" (141). The most recent arrival on the evolutionary scene, this creature stands only 2.5 million years young.[1] The cutting-edge accomplishments the human species—agriculture (at 19000 years old), writing (5000 years old), and "'expert' knowledge" (the product of the Renaissance and the Scientific Revolution)—are deliberately marginalized in the deep-time perspective Brooks employs here.

The conclusion Brooks draws from this marginalization of *Homo sapiens'* sapience in evolutionary terms recasts the problem of intelligence as a problem of life:

> This suggests that problem solving behavior, language, expert knowledge and application, and reason, are all pretty simple once the essence of being and reacting are available. That essence is the ability to move around in a dynamic environment, sensing the surroundings to a degree sufficient to achieve the necessary maintenance of life and reproduction. That part of intelligence is where evolution has concentrated its time—it is much harder. (141)

Mobility is evolution's most impressive technical feat, requiring "the luxury of incredibly long time scales and enormous numbers of individual experiments" to bring about (149). The hope is that, with his own careful engineering and experimentation, and in spite of his comparatively poor resources, he might emulate this feat, making artificial creatures

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1. It is curious that Brooks chooses to occlude the fact that the "Man" we ostensibly are, *homo sapiens sapiens*, is much younger even than this figure, originating about 200 000 years ago. 2.5 million years ago refers more correctly to the origination of the genus *homo* with *homo habilis*—a rough form of ourselves indeed.

that at least resemble the humblest exemplars of bare survival.

The moral of the story is the old canon of natural historians and biologists: *natura non facit saltum*, nature does not make leaps and bounds.[2] As any good evolutionary biologist would do, Brooks adopts a mode of thinking that involves an imbrication of the genealogical and the geological, attending to lineages and layers: "From an evolutionary stance, human level intelligence did not suddenly leap onto the scene. There were precursors and foundations throughout the lineage to humans. Much of this substrate is present in other animals today" ("Intelligence without Reason" 134-35). The AI practitioners afflicted by self-deception are those who do not heed this model of accretive development and attempt to achieve something that appears only after the fact of a slow sedimentation and stratification that always inherits and retains that which is most primordial. The AI practitioners who delude themselves are those beset by a highly modern, anthropocentric idea of what constitutes intelligent behaviour, fixated by what appears on the surface, and fooled into trying to raise something human-like authochthonously.

Their promethean hubris prompts them to look ahead to the most state-of-the-art model of the *anthropos*, forgetting its nonhuman elements in favour of those things most highly regarded by men of science:

> Judging by the projects chosen in the early days of AI, intelligence was thought to be best characterized as the things that highly educated male scientists found challenging. Projects included having a computer play chess, carry out integration problems that would be found in a college calculus course, prove

2. As Christopher Langton wryly counsels in the final sentences of "Artificial Life": "Above all, when in doubt, turn to Mother Nature. After all, she is smarter than you!" (93).

> mathematical theorems, and solve very complicated word algebra problems. (*Flesh and Machines* 36)

Such projects are characterized by high levels of abstraction and formalized rules and procedures. Despite the intellectual excitement afforded to a stereotypically masculine and scientifically minded community attracted to the challenges of puzzle-solving activities,[3] it is nevertheless the case for Brooks that "the semantics of these domains were fairly simple" ("Intelligence without Representation" 142). In the 1960s and 1970s, Brooks recalls, AI research began to delve into what is known as the "blocks world." Programming in the blocks world meant creating planning functions for sorting and stacking building blocks and other simple geometric shapes, whether in graphical simulation or through the efforts of an actual robotic arm linked to some form of vision system.[4] The idealized domain of this world "had a uniform and simple semantics," success hinging upon the ability to represent the world "completely and explicitly" with limited computational resources (142).

Brooks writes that the blocks world was eventually looked down upon as a "toy world" and that the economic pressures of funding "forced" researchers to "become relevant" in a commercial and industrial sense (142). In short, AI had to grow up and get a job, developing applications for route planning, medical diagnosis, expert systems, and other sorts of "intelligent assistants." Despite such attempts at relevancy, Brooks levels

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3. Thomas Kuhn, in *The Structure of Scientific Revolutions*, argues that "normal science," the incremental work of fact production in a particular field by way of experimentation and observation, is fundamentally a practice of "puzzle solving" (see esp. 35-42).

4. The most well-known blocks-world project is probably Terry Winograd's SHRDLU, which used a "natural English" textual interface for the user to issue commands for the manipulation of blocks as well as to query the AI on the status of its world. Winograd's dissertation was published in 1972 as *Understanding Natural Language*.

criticism at the state of the field for failing actually to move beyond the point of game playing, claiming that "most AI work is still done in the blocks world. Now the blocks have slightly different shapes and colors, but their underlying semantics have not changed greatly" (143). For Brooks, something puerile abides in the strong "lure of logic and reason," as he calls it (*Flesh and Machines* 26), a lure toward those forms of intelligence most at home in abstract and formal realms.

Ironically, this refusal to let go of the comforts of the "toy world" summarily ignored anything a small child could do spontaneously. The most habitual activities for typical four- or five-year-old children, "such as visually distinguishing between a coffee cup and a chair, or walking around on two legs, or finding their way from their bedroom to the living room were not thought of as activities requiring intelligence" (36). It would seem, however, that these quotidian abilities, expressed here as domestic and domesticated child's play, are in fact the more difficult problems. Part of the difficulty has to do with the near invisibility of these processes to reasoned introspection and conscious decomposition into step-by-step procedures: "Seeing, walking, navigation . . . do not usually take explicit thought, or chains of thought-out reasoning. They just happen" (36-37). At least, they appear just to happen, the technicity of a living being's autonomous locomotion residing in a space quite outside the purview of an epistemological framework shaped by subjects who define themselves by their own self-possession, capacity for rational self-reflection, and freedom of movement. This technicity is embedded in the body and the body's concrete situation within, and intimate coupling with, the material world, a relation resistant to a tradition of modern thought characterized by a profound suspicion of matter and the body.

Realizing an intelligence without representation means for Brooks a paleontological uncovering of the material substrata covered over by the symbolic reasoning privileged in modern scientific thought. He therefore turns to the principles of situatedness and embodiment, which he defines perhaps most lucidly in *Flesh and Machines*:

> A *situated* creature or robot is one that is embedded in the world, and which does not deal with abstract descriptions, but through its sensors with the here and now of the world, which directly influences the behavior of the creature.
>
> An *embodied* creature or robot is one that has a physical body and experiences the world, at least in part, directly through the influence of the world on that body. (51-52; original italics; cf. "Intelligence without Reason" 138)

The coupling of situatedness and embodiment entails an immanence to the world that *grounds* the behaviour of his robotic creatures, whose lively intelligence emerges, from the bottom up, out of the dynamics of this physical grounding. For Brooks, such an emergence helps ensure an injunction to realism that counters the traditional approach, lodged as it is in a world of toys and games: "At each step we should build complete intelligent systems that we let loose in the real world with real sensing and real action. Anything less provides a candidate with which we can delude ourselves" ("Intelligence without Representation" 140).

Subsumption architecture

> We hypothesize . . . that much of even human level activity is . . . a reflection of the world through very simple mechanisms without detailed representations.
>
> —RODNEY BROOKS, "Intelligence without Representation," 149

The theory of evolution turns into concrete engineering practice in the structural design of Brooks' creatures. Their hardware hypostatizes a the notion of accumulative or accretive development, starting from the fundamentals of sensing and acting to build incrementally toward more complex capabilities. He lays out the logic of this analogy most lucidly in Morris' documentary:

> All along, we've been inspired by an evolutionary analogy: that inside the human brain is a reptile brain, and inside the reptile brain is a fish brain. Evolution didn't just pop out with a person fully formed. We've had that same idea in building our robots. Let it do simple stuff, like move about, then add some more complexity to it, so it would move about without hitting things. Then add some more complexity to it, so it could go find a soda can. But the idea is not to go back and change the earlier pieces, but to have the earlier pieces run in parallel. To an observer, it appears as though the robot has intentions and goals . . . but it's just the interaction of lots and lots of much simpler processes.

The model of evolution Brooks uses to draw his analogy is a retrospective one that traces the history of extant life forms as a proof-of-concept for speculative ones. As such, he adopts a progressivism that assumes something humanlike as the inarguable *telos* of robotics. At the same time, however, the focus is decidedly non-anthropomorphic. Brooks' approach, which comes at AI from an ethological rather than a humanistic direction, strips intelligent, lively behaviour of explicit intentionality and purpose.

Behaviour is instead conceived as the effect of many simultaneous, low-level interactions between creature and world having to do with mobility and reactivity.

This evolutionary approach to design takes shape in the parallel layers of what Brooks calls "subsumption architecture," in which a robot's "activity producing subsystems" constitute various "layers" that decompose behaviour into multiple tasks ("Intelligence without Representation" 150-54). Each layer is discrete and works in parallel with the others; there is no central mechanism that controls the system globally.[5] The interface between layers allows those at a "higher" level to override the others should conflicts arise, but his creatures are ultimately acephalic,[6] a multiplicity of peripheral systems whose unity is an illusion projected by a human onlooker:

> Each activity-producing layer connects perception to action directly. It is only the observer of the Creature who imputes a central representation or central control. The Creature itself has none; it is a collection of competing behaviors. Out of the local chaos of their interactions there emerges, in the eye of an observer, a coherent pattern of behavior. There is no central purposeful locus of control. (148-49)

In this abandonment of central decision-making and command, the "intelligent" actions of the creature are simply what emerge out of the conflict of its parallel subsystems as they respond to the environment. Its behaviour persuades an observer to misrecognize

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5. Brooks' subsumption architecture was inspired in no small way by Marvin Minsky's society of mind theory, which the latter outlines in *The Society of Mind*.

6. Hayles notes how Canadian roboticist Mark Tilden, a follower of Brooks,

> was struck by how chickens ran around after their heads had been cut off, performing, as he likes to put it, complicated navigational tasks in three-dimensional space without any cortex at all. He decided that considerable computation had to be going on in the peripheral nervous system. He used the insight to design insectlike robots that operate on nervous nets. (237)

something coherent or purposeful in the way its largely unmediated relation to the world plays out.

Brooks writes, "When we examine very simple level intelligence we find that explicit representations and models of the world simply get in the way" ("Intelligence without Representation" 140). On this account, the most notable mobile robots from the 1970s and 1980s—Shakey at the Stanford Research Institute, the Cart at Stanford University, and Hilare at the Laboratoire d'Analyse et d'Architecture des Systèmes in Toulouse—amount to little more than brilliant failures in the quest for an artificial creature (see "Intelligence without Reason" 136-37; *Flesh and Machines* 22-31). None of these machines were self-contained. Instead, they all relied on radio uplinks to the mainframes of their respective institutions in order to make use of "the largest most powerful computers available at the time and place" ("Intelligence without Reason" 136). These powerful processors translated sensory data into two- or three-dimensional models of the environment that then served as the basis for planning each robot's route according to whatever goals it may have been given. In the case of each robot, Brooks notes, the planning function would "*ignore the actual world*, and operate *in the model* to produce a plan of action" ("Intelligence without Reason" 136; my italics).

These projects all abstracted the worldly "here and now" within which living beings move as a matter of (largely) unreflective reactivity. Such an abstraction of animal embodiment and situatedness turned mobility into a problem of logistical puzzle-solving or game-playing: Shakey, the CART, and Hilare all "used reasoning in situations where animals have direct links from perception to action" (*Flesh and Machines* 23). The emphasis placed on reasoning made for systems that lacked lifelike spontaneity.

Each robot moved forward in slow, periodic lurches as it would sense the surroundings, radio the sensory data to the mainframe to update its world model and plan a collision-free path, move forward a little, and begin sensing again. Due to the lag in response and the processing power needed to compile the navigation data, all of these robots demanded "mostly static" and "specially engineered" environments to ameliorate the effect of miscalculations and other confusions ("Intelligence without Reason" 136).[7] In spite of contrived conditions and the most powerful available computers, "all these robots operated excruciatingly slowly" (137). In a certain sense, the more "human" the approach to mobility, the more mechanical the outcome.

For Brooks, representation makes for "brittle" systems that break down once they move outside the abstract and idealized environments constructed to conform to the robot's capabilities.[8] By contrast, he insists that an artificial creature "must cope appropriately and in a timely fashion with changes in its dynamic environment" ("Intelligence without Representation" 145). Because his behaviour-based approach connects sensors and effectors without the mediation of a central system of

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7. In *Flesh and Machines*, Brooks relates an adventure a late model of the CART experienced at the hands of Hans Moravec, with some assistance from himself. This iteration of the robot calculated its movements against a 3D model it generated using a convoluted camera system that relayed visual data to the shared mainframe at the Stanford Artificial Intelligence Laboratory. Because of the time it needed to calculate the visual data and update its world model, it only was able to "lurch" forward about one meter every fifteen minutes. One Saturday afternoon, after securing dedicated use of the mainframe for several hours, they attempted to run the machine outdoors. Because the interval between observations was so protracted, they found that it was severely confused even by shadows on the ground as they moved with the shifting angle of the sun (*Flesh and Machines* 28-30).

8. In Brooks' rhetoric, the brittleness of representation carries potentially dangerous consequences:

> For example, MYCIN is an expert at diagnosing human bacterial infections, but it really has no model of what a human (or any living creature) is or how they work, or what are plausible things to happen to a human. If told that the aorta is ruptured and the patient is losing blood at the rate of a pint every minute, MYCIN will try to find a bacterial cause of the problem. ("Intelligence without Representation" 143)

Why someone would consult a program that diagnoses infectious blood diseases in order to treat an aortal rupture is anybody's guess, though obviously beside the point from the standpoint of the argumentative effect Brooks seeks here.

representational modelling or symbolic manipulation, his robots are ideally able to handle unforeseen circumstances in a way that ensures continuing activity: "Low-level simple activities can instill the Creature with reactions to dangerous or important changes in the environment. . . . By having multiple parallel activities, and by removing the idea of a central representation, there is less chance that any given change in . . . the world can cause total collapse of the system" (148). Such a system is flexible and adaptive, the allusion to danger evoking once again the notion of creaturely survival at the base of Brooks' methodological concerns.

The lack of mediation between perception and action frees the creature by allowing for a degree of errancy: "By not trying to have an analogous model of the world, centrally located in the system, we are less likely to have built in a dependence on that model being completely accurate" (148). Instead, a nonrepresentative real takes the place of an abstract internal model: "It turns out to be better to use the world as its own model" (140). Elsewhere he writes, "We take this idea even further and often actually use the world as the communication medium between distributed parts of the subsumption programme" ("Fast, Cheap, and Out of Control" 479). The world is an integral part of the creature's software and a material component of its hardware. Its embodiment and situatedness make it dependent upon environmental contingencies to govern its behaviour: "To a large extent the state of the world that determines the action of the Creature" ("Intelligence without Representation" 149). In the intense cybernetic gathering of creature and world, behaviour becomes an effect of relations of exteriority rather than the determinate result of a preceding intentionality.

Brooks suggests that behavioural complexity is not "necessarily inherent in the

complexity of the creature, but perhaps in the complexity of the environment" (149). The implication this carries for his engineering practice he best expresses in Morris' documentary with a sort of geek mysticism: "Sometimes I feel a little like Yoda. I have to say, sort of, 'just feel the force.' Don't try and control the robot, but feel how the world is going to control the robot." Despite the glib reference to *Star Wars*, this statement reveals both the aesthetic and evolutionary aspects of Brooks' style of robotic engineering, a kind of design that is about open-ended adaptation. There is a sense here in which the engineer must intuit how the dynamic relations between his creatures and the noisy milieux they might wander into can be decomposed and recomposed to engender something lively. This liveliness, moreover, has to do with feeling rather than understanding or knowledge. Brooks' creatures, with their direct links of sensors and actuators, are stripped of any mediating calculations or symbolic reasoning, and therefore never "know" what is happening, where they are, or what they are doing. They are "swimming in a sea of uncertainty" (*Flesh and Machines* 54).

Tiziana Terranova calls this "sea of uncertainty" that Brooks' robots inhabit a heterogeneous "informational space" whose fluidity derives from the "huge information flows generated by even the most simple environment" (Terranova 37). This should not be confused with what N. Katherine Hayles calls the "computational universe," whose ground is an essentially representational metaphysic that takes computation as the paradigm according to which all natural phenomena manifest. Terranova does not consider space to be informational, she is careful to point out, "when it is computed by a machine." On the contrary, such a space resists calculative computation; it overflows observation, knowledge, and causal deduction:

> Space, that is, does not really need computers to be informational even as computers make us aware of the informational dimension as such. An informational space is inherently immersive, excessive and dynamic: one cannot simply observe it, but becomes almost unwittingly overpowered by it. It is not so much a three-dimensional, perspectival space where subjects carry out actions and relate to one another, but a field of displacements, mutations and movements that do not support the actions of a subject, but decompose it, recompose it and carry it along. (37)

Such a space necessitates an evolutionary approach to design. In order to ensure that a system remains robust and maximally flexible in its interactions with the environment, it must be able to accommodate the unforeseen, allowing itself to be "carried along" rather than strictly controlled.

One of the defiant mottos Brooks uses to describe his approach to robot-building is "fast, cheap, and out of control," which served as the title for an important article he co-authored with Anita Flynn in 1989, and which Morris adopted for the title of his documentary. Despite the "local chaos" ("Intelligence without Representation" 149) that is vital to his creatures' emergent behaviour, Brooks' relinquishment of control is not an advocacy for chaos *tout court*: "Note carefully that we are not claiming that chaos is a necessary ingredient of intelligent behavior. Indeed, we advocate careful engineering of all the interactions within the system (evolution had the luxury of incredibly long time scales and enormous numbers of individual experiments and thus perhaps was able to do without this careful engineering)" (149). The analogy to evolution stops at the timescale of the individual researcher, limited by his lifespan and, much more pressingly, the

exigencies of institutional funding cycles. Careful engineering (as opposed to evolution's luxurious, aleatory engendering) is required at the outset, followed by an extensive process of testing and debugging. A process of artificial selection takes place as the creatures are versioned, tested, and retested: the cornerstone of digital husbandry.

As Terranova points out, "Being out of control does not mean being beyond control" (Terranova 114). It is a question of what she calls "soft control." There is indeed careful planning and design, but the fluidity of emergent processes within a field of mutation means that any control one has comes only at the beginning: "Since planning is confined to the initial conditions, preferred outcomes can only be hoped for rather than counted on" (108). This mode of control is oblique, a tweak to the conditions and constraints under which something takes place that opens a "site of a *reinvention* of life" (37; original italics). This reinvention must be sought after experimentally rather than programmatically, in response to the unforeseen rather than its outright prevention. The soft control Brooks has to feel out, Yoda-style, in the immersive, excessive, dynamic interactions between his creatures and their milieux creates a breeding ground for surprise, where a subject, human or otherwise, is overtaken by the field of relations through which and in which it is composed and animated.

Overanthropomorphization

> The expression 'anthropomorphic' considerably underestimates our humanity. We should be talking about morphism. Morphism is the place where technomorphisms, zoomorphisms, phusimorphisms, ideomorphisms, theomorphisms, sociomorphisms, psychomorphisms, all come together. Their alliances and their exchanges, taken together, are what define the anthropos. A weaver of morphisms—isn't that enough of a definition?
>
> —BRUNO LATOUR, *We Have Never Been Modern*, 137

Always more than the sum of their parts, both life and intelligence continually surprise in their unexpected excesses. There is a fluidity and porousness to life and intelligence that is important to consider in theorizing the import of Artificial Intelligence, Artificial Life, and robotics toward a nonhuman pedagogy and an eco-philosophical ethics. Philosopher of cognitive science Andy Clark argues that the sort of intelligence Brooks instantiates in his robots points to a distributed model of intelligent life. Clark argues that intelligence is not located within the interior of a thinking or sentient being, but instead is diffused among the material elements of the environment in which that being is embedded.

Extending this inference to human beings stirs something troublesome for our understanding of the origin of subjectivity: namely, that our thinking may be a by-product of our environment, which, for good and bad, our technologies and techniques are capable of decomposing and recomposing, organizing and reorganizing, engineering and reengineering, at various scales and with various levels of complexity. Idiocy thus becomes the key to the evolutionary design of human living: "We use intelligence to structure the environment so that we can succeed with less intelligence," Clark writes. "Our brains make the world smart so that we can be dumb in peace!" (180). We are an afterthought of ourselves and of the world we inhabit, not the direct object of our own subjective production and reproduction. Clark's exclamatory claim about the

organizational power of human brains just looking for a little down time has its uncanny flip side in the sensation that the intelligent environment those brains have made is taking on a life of its own.

The more far-reaching philosophical implications Brooks draws from his evolutionary framework have to do with a deracination of the humanist subject's conception of itself as self-possessed and self-knowing. Since intelligence is something that emerges from embodied and situated relations of provocation and response between mobile creatures and their informational habitat, the appearance of goals and intentions, might simply be an aggregate of so many tropisms and feedback processes. In *Fast, Cheap, and Out of Control*, between over-saturated archival clips of insectile robots taking tentative steps around laboratory rooms, Brooks posits that the model of intelligence his subsumption architecture provides

> certainly looks good enough to explain insect-type behaviour. Now the sort of more radical hypothesis is: maybe that's all there is. Maybe a lot of what humans are doing could be explained this way. After all, humans have evolved from simpler systems over time. When I think about it, I can almost see myself as being made up of thousands and thousands of little agents, doing stuff almost independently. But at the same time, I fall back into believing the things about humans we all believe about humans, and living life that way. Otherwise, I think, if you analyze it too much, life becomes, almost meaningless.

As Brooks begins to speak about the beliefs about humans he "falls back into," the visuals shift to grainy, black-and-white footage in which he arrives at a lab party to the delight of grad students and colleagues. Even as his words cease, the film continues on

with a montage of cake-eating festivities and genial fraternizing, shot in lingering slow-motion to the accompaniment of a pensive score of strings and woodwinds. There is a dreamy, distant quality to this sequence that contrasts with the crisp close-ups of Brooks and the colourful images of gangly robots that precede it, a contrast that lends an unreal quality to the more meaningful ways we humans understand and live with ourselves. Morris' filmmaking suggests that to believe that the way we live life is radically different in kind from the insects Brooks' robots resemble so closely may be a sign of nostalgic longing rather than true conviction.

Even if most humans are capable of more complexity than insect-type behaviour, this does not at all guarantee a position as the pinnacle of evolutionary development. Indeed, Brooks himself points out that modelling an engineering paradigm after evolution contains a potential pitfall in that nature's design practice does not modify biological systems toward the ends of their optimization: "Rather they were patched together and adapted from previously working systems, in ways which most expeditiously met the latest environmental pressures" ("Intelligence without Reason" 135). Contingency and compensation are the name of the game in biological evolution, which has awkward consequences for thinking about the constitution of intelligence: "Perhaps the solutions found for much of intelligence are terribly suboptimal. Certainly there are many vestigial structures surviving within humans' and other animals' digestive, skeletal, and muscular systems. One should suppose then that there are many vestigial neurological structures, interactions, and side effects" (135). What fossilized vestiges of our biological inheritance keep us knowers unknown to ourselves, despite our reason? What does it mean, and what is at stake, when human cogitation, the metaphysical basis for the being

of the subject in modernity, is recognized to be merely an expedient patch-job of evolutionary variance and selection?

Brooks indicts us all for our tendency to "overanthropomorphize" ourselves, alleging that we "attribute too much to what people are doing" (D'Aluzio and Menzel 58). For Brooks, unified consciousness, the appearance of goals and intentions, is a "cheap trick" that enters late in Earth's history. "My feeling," he writes, "is that thought and consciousness are epiphenomena of the process of being in the world" ("Intelligence without Reason" 184). What modern humanism institutes as the central attributes properly peculiar to humankind are instead what comes after-the-fact of innumerable communicative processes, working more or less independently, through which the perceptions of situated and embodied beings are organized into concrete actions. In our privilege of rational intelligence as the intentional root of our behaviour, we mistake an effect of our interactivity with the world for the cause.

I find the overanthropomorphization of human life Brooks arraigns us all for, himself included, to resonate broadly with what Derrida questions, in *The Animal That Therefore I Am*, as the "auto-biography of man." Derrida points out that humanity is a species that has granted itself the authority to name itself, to recount its own history to itself, to identify and delineate its own bounds. Humankind therefore appears through the logic of the *autos*, as an "auto-definition," an "auto-apprehension," an "auto-situation" (24). By this self-positioning, the human also gives itself the authority and the right to subsume the multitude of nonhuman life forms under the general category of "animals" or the singular concept of "the animal." This blanket naming places humans and nonhuman animals on opposite sides of an abyss, tracing an indivisible limit between

them. In his deconstruction of this self-sanctioned naming and boundary drawing, Derrida does not wish to endorse the notion of a simple continuity—biological or otherwise—between humans and animals. Rather, he is concerned with the maintenance and multiplication of difference:

> Beyond the edge of the *so-called* human, beyond it but by no means on a single opposing side, rather than "The Animal" or "Animal Life" there is already a heterogeneous multiplicity of the living, or more precisely (since to say "the living" is already to say too much or not enough), a multiplicity of organization of relations between living and dead, relations of organization or lack of organization among realms that are more and more difficult to dissociate by means of the figures of the organic and inorganic, of life and/or death. (31)

The boundary between the human and the animal describes not a single, uniform opposition, but a plurality of disruptions. So too the fuzzy boundary between the living and the nonliving, which is difficult to discern because of the heterogenous relations between species of life and species of nonlife.

The philosophical, ethical, and political danger of the autobiography of the human species lies in its erasure of difference in multiplicity in favour of monumental antitheses and the restriction of communicability:

> Autobiography, the writing of the self as living, the trace of the living for itself, being for itself, the auto-affection or auto-infection as memory or archive of the living, would be an immunizing movement . . . but an immunizing movement that is always threatened with becoming auto-immunizing, like every *autos*, every ipseity, every automatic, automobile, autonomous, auto-referential movement.

> Nothing risks becoming more poisonous than an autobiography, poisonous for oneself in the first place, auto-infectious for the presumed signatory who is so auto-affected. (47)

The risk to the human species of such auto-ism is not only an autistic withdrawal from the world of nonhuman beings, but a solipsistic closure to and attack upon the manifestations of its own nonhuman aspects. We are threatened by the immuno-logics of our own autobiographism. Without a renewed understanding of life as a collective, multiple phenomenon, emergent from the dynamics of an interactive and interdependent environment, we risk succumbing to the inertia of our own overanthropomorphization.

PART 2

Chapter 3

Steering to other ends;
or,
Modern encounters

In question

> On the other hand, it is plausible that we as engineers may be able to come up with something cleverer than evolution was able to do . . .
>
> —RODNEY BROOKS, *Flesh and Machines*, 155

The central theme of *Flesh and Machines* is the "merger" of bodies and technology that Brooks repeatedly claims will change not only "the fundamental nature of our society" but also "the fundamental nature of us" (11). This merger will take place at the point where the "irreversible journey of technological manipulation of our bodies" (ix) and the "quest for an artificial creature" (12) cross, where the robotics and biotechnology revolutions he predicts spin headlong into one another. Not wanting his discussion to appear derivative of so many arguments, both popular and academic, about our intimacy with technology, Brooks asserts with a section heading that what he is speaking about goes "beyond cyborgs," beyond prostheses and augmentations—wearable computers, cochlear and retinal implants, subdermal microchips, pacemakers, and so on—toward a more radical merger by way of "engineered biotechnology" (233).

Brooks illustrates an initial stage of this post-cyborg merger with reference to work being done on artificial limbs by Hugh Herr, a double-leg amputee who, at the time Brooks was writing *Flesh and Machines*, was cross-appointed with Harvard Medical

School and the MIT AI Lab.[1] Not satisfied with even the most advanced servo-mechanical prostheses, Herr and his students began to investigate the potential use of organic muscles to drive replacement limbs. To this end, they grew mouse muscles in vitro, to which they wired a microprocessor in a "marriage of silicon and steel with biological matter" (233). Through this marriage they have conceived tiny "robots" that swim around in a nourishing glucose solution, the microprocessor coordinating command signals in order to "innervate the biological but artificial muscles" (233). For Brooks, going "beyond cyborgs" is thus about ever-more intricate qualifications that render an entity biological but artificial—and vice versa. It is about the increasing scope and depth of what he elsewhere calls "invited bodily invasions" ("Technology's Elder Boom" 32), which effect increasingly penetrative innervations of the animal by the inanimate.

At its most far-reaching, the crossover of biotechnology and robotics bleeds into a fairly commonplace fantasy of genetic engineering in which "We will have the keys to our own existence. . . . We will be taking over from ourselves with manipulable body plans and capabilities easily able to match those of any robot" (236). It is in this sense that he contends that "there won't be any us (people) for them (pure robots) to take over from" (ix). But the posthuman coup d'état Brooks imagines is no straightforward repudiation of the human, a simple reduction of embodied subjects to the status of machines and their subjection to a relentless technical logic. Despite his criticisms of the various arguments, assumptions, opinions, and feelings by which we "overanthropomorphize" ourselves in an attempt to hold on to our "tribal specialness"

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1. Herr currently holds a joint appointment with MIT's Media Arts and Science Program and the Harvard-MIT Division of Health Sciences and Technology. He is also director of the Biomechatronics Group at the MIT Media Lab.

relative to other living things and intelligent machines (175), at the heart of his thinking there nevertheless abides an anthropocentrism that speaks to intensified values of possessive individualism and mastery over the material world, with the organic body arguably the privileged target of that mastery. Brooks' arguments suggest that, even if our destiny is to become not quite human, and that of our robots, to become not quite machines, as long as engineers can be more clever than evolution, perhaps we may yet still be Man.

Over the next two chapters, I wish to interrogate the ontological, ethical, and political implications of this high-tech remediation of the modern liberal humanist subject, which I believe not only to be expressed in Brooks' thinking, but to be part and parcel of the popular imaginary surrounding the promises held out by Artificial Intelligence, Artificial Life, and biotechnology more generally. In this chapter, I flesh out a conception of the modern attitude through a reading of key moments in Martin Heidegger's and Bernard Stiegler's philosophies of technology. In the chapter that follows, I interrogate how Brooks' predictions about the future of biotechnology and robotic technology speak to a neoliberal economy of human capital, with its attendant structural logics of optimization and immunity.

The broad stakes in these chapters have to do with theorizing the role of technoscientific practice in contemporary biopolitics, where engineering life and ways of living become a matter of managing populations of embodied human subjects. In a famous passage near the end of the first volume of *The History of Sexuality*, Michel Foucault writes that "what may be called a society's 'threshold of modernity' has been reached when the life of the species is wagered on its own political strategies" (143). The

modern *ēthos* or attitude thrusts the human beyond its Aristotelian definition as a *zoon politikon*; instead, "modern man is an animal whose politics places his existence as a living being in question" (143). Foucault would likely be the first to say that societies across the globe have not only reached, but thoroughly breached this threshold in innumerable ways, and that modern politics has long wagered far more than the life of a single species, even in those places where the gamble has already been lost. Our frightful inertia is perhaps most patent in the sense that we continue to respond to the challenge of how to live in the world with largely the same attitude as we have for the past two centuries. The ecological crises that threaten humans and nonhumans, organic and inorganic entities alike, when they are not outright neglected, most often elicit thoughts and feelings that draw on assumptions of our own sovereignty of will, and prompt actions and behaviours derived from models of the human subject that presuppose its ability to direct, from a place of detached privilege, the course of its natural, cultural, and technological environments.

That our existence as living beings has been placed in question is certainly clear in cybernetics and its descendants. At the heart of cybernetic theory there is a radical displacement of the human subject with regard to its autonomy and self-possession. At the same time, cybernetics remains, as its Latinate cognate suggests, a science of *governance*. It is, moreover, a science that theorizes the technological governance of life. The very natural way in which Brooks is able to cross the narratives of robotics engineering and biotechnology indicates an affinity that derives from their common roots in cybernetics and communications theory. Addressing this affinity, Haraway writes:

Communications technologies and biotechnologies are the crucial tools recrafting

> our bodies. . . . Furthermore, communications sciences and modern biologies are constructed by a common move—the translation of the world into a problem of coding, a search for a common language in which all resistance to instrumental control disappears and all heterogeneity can be submitted to disassembly, reassembly, investment, and exchange. (*Simians, Cyborgs, and Women* 164)

It goes without saying that the translation of the world into a coding problem threatens human values, especially as it subverts the integrity of the human subject, now permeated down to its most basic elements by (calculable) flows of information. From a different perspective, however, humanism is not at all threatened in the cybernetic paradigm, but is instead carried to its most consummate end.

Gathering

> It isn't German philosophy. . . . It is based purely on engineering considerations.
> —RODNEY BROOKS, "Intelligence without Representation," 155

> SPIEGEL: And what takes the place of philosophy now?
> HEIDEGGER: Cybernetics.
> —MARTIN HEIDEGGER, "Der Spiegel Interview," 58-59

For Martin Heidegger, cybernetics heralds the end of philosophy, as he suggests in "The End of Philosophy and the Task of Thinking." He does not mean this, he is careful to say, "in the negative sense as a mere stopping, as the lack of continuation, perhaps even as decline and impotence" (56). On the contrary, he means it in the sense of a fulfillment or "completion": "As a completion, an end is the gathering into the most extreme possibilities" (57). Philosophy—which is to say, Western metaphysics beginning more or less with Plato—is characterized by representational thought that seeks to "give

reasons" for the presence of beings. It grounds entities in a certain epistemology of causation and objectivity, "where beings are such as they are in their becoming, perishing, and persisting as something that can be known, handled and worked upon" (56). With modernity, this *scientia* becomes a mode of thought entirely divorced from metaphysical questioning. At this point, Heidegger writes, "Philosophy turns into the empirical science of man, of all of what can become the experiential object of his technology for man, the technology by which he establishes himself in the world by working on it in the manifold modes of making and shaping" (57). Any thinking about the world becomes a generalized anthropology, attuned to nonhuman entities only to the extent that they represent a series of manipulable objects. Knowledge characterized in the first instance by calculation, operability, and objective representation comes to dominate in "a world civilization based on Western European thinking" (59). In this globalized Occident, whose future holds either abrupt destruction or restless stability under a regime of permanent innovation, the implication of technoscientific endeavour and industrial concern becomes "the sole criterion of man's world sojourn" (60).

Composing this lecture in the early 1960s, it seemed to Heidegger that, through such technoscientific "modes of making and shaping," the industrialized world would "soon be determined and guided by the new fundamental science which is called cybernetics" (58). For him, cybernetics is *fundamental*, the new ground of the independent sciences, because it "corresponds to the determination of man as an acting social being. For it is the theory of the steering of the possible planning and arrangement of human labor" (58). This extends to the twenty-first century and what has become for us in the West a society defined in large part by the economics of neoliberalism. The

objectivity of the world and its inhabitants has been secured in the interests of human societies governed by accelerating cycles of production. Philosophy comes to its end with "the scientific attitude of socially active humanity," where "the fundamental characteristic of this scientific attitude is its cybernetic, that is, technological character" (58). As the things of the world become known solely as raw material for the ongoing production and reproduction of human life, social activity can become only technological. Human labour only feeds back into itself, having no other end than to produce its own productivity. All making and shaping now becomes a making and shaping of the human on the model of the Western humanist subject, a hermetical cycle that engineers Man as the sovereign engineer of himself.

This is why Heidegger calls our everyday understanding of technology as a means to an end both an "instrumental" and "anthropological" conception. In his well-known essay, "The Question Concerning Technology," he explains that the foremost concern of this conception has to do with the constitution of a morality whose core is the human mastery of technology:

> [T]he instrumental conception of technology conditions every attempt to bring man into the right relation to technology. Everything depends on our manipulating technology in the proper manner as a means. We will, as we say, "get" technology "spiritually in hand." We will master it. The will to mastery becomes all the more urgent the more technology threatens to slip from human control. (*The Question Concerning Technology* 5)

Far from securing the sovereignty of the human subject, Heidegger suggests that the instrumental-anthropological conception of technology casts mastery as a constant

problem. Humanity's full grasp of its own inventions remains always deferred, the will to mastery structured by the very impossibility of definitive mastery. Moreover, our state of relentless innovation repeatedly and urgently throws into relief this deficit of mastery, making the question of our "proper" relation to technology a constant problem.

Heidegger notoriously argues that the "essence" of technology is "by no means anything technological" (4). What he means by this is simply that an interpretation of technology and technical practice must go beyond a discussion of instrumentality because there is much more to the story than the morality of means and ends. Instead, he suggests that technology involves a "mode of revealing," a "bringing-forth" or "unconcealment" that makes things present themselves meaningfully (13). The essence of technology resides in the way the world is disclosed and known to us; it frames or scaffolds our understanding of the innumerable beings that surround us.

Heidegger names this revelatory essence of modern technology *Ge-stell*, which is most often translated "Enframing" or "the framework," though it has also been rendered as a "construct" and even an "emplacement."[2] As he often does, Heidegger repurposes this fairly common German word to sound out specific meanings held within the accretions of language. He tells the reader that, ordinarily, *Gestell* "means some kind of apparatus, e.g., a bookrack" (22). This sense extends to other sorts of architectural "frames," such as the frame of a house or the chassis of a car. But there is also a sinister quality that Heidegger sounds out from this word. "*Gestell* is also the name for a

2. Because I do not wish to limit the sense of *Ge-stell* as a concept, I have chosen to retain it in the German throughout, substituting for its translations in the quotations I cite. Of course, Heidegger's intention to use a common word in an "eerie" way is lost through this decision. It is nevertheless the case that he intends to interrogate the essence of technology such that it is made to appear in an unfamiliar way, which is what I wish to emphasize in my own discussion.

skeleton," he writes, adding, "the employment of the word *Ge-stell* that is now required of us seems equally eerie" (22).[3] Oddly enough, given his usual propensity for exhausting the potentials of language, Heidegger buries the skeleton residing in the essence of technology as soon as he evokes it. Nevertheless, Heidegger's interrogation of our relation to technology through *Ge-stell* reveals an unsettling quality that is, for him, the inner frame of the modern age.

What Heidegger wishes the reader to hear in the word *Ge-stell* is at once the notion of gathering or assembling in the prefix *ge-*, as well as the host of uses for the verb *stellen*, which can mean to set or place, to provide or supply, and to challenge or engage.[4] Under the purview of *Ge-stell*, whatever we encounter is gathered together and set in order in terms of the "challenging claim" that "calls" humankind to engage a particular mode of revealing that establishes the natural world as a storehouse of energies that can be unlocked, distributed, and "switched about" within a productive network (16). The things of nature appear to us as resources to be expedited and refined; the world is a reserve of raw materials, the beginning point in a cycle of human consumption. Everything is put in order in such a way that it is on "stand by," a stockpile of energy always at the ready, which Heidegger calls the "standing-reserve" (*Bestand*).

The standing-reserve ensues in a relentless operability that denudes all that is of any other substantive meaning. "Everything functions. That is exactly what is uncanny. Everything functions and the functioning drives us further and further to more

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3. Incidentally, *Gestell* is also a slang term for a skinny person, in the same way, I suppose, that an English speaker might say someone is "skin and bones."

4. See the translator's note on *stellen* and the decision to translate it with "to set upon" (*The Question* 15n14).

functioning, and technology tears people away and uproots them from the earth more and more" ("Der Spiegel Interview" 55). As this deracination broadens to a global scale and we grow paradoxically more rooted in our abstract role of measuring and ordering, we are increasingly endangered by the seeming inability for us *not* to intervene, *not* to leave the marks of our own handiwork upon the world around us. If one day we achieve the fabulous world of tomorrow promised in our most extreme technological fantasies, if a posthuman singularity frees us from the burden of all our physical and spiritual sufferings, as the likes of Ray Kurzweil and Hans Moravec promise, it will nevertheless be the result of an "injurious neglect" (Heidegger, *The Question* 48), an irresponsible lack of concern for all that is not human in the interests of the abstract functioning of human culture.[5]

As this "will to technology," as Arthur Kroker calls it, compels us down a path to which it is exceedingly difficult to see alternatives, we are increasingly exposed to what Heidegger calls the "supreme danger":

> As soon as what is unconcealed no longer concerns man even as object, but does so, rather, exclusively as standing-reserve, and man in the midst of objectlessness is nothing but the orderer of the standing reserve, then he comes to the very brink

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5. Throughout Kurzweil's writing, for instance, he suggests that we as humans are grievously disabled physically, intellectually, sexually, and spiritually. The human transcendence from biology would rectify all these impairments. He thus speaks excitedly about "the effective end of handicaps," claiming that "Intelligent technology has become the great leveler" (*The Age of Spiritual Machines* 178; 193). These utopian conceits easily slip into a language of domination, as Kurzweil asserts the ultimate sovereignty of humankind in the universe. By way of the "anthropic principle" to which he ascribes (*The Singularity Is Near*, 359-64), he understands the universe as something that exists for our own sake, despite a history of science that has largely displaced the great chain of being. Kurzweil maintains a belief in intelligence "as the most important phenomenon in the universe," giving privilege, as one might expect, to humankind as the pinnacle of earthly beings. And, because we have yet to find any communities of respectable intelligence anywhere else in the universe, our civilization is, quite obviously and quite simply, "The community that matters" (362). "[I]t turns out that we are central, after all" he writes, and it is our technologies that will allow us to evolve "until the universe is at our fingertips" (487).

> of a precipitous fall; that is, he comes to the point where he himself will have to be taken as standing-reserve. Meanwhile man, precisely as the one so threatened, exalts himself to the posture of lord of the earth. In this way the impression comes to prevail that everything man encounters exists only insofar as it is his construct. This illusion gives rise to one final delusion: It seems as though man everywhere and always encounters only himself. (*The Question* 27)

The desperate urgency of humankind to assert its mastery over the nonhuman world and to see thereupon the imprint of its will is a panic response to its own subjection to the essence of technology. To an apocalyptic theorist like Kroker, Heidegger's work reads as a desperate warning against an anthropophagic techno-fascism in line with millennial cyberpunk narratives like *The Matrix*. As *Ge-stell* comes to dominate both subject-object and intersubjective relations, such a reading admonishes, the human becomes little more than a "support-system for technicity" (Kroker 49), its self-engineering directed toward invigorating the ontological framework that assures its own disappearance.

But is it the *disappearance* of the human that is the supreme danger of our technocultural framework? On the contrary, Heidegger is most troubled by the very *persistence* of the human in this passage, the heady delusion that renders the entire universe anthropological. This universalized anthropology manifests in what Heidegger calls the "world picture" (*Weltbild*), which, he writes "does not mean 'picture of the world' but, rather, the world grasped as picture" ("The Age of the World Picture" 67). This comprehensive image neutralizes the multitude of nonhuman beings, producing the largely inanimate and de-historicized generalizations falling within the domains of "nature" or "matter," which stand against the vital creativity of those human institutions

known as "society" and "culture." The human subject thus arises and "puts himself in the picture," installing himself as the representative of a world now "publicly" held for observation and management (69).[6] Despite being in the picture, this subject stands, not so much a part of the world, in an interconnected being in a relationship of belonging, but apart from the world, in a detached relationship of representation, which means, via the German *vorstellen*, that the world is "set before" the human subject as something secured and certain (82). The world picture, then, is Heidegger's emblem for the metaphysics of representation that establishes the subject-object dyad and the simultaneous invention of "Man" in his contrariety to "nature."[7]

This metaphysical picture show dramatizes the emergence of humanism, which for Heidegger denotes a generalized anthropology that "does not refer to an investigation of the humanity by natural science. . . . It designates, rather, that philosophical interpretation of man which explains and evaluates beings as a whole from the standpoint of, and relation to, man" ("World Picture" 70). Such an anthropology implies a double entrapment, not only securing the world as an object in relation to the human subject, but also subjecting the human to a totalizing interpretation in whose self-evidence it "already knows, fundamentally, who man is and can, therefore, never ask who he might be. For with this question it would have to confess itself shaken and overcome" (84). An

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6. The several valences of representation are apparent from an attentive reading of the following passage from "World Picture":

> Representation [*Vor-stellen*] here means: to bring the present-at-hand before one as something standing over-and-against, to relate it to oneself, the representer, and, in this relation, to force it back to oneself as the norm-giving domain. Where this happens man 'puts himself in the picture' concerning beings. When, however, in this way, he does this, he places himself in the scene; in, that is, the sphere of what is generally and publically represented.…Man becomes the representative [*Repräsentant*] of beings in the sense of the objective. (131-2)

7. "That the world becomes picture is one and the same process whereby, in the midst of beings, man becomes subject" ("World Picture" 69).

anthropological life-as-we-know-it situates itself prior to any questioning, making it difficult to imagine a life-as-it-could-be, human or otherwise, without an existential shudder.

This epistemological situation gives rise to a bioethical structure in which human life is more than just the "measure of all things"; it animates the very being of things in the first place. The world so "decisively" becomes picture, Heidegger writes, "as soon as man makes his life as subject the primary center of reference. This means: the being counts as in being only to the degree and extent that it is taken into, and referred back to, this life, i.e., is lived out [*er-lebt*] and becomes life-experience [*Er-lebnis*]" (71). Only to the extent that an entity is included in humankind's history as something implicated in the making and shaping of human life can it appear as something at all. The things of the world are thus subjected to a sort of universal eugenics in which, "humanity sets in motion, with respect to everything, the unlimited process of calculation, planning, and breeding" (71). The world is calculated, planned, and bred in such a way, and according to such a predetermined image, that the human calculates, plans, and breeds itself.

Ge-stell submits the challenge to engage in this selective breeding program, an exhortation to propagate human existence from the ordering, stockpiling, and expediting of the world's energies. Our absolute, planetary embrace of technological life unfolds in a restless voluntarism that technological use apparently guarantees for us. The danger intrinsic to *Ge-stell* is perhaps most dire when our actions are for the good of humankind as a species, since it is then that *Ge-stell* is at its most inconspicuous as to the way in which it frames our understanding of the world. When our inability to encounter anything but ourselves in our technical practices has us feeling most at home in the

world, this is the moment that Heidegger insists we are most threatened:

> What has long threatened man with death, indeed with the death of his essence, is the absoluteness of his sheer willing in the sense of his deliberate self-assertion in everything. What threatens man in his essence is the willful opinion that through the peaceful release, transformation, stockpiling, and delivery of natural energies, man could make man's being bearable for all and happy in general. However, the peace of this peacefulness is merely the undisturbed, lasting frenzied restlessness of self-assertion deliberately thrown back on itself. ("Why Poets?" 221)

It is in the "injurious neglect" of things attendant to this urgent self-assertion, the anthropological solipsism that lies behind the utopian hope that technoscientific innovation can make life "bearable for all and happy in general," that human beings turn cannibalistically on themselves as a storehouse of energies, a reservoir of skills and capabilities, a naked ability to do work.

For Heidegger, the human, that being who cares for its own existence, is never reducible to the everyday physicality of embodied life and the capacity for material production. There is a "saving power" that preserves human beings from being thoroughly subsumed by *Ge-stell*. This power lies in humanity's ability to think "piously," in a mode of questioning and meditation rather than one of calculation, as well as its ability to produce artistically and poetically, in a mode of *poiesis* rather than of industry. This is why he presents humanity on the "brink" of a precipitous fall that it apparently cannot suffer: "Yet precisely because man is challenged more originally than are the energies of nature, i.e., into the process of ordering, he never is transformed into mere standing-reserve" (*The Question* 18). Yet have we not, over the course of the past

two centuries, fallen continuously and repeatedly over the precipice, having stripped individuals and populations down to the skeleton in the harvest of various energies, denuded the physicality of human bodies and the materiality of human lives, as effectively and as thoroughly as any other animal, any other natural *thing*, to an abstract capacity for production? It is not difficult to see in Heidegger's perspective an ethnocentrically Western sensibility, and a privileged one at that. His appeals to the saving power held in poetry and the work of art—of which some of his more prominent examples across various texts include the painting of Van Gogh, the poetry of Hölderlin and Rilke, and the craftsmanship of ancient Greek chalices, temples, and jugs—certainly speak to the strong humanism that abides in his thinking.

Is there a way to uncover the "saving power" of *Ge-stell* in a different light from Heidegger's appeal to the fine arts and its authentic revelations of truth, piously separated from the "sector of cultural activity" (34)? By no means do I wish to downplay the insights into our own condition to be gained from the arts. However, I do agree to some extent with the criticism of Heidegger that there is an overtone of reactionary conservatism in his writing on technics that betrays his own effort not to fall into a morality that either lauds or decries modern technology. At the same time, I think there are hints in "The Question Concerning Technology" of a more radical mode of thinking about our intimacy with technology, hints that begin with the standing-reserve.

Heidegger's best-known example of the standing-reserve is that of a hydroelectric plant on the Rhine, which captures the movement of the river's waters to generate electrical power. But the energy that he speaks about being unlocked from the earth is much more inclusive than this example lets on. This energy is an ability to do work taken

in the widest sense. A much more detailed illustration of the way in which *Ge-stell* calls forth the things of the world as standing-reserve can be found in his remarkable description of a forester in the wood:

> The forester who, in the wood, measures the felled timber and to all appearances walks the same forest path as his grandfather is today commanded by profit-making in the lumber industry, whether he knows it or not. He is made subordinate to the orderability of cellulose, which for its part is challenged forth by the need for paper, which is then delivered to newspapers and illustrated magazines. The latter, in their turn, set public opinion to swallowing what is printed, so that a set configuration of opinion becomes available on demand. (18)

At first glance, this seems less a radical disclosure of the metaphysics of technics and more a critique of disenchantment, instrumental rationality, and capitalist nihilism in the manner of the Frankfurt School. This seems especially so as the forester is "commanded by profit-making" and as the "challenging forth" of cellulose extends to the manipulation of public opinion through the popular press. Indeed, under the aegis of late modernity, the abstraction of the standing-reserve, its protean ability to unfold in various ways to various productive effects, becomes a source of capital accumulation, a way of making anything and everything a source of labour. Yet what intrigues me more in this passage is the impressionistic sketch of something like an actor-network theory *avant la lettre*, which places as much emphasis on the sense of gathering as it does on that of challenging. In this brief series of transformations and distributions, Heidegger highlights a series of human-nonhuman relations that act to produce a sociotechnical collective. The ways in which cellulose presents itself to the forester, the ways in which

its capacities provoke a series of concrete metamorphoses, are equally as important as the profit motive toward giving shape to human action and its comportment to the so-called "natural" world.

In fact, nature here seems, not so much a static object of representation, as it does a potential for transformation and organization, its ability to do work a capacity for renewed utility in ever-expanding contexts. The human forester, now a "subordinate" to cellulose and what might be done with it, becomes the sort of "mediator" Latour describes in *We Have Never Been Modern*. The dynamic work of mediation and translation, of creating networks and mixing hybrids, of ordering and reordering, is about *gathering*. *Ge-stell* gathers humans and nonhumans into productive relationships, the dynamics of which give rise to the actualities of technological life in modernity. The essence of modern technology is about nothing if not putting living things together through the structured mediation of nonliving things—engineering, for better and for worse, new inflections of *bios* and *technē*, new forms of artificial life. As a placing-together, a setting-forth-that-gathers, another rough equivalent for *Ge-stell* could very well be *synthesis*. In its ontological intimacy with modern technology, the human then becomes both a mediator and a medium, a being whose life is synthetic.

What Heidegger may have intuited was a primordial complication of knowing and experiencing human *being* brought to light most acutely by cybernetics, namely, that the human-in-itself, as the end of technology and the end of philosophy, can be disclosed only by means of the other-than-human.[8] In a certain sense, the ontological crisis that the

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8. In "The Spiegel Interview," Heidegger comments:

> The workings of the con-struct [*Ge-stell*] mean: Human beings are caught [*gestellt*], claimed, and challenged by a power that is revealed in the essence of technology. The experience that humans

science of steersmanship invokes, being the culmination of "the most extreme possibilities" of Western thought, is precisely what Heidegger seeks to address in the question of Being that obsesses his career. Indeed, if there is one thing he teaches throughout his oeuvre, it is that "there is no such thing as a man who, solely of himself, is only man" (*The Question* 31). To focus on our subordinate role as mediators and media, necessarily inter-involved with the lively worlds of nonhumans—including the nonhumans that "we" are in our ontological constitution—is to elect a mode of thinking that may be a little less "pious" than Heidegger's contemplative questioning. Nevertheless, it might offer an occasion to sidestep the morality of instrumental mastery with an insistence, however shaken and overcome it leaves us, that we cannot know what a human being is without asking about the nonhuman beings that frame what it is and what it could be.

Low on gas

The British neurophysiologist and early cyberneticist W. Grey Walter does not position cybernetics at the end of philosophy, but at the very origins of life. In the first chapter of *The Living Brain*, the volume that influenced Brooks to construct his first artificial creature as a teenager, Walter invokes cybernetic theory at the end of a discussion of evolutionary processes (specifically, the evolution of complex nervous systems in multicellular organisms). He writes that, on account of the "inherent mobility of animal cell and organisms," feedback is vital to an organism's survival amidst a bustling,

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> are structured [*gestellt*] by something that they are not themselves and that they cannot control themselves is precisely the experience that may show them the possibility of the insight that humans are needed by Being. (57)

agonistic world, and is thus a fundamental component to the machinery of evolution:

> Anything that moves about increases its risks, runs into new dangers. The protozoan scene under the microscope is one of continual traffic jams and innumerable collisions. Jay-walkers following their insensitive noses will be eliminated in the course of a few million years. . . . In the multicellular world, among beings of more delicate construction than the plastic single cell, there is an even higher premium on road-sense, on steersmanship. . . . This principle of steersmanship . . . by feedback undoubtedly played a very important evolutionary role in the first stages of animal life. Possibly even before life appeared. Feedback as the first act of creation, or as the process of continuous creation, is a pretty subject for the metaphysician. (25-26)

The spontaneity afforded by continuous communication with a world of surprises and accidents is essential to an organism's capacity for survival. Feedback is the basis of adaptation for Walter; it ensures the plasticity of an organism or species with regard to environmental provocations. More than that, however, he suggests that cybernetic principles condition the very possibility of life, driving an evolutionary process that even precedes life's very appearance.

The traffic metaphor Walter uses to describe the origins of animal life complements an automotive trope Stiegler uses to characterize an "essential" aspect of human ontology in *Technics and Time*. Following the paleoanthropology of André Leroi-Gourhan, Stiegler suggests that life is about a negotiation of movement, that survival and development have to do with an organism's control over space and time. "Life is the conquest of mobility," he writes (*Technics 1* 17). Human beings have a

distinct lack of road-sense, however: "Man is this accident of automobility caused by a default of essence [*une panne d'essence*, a 'lack of fuel,' an 'empty tank']" (121; translator's gloss). As David Wills points out, however, even with the translator's gloss the shift to English marks a breakdown in Stiegler's endeavour to express the human's originary faultedness with the poetic assertion, "*L'homme est cet accident d'automobilité que provoque une panne d'essence*" (qtd. in Wills 239). For Stiegler, the human is a being that has run out of gas, both ontologically and evolutionarily. It is without essence and without origin, an essentially disoriented entity whose being is constituted entirely through its prostheses.

For Stiegler humanity is insufficient in itself, appearing only in its material and temporal relations to the things of the world gathered around it. The myth of Epimetheus is the key narrative in developing his theory of prostheticity and its relation to time. The forgotten and forgetful brother of the titan Prometheus, Epimetheus was charged with the task of granting powers to all the world's creatures in order that none would overcome and destroy any other outright. But the rather dim-witted Epimetheus used up all the powers before providing for mankind. Thus engendered of negligence, humans were born without powers or properties of their own. Prometheus, fearing that these naked creatures would perish if left unprovided for, stole technical skill and command over fire from Athena and Hephaestus and gave them to the humans, which guaranteed their survival. Human nature, then, is to have no nature, save for stolen gifts. The myth suggests, then, that human beings exist by a power that precedes their genesis and over which they have no rightful claim, a power they cannot fully control but which compensates for their essential indeterminacy.

Thus human life and being are ultimately prosthetic, meaning that the conditions of its existence are fundamentally paradoxical:

> The evolution of the 'prosthesis,' not itself living, by which the human is nonetheless defined as a living being, constitutes the reality of the human's evolution, as if, with it, the history of life were to continue by means other than life: this is the paradox of a living being characterized in its forms of life by the nonliving—or by the traces that life leaves in the nonliving. (*Technics 1* 50)

This is our originary technicity, *Ge-stell* in its primordial form as the skeleton or framework of our being. We live only by the things we set before of ourselves: human and prosthesis emerge in a "coup," a rupture in time in which neither one precedes the other.

Stiegler argues that today the feedback between the human and the technical systems that are its prostheses is out of sync. There is "a divorce, if not between culture and technics, at least between the rhythms of cultural evolution and the rhythms of technical evolution. Technics evolves *more quickly* than culture. . . . It is as if time has leapt outside itself" (*Technics 1* 15; original italics). Social structures are always playing catch-up with technical systems that quickly erode their relevance. This structure of delay and anticipation, default and supplement, *ēpimētheia* and *promētheia*, is what gives rise to our experience of temporality. For Stiegler, technology is a concretization of memory, the establishment in matter of an already-there.[9] This technical memory makes it possible to access the inherited past; it establishes "the pre-given horizon of time, as the

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9. The concrete folding of past meaning and activity into present artifacts Latour calls a "congealed labour": "The relative ordering of presence and absence is redistributed—we hourly encounter hundreds, even thousands, of absent makers who are remote in time and space yet simultaneously active and present" (*Pandora's Hope* 189).

past that is mine but that I have nevertheless not lived, to which my sole access is through the traces left of that past" (*Technics 1* 159). Of course, memory is not simply that which exists in the past; it is something retained in anticipation of a future, that which is expected to endure. The capacity for anticipation "is also the capacity of putting-in-reserve, of memorization *qua* the possibility of being affected by a *past that lasts*" (166). A past that lasts is therefore also a past that may return in response to anticipated possibilities. This is why Stiegler understands the "pro-" in prosthesis in both spatial and temporal terms, as a setting *in front* and a setting *in advance* (152). Our future is held in this concretization of a past that we may carry with us.

Stiegler remains vague regarding why human social practices are out of sync with technical systems when the human emerges through a transductive ontogenesis with its prostheses, in a *coup* where neither partner precedes their relating. The reason appears to me to lie in the "essential" faultedness of the human, for which its prostheses are supplementary compensations. As a play of spatio-temporal *différance*, the prosthetic response to an anticipated future is iterative, a matter of translation and deviation. This is a response to indeterminacy, rather than the determination of a particular future. Technology is not a destiny but a "destining," a "starting upon a way," as Heidegger would say (*The Question* 24). We as humans will always be at the wrong place and in the wrong time; we must always make corrections after the fact for their errors. Our prostheses are the materialized memories that turn us toward a past from which future errors have been anticipated. They compensate ahead of the fact for faults that are always already-there and always returning. In a sense, then, our prostheses multiply the errors of which we are capable. But it is the fallibility that comes from living in time that

guarantees futurity: "To have a past is to be fallible: nothing can happen to the infallible; no difference can affect it" (*Technics 1* 199). Because we are so error-prone, action in the present, which is action toward the future, remains contingent, surprising, and therefore consequential.

Meanings accrue to technical practices through the negotiation of contingency. The boundaries by which a society orients itself, the norms and values it institutes and that ground its attitudes, are the result of an iterative and evolutionary process through which some articulations between people and things, humans and nonhumans, are selected at the expense of others. What Judith Butler calls a process of "materialization," through which such orienting boundaries are sedimented over time and stabilized in and as matter (*Bodies that Matter*), enters into a rapprochement with Latour's notion of "socialization," by which technoscientific artifacts and other nonhuman actors come to circulate among collectives as both matters of fact and matters of concern (*Pandora's Hope*). Accepting this conceptual cross-wiring, human collective practices emerge in a historical and contingent co-constitution with their technical practices. But it is through a selective repetition of error and correction that a society negotiates technological development, tracing its contours in the prostheses that come to concretize its own past.

So collective practice and the forms of labour congealed or memorized in technological artifacts must engage in a process of iterative materialization. Yet the materialization of modern industrialization and its attendant regime of perpetual innovation has exacerbated this temporal disjunction, precipitating what Stiegler identifies as a pervasive "disorientation" in global technoculture: a dissolution of both spatial and temporal boundaries, a disruption of cultural bearings and conceptual

reference points by virtue of a generalized deracination. No longer is the human's lack of origin supplemented by prostheses that prompt socio-cultural orientations that open "a space of difference, between here and there, public and private, profane and sacred, strange and familiar, and so on" (*Technics 2* 3). The drive of technoscientific development, divorced from social responsibility, instead constitutes an impotent meandering: "at present not only does the invention of that brave new world quickly named 'progress' no longer seem to be the spontaneous bearer of the future but, for the majority of the world's population—Occidental as well as Oriental, it seems to lead nowhere—when it is not a nightmare" (1).

For Stiegler, the primary factor in contemporary disorientation is speed, especially the speed of electronic, digital, and informatic technologies whose processes occur near the speed of light.[10] In a globalized economy where profitability is dependent upon perpetual innovation, where time is interpreted in terms of its economic value, technology is "characterized as a system for producing and managing speed" (138). The "temporal mode of being" peculiar to this system, its "principle effect," is "a generalized state of urgency" that reduces futurity to a matter of risk management: "Urgency occurs when the immediate future is violently introduced into the present as the undetermined but immanent possibility of an accidental, unforeseen event" (138). Anticipation comes to dominate the present, but without a connection to an enduring past. Instead, it is an anticipation rooted in a logic of pre-emption that seeks to make the future a foregone conclusion, ameliorating risk by shrinking the scope of the unforeseen.

Stiegler argues that "the condition of urgency" makes it seem "as if the state of

10. In his discussions of speed, Stiegler echoes the arguments of Paul Virilio. See, for instance, the latter's *Negative Horizon*.

emergency [has] become the law—a 'law' whose usual role is to contain urgency" (140). Since perpetual acceleration is the primary strategy of risk-reduction, "laws of exception exist to control, through speed, the urgency created through the law itself" (140). A paradox arises in that this generalized suspension of law creates a normalization of technological risks. In keeping with the motif of automotive breakdowns and traffic jams, Stiegler writes, "An accident between an ambulance and a police car both breaking the speed limit going to the scene of an accident would be an example of an ordinary situation creating the structural tendency toward acceleration" (140). Here Paul Virilio's influence is quite palpable, specifically his claim that with each new invention is the indirect invention of new accidents, of the invention's very malfunction and breakdown. Acceleration at all costs, Stiegler writes, is about a generalized profiteering in which gaining or saving time constitutes "an advance against the future" (140). The accelerated multiplication of errors and accidents in order to pre-empt risks, which puts the future up as collateral against a time of certainty, "puts technics into crisis, into a permanent state of urgency" (140). What the translation of Stiegler's language obscures here is the ambiguity in the French between urgency and emergency, "*état d'urgence*" rendered both by the more literal "state of urgency" and the idiomatic equivalent "state of emergency."

For Stiegler, it would appear we no longer possess the requisite steersmanship to come to terms with provocations from the environment that our technologies constitute. In this political, economic, and ontological milieu of urgency, governed by techniques of risk-management calculated at electronic speed, the inertia of the human body becomes painfully apparent. An informatic regime can only be slowed down by the responsive and responsible give and take of *promētheia* and *ēpimētheia*; however, "the usual

receiver of information, the thinking *who*, seems to be dismissed, since it cannot think fast enough and must automate the process of anticipation. In order to do that, it employs the cybernetic tool called 'real time'" (141). This tool allows action to occur without deliberation or reflection: the lightning stroke of technological decision-making. At the same time that the proliferation of modern technologies multiplies our capacities for error, the speed of their functioning, the speed they *produce*, attenuates the delay during which we materialize cultural, that is to say, ethical, responses to the problems they pose.

The tense overlap of evolution and revolution makes itself felt when the sluggishness of social or cultural "adaptation" is mapped onto the limited speed of the organic body and the "natural" processes of evolution. As a movement whose speed is such that it is legible only retroactively, on the order of tens of millennia, and only in terms of populations generalized to the level of a species, the evolution of the genus *Homo* would certainly appear to be at a stand-still by the measure of human history. This perception sets the scene for grave diagnoses of our fundamental deficiency relative to the frenetic technological landscape and imperilled natural environment in which we reside, leading in turn to the extropian, singularitarian, and transhumanist arguments for the need to augment and modify ourselves through the continued innovation and application of technological solutions in order to preserve the human species and human "civilization" from succumbing to its own finitude.

The ecstatic promises of increasingly sophisticated biotechnological interventions and syntheses suggest the possibility for a "departure from the laws of evolution"—a promised departure that for Stiegler speaks more primordially to the notion that human "nature" lies in its own denaturalization, its originary technicity:

> One could go so far as to claim, perhaps above all, that it effectively makes it seem that the 'laws of evolution' have been suspended at least since the invention of the human (i.e., technics), and that it is no longer possible to ignore this, at the very moment when this suspension attains a radically new set of effects. . . . [A]pparently 'we' left those laws behind four million years ago. And we continue to 'leave' them, being today at a threshold, the brink of a gateway, at the moment of an imminent leap . . . (*Technics 2* 152)

From this evolutionary state of emergency, Stiegler conjures another threshold and another brink, which recall for me Foucault's threshold of modernity and Heidegger's precipitous fall into the extreme danger of *Ge-stell*. What I find disquieting is that the arguments for an ostensible "suspension" of evolutionary laws so easily and so often seem to ensue in a technocratic possessive individualism, solipsistic economies of a human-in-itself and -for-itself that do not acknowledge, let alone assume a responsibility for, the mediations and translations that make human being possible in the first place. It is troublesome to speak of gaining "the keys to our existence," as Brooks writes, to be put in the driver's seat of life and being, when our road-sense remains so very much in question. Doing so sends the body "crashing through into its own unrecognizable or catastrophic otherness" (Wills 247). On the one hand, the contemporary human being is more humanist than human. The urgency of technological innovation poses a challenge to adopt a self-interested attitude that overanthropomophizes both the human species and the world it inhabits. On the other hand, the contemporary human being is a biotechnological organism that lives precisely because it is a synthetic intermingling of living and nonliving bodies and because it is open to reengineering and redesign.

Chapter 4

More humanist than human

Optimization

> I want more life, fucker, I ain't done.
>
> —ROB ZOMBIE, "More Human than Human"

Brooks relies on a radical version of the familiar organism-as-machine analogy in order to support a broad claim he makes about our "nature" being intimately bound up with technology and technological development. In a particularly reductive turn, he describes the human body as a machine composed of more or less robotic biomolecules, the product of an evolutionary engineering: "The body consists of components that interact according to well-defined (though not all known to us humans) rules that ultimately derive from physics and chemistry. The body is a machine, with perhaps billions and billions of parts, parts that are well ordered in the way they operate and interact" (*Flesh and Machines* 173). Life emerges from the organization of molecular components that are not in themselves alive, but whose "well ordered" operation and interaction animate the totality. The crucial point to consider, for Brooks, is that the life sciences have begun to shift their focus from the meticulous scrutiny and decomposition of the body's molecular mechanisms to their deliberate manipulation and recombination. This shift "from analysis to synthesis," he argues, represents "the standard transition from science to engineering" (233). Caught up in this trajectory, the human body becomes less an object of science and more a project of engineering.

What Brooks expresses here is very much in line with the "genetic imaginary"

that Sarah Franklin argues governs the "technologisation of life itself" through its redefinition as an informatic or computational process (Franklin 188). To exert a wilful control over the processes and products of organic life answers to an ambiguous "dual imperative" Franklin identifies at the heart of biotechnological discourse and practice: namely, "to take evolution in one hand and govern it with the other" (188). To be sure, Brooks' more heady prognostications speak of our breaking free from the confinements of Darwinian evolution and "participating in explicit ways in that evolution, both as individuals and as a species" ("The Merger of Flesh and Machines" 192). An exquisite machine for the deliberate synthesis and expansion of human vitality replaces the blind mechanism of growth, variation, selection, and descent. While Brooks may avoid some of the more far-reaching claims about the obsolescence of the body and our need to transcend biology altogether, it nevertheless remains that, in his assessment, the future of human life depends upon our ability and willingness to manipulate biology. We are now "orphaned from natural history but full of dazzling promise" (Franklin 191). In this chapter, I argue that the belief in this dazzling promise is a distinguishing mark of contemporary neoliberal biopolitics, whose object is the maintenance and even enhancement of human life in the interests of increased and extended productivity.

Despite the technological determinism that colours these conjectures, I wish to avoid critical assessments as to the reduction of the organism to the machine and the unilateral subjection of life itself to technological discourses and practices. The various mergers and reciprocal invasions of organic beings and inorganic things that are the prime subject of Brooks' speculative probes suggest a more complicated relationship, and call for a more nuanced response. In *Transductions*, Adrian Mackenzine stresses that

biotechnology "should not be seen as a simple reduction of the living to the nonliving, but as a specific co-implication of the living and the nonliving" (193). Such a co-implication is, of course, true of any technological system: "There is no purely nonliving technological system. However, biotechnology is distinctive in the way that it configures living bodies as reservoirs of technical elements" (193). Such a configuration lies at the heart of Brooks' biotechnology revolution, which taps into the reservoir of technical elements held within the living body such that the body becomes prosthetic to itself, an uncanny double that is both an organic machine and a mechanical organism.

For Brooks, the upshot of accessing this reservoir is the promise of increased longevity. Brooks foresees the increasing prevalence of biotechnological implants and genetic manipulation being used to restore failing senses, to repair various physiological and neurological "frailties," and so on. This comes down in the end to engineering "ways of extending our useful and enjoyable lives" for as long as possible (*Flesh and Machines* 238). Put this way, the sentiment does not seem like a presumptuous declaration on the part of a techno-evangelist, but rather a reasonable statement of our everyday hopes. In his emphasis on the extension and enhancement of life, Brooks simply speaks to the reality of contemporary biopolitics, the end of which Nikolas Rose claims is "the optimization of life itself" (Rose 82).

Primarily addressing medical knowledge and practice, Rose argues that this focus on optimization has largely superseded the concern with normalization in the life sciences. The accent no longer falls on the identification and regulation of pathologies as much as it does on pre-emptive ministrations toward already healthy bodies. The supervision and prophylactic treatment of susceptibilities to physical and psychiatric

disease, coupled with the technological improvement of various capacities of the mind and body, are twin strategies geared toward improving individuals' "future vitality" (82). Moreover, Rose writes that, in "advanced liberal" societies, the "maximization of lifestyle, potential, health, and quality of life has become almost obligatory," placing an ethical imperative upon subjects to take up an "active, informed, positive, and prudent relation to the future" (25).

Rose contends that this "somatic ethics" is the basis for the production of "biological citizens" in the twenty-first century. Citizenship now enjoins us to assume deepened responsibilities toward our own biological futures, as well as those of our loved ones. Rose readily admits that a discourse of susceptibility and risk has the capacity to generate anxieties that bring subjects under the authority of physicians, therapists, pharmaceutical companies, and other kinds of "somatic experts." There is always the possibility that induction into a group defined by risk may draw an individual into a network of power relations that operate through techniques of coercion, constraint, and exclusion (253). However, Rose emphasizes the promises of a biopolitical scene in which "biology is no longer destiny" (253). Especially important to this newfound liberation is the advent of biotechnologies that expose life to surveillance and manipulation at the molecular level. With this "molecularization" of the body, a synthetic biology takes hold:

> In contemporary molecular biology . . . the search is not for simplifying underlying laws but precisely the reverse: for simulations of dynamic, complex, open systems, combining heterogeneous elements, to predict future vital states and hence to enable intervention into those vital systems to reshape those futures.

> . . . [A]lmost any vital element can, in principle, be freed from its ties to cell, organ, organism, or species, set free to circulate and to be combined with any other, provided certain conditions are met. (16)

The shift from a politics of normalization to one of optimization thus involves the decomposition of life into deterritorialized components that may subsequently be transformed, switched about, and redistributed in the interest of mastering an individual's future vitality.

While Rose himself makes it a point to resist epochal or revolutionary rhetoric, he does indicate that the increasing prominence of biotechnology is crucial in the production of a utopian sensibility, central to the biopolitical imagination of Western societies. Inspiring the "political vocation" of the contemporary life sciences is a "dream" in which the identification of an individual's susceptibility or predisposition to abnormality "might be followed by technical intervention at the biological level to repair or even improve an organism, and hence a life, that would otherwise be painful, short, or suboptimal" (253). That said, Rose rejects as overblown discourse surrounding our apparent posthuman transformations, with its assumption that we are becoming less fleshy and more machinelike. On the contrary, he insists that "it is as if, in the inescapable connections that have now been forged between human life and biotechnology, we have become more biological" (80). However, this erasure of the technological in our sense of self seems to expose the embodied subject even further to technical intervention and to implicate the organic and the technical even more thoroughly, serving only to heighten the ambiguity of the status of life in contemporary biopolitics. The "inescapable" involvement of *bios* and *technē* makes the heightened sense of our own biology occur "at the same time as the

vitality of the body has become increasingly open to machination" (254)—at the same time, too, that our machines have become increasingly open to animation, a proposition whose implications do not enter into Rose's assessment of what he calls "an emergent form of life" in contemporary liberal polities.

Biological citizenship takes place in the space of this ambiguity, in which an individual is asked to adopt an intensified sense that she owns her body, an ownership she exercises by exposing her body to technological reshaping. Rose adopts a sort of Foucauldian "care of the self" with regard to his somatic ethics, though it is a project of learning and practicing "different ways of being human" (40) through the application of what one might call *bio*technologies of the self. This technical project of taking care of one's self is not so much, as in Foucault's writing, an *aesthetics* of life, a vigilant concern with inventing and cultivating a "style of existence" that takes place in a creative dialogue with one's community, inextricable form one's political situation, and above all directed toward countering the limits of that situation. In Rose's analysis, somatic ethics is in many ways a highly privatized affair. This conception is consistent with contemporary modes of governance in Western societies: "Today, we are required to be flexible, to be in continuous training, life-long learning, to undergo perpetual assessment, continual incitement to buy, to constantly improve oneself, to monitor our health, to manage our risk" (154). Where biology is no longer destiny, a biotechnologically amplified possessive individualism structures an ethical program that engages each of us as "a prudent yet *enterprising* individual, actively shaping his or her life course through acts of choice" (154; my italics).

Rose's liberal humanism closes ranks with neoliberalism at the point where

enterprise slips so neatly between prudence and the freedom of choice. A "moral economy of hope" arises from our biological voluntarism and the entrepreneurial attitude toward life it insists upon, a moral economy which is "also an economy in the more traditional sense, for the hope for the innovation that will treat or cure stimulates the circuits of investment" (27). Rose suggests that improved vitality couples with economic growth; to hope for the one is to hope for the other. As a moral and affective relation to the future, hope innervates the dynamic circulation of life, labour, knowledge, and capital toward new syntheses of organic bodies and technical apparatuses. In this respect, somatic ethics draws "an elective affinity . . . with the capitalization of life itself," mobilizes "our economies of hope, of imagination, and of profit," and thus conjures an alliance with what Rose dubs the "spirit of biocapital" (258). This is not to say that he considers the entanglement of biological life with commerce to be unproblematic. Indeed, the entry of life itself into the circuits of capital demands careful scrutiny and critical evaluation. But the stress he places on enhancement and optimization and his characterization of self-care as self-enterprise resonate strongly with the logic of what neoliberal econonomists call "human capital," in which the physical and psychiatric health of free human subjects and the health of the free market are of a piece. I wish now to turn to Foucault's analysis of human capital, in which human individuals are conceived to be a fundamentally economic species of man-machines.

Neoliberal man-machines

> An all-inclusive concept of technology presumably also would include the innate abilities of man.
>
> —THEODORE W. SCHULTZ, *Investment in Human Capital*, 10

In the series of lectures he delivered at the Collège de France between January and April of 1979, entitled *The Birth of Biopolitics*, Foucault takes as his object of study the "governmental regime called liberalism" (22). In the course of these lectures, he pays considerable attention to the new forms of liberalist economic thought that took form in Germany and the United States in critical opposition to interventionist policies in place before and after the Second World War. As Foucault demonstrates, the "utopian focus" of neoliberal society renders humankind a radically economic species, one whose social and biological life becomes a resource to be managed as a matter of capital investment. American neoliberalism as developed by the Chicago School is striking for him in the sense that it generalizes and diffuses "the economic form of the market . . . throughout the social body and including the whole of the social system not usually conducted through or sanctioned by monetary exchanges" (243). A unique analysis of labour arises from this "absolute" and "unlimited generalization," in which the worker's point of view is taken up and the entirety of her everyday behaviour becomes bound to economic production.

As Foucault demonstrates, one noteworthy aspect of American neoliberalism has to do with undertaking an analysis of labour that perceives the worker as an active subject with a certain amount of "human capital" at her disposal. This capital is the sum of the worker's abilities and skills; her body and its capacities, her talents, aptitudes, and

expertise, comprise what Foucault calls an "abilities-machine," from which she may generate an income. Unlike a traditional Marxist critique of political economy, this is not about a "capitalism [that] transforms the worker into a machine and alienates him as a result" (224). Clearly an engine of possessive individualism, this machine and the work it can do are immanent to the worker and inalienable: "Ability to work, skill, the ability to do something cannot be separated from the person who is skilled and who can do this particular thing" (224). Foucault asserts that, in a very real sense, "the worker is a machine, but a machine understood in the positive sense, since it is a machine that produces an earnings stream" (224). The labour this machine performs is not to be understood as "a commodity reduced by abstraction to labour power and the time [during] which it is used" (224). The worker does not sell her abilities discontinuously for wages dictated by the labour market. Instead, she is remunerated continuously over her lifespan at differing rates as her productivity waxes and wanes, increasing with education, training, and use and then, eventually, decreasing as she obsolesces with age. Just as the worker is an incessantly producing machine, her labour cannot be abstracted and thus made discrete from the rest of her social and biological life. This life is ordered and organized as a reservoir of potential to be distributed in such and such a way so as to guarantee the very possibility of a future income.

For the economists of the Chicago School, the flow of an earnings stream is precisely the income allocated to a worker's human capital. "This is not a conception of labour power," Foucault writes; "it is a conception of capital-ability" in which the worker invests in himself, invests in the optimization of himself as a machine, "so that the worker himself appears as a sort of enterprise for himself" (225). A particular species of

human, *Homo oeconomicus*, emerges from this conception, which Foucault claims "is not at all a partner of exchange. *Homo oeconomicus* is an entrepreneur, an entrepreneur of himself. . . . being for himself his own capital, being for himself his own producer, being for himself the source of [his] earnings" (226). His own stock of resources, his own machinery, his own entrepreneurship, *H. oeconomicus* is an incorporated firm for the development, manufacture, and marketing of himself.

To be a good neoliberal citizen is not only to be an entrepreneur of oneself, but an engineer of oneself as well—a good biotechnological citizen. With the human body figured to be *more* biological than ever before, the technicity that animates biopolitical living today under heavy erasure, we have become entirely at home with the machinations that target the human body as a resource in need of ongoing optimization. Our biological being is, subtly, innocuously, a store of energy, a reservoir of technical elements, and a stock of capital. *Homo oeconomicus*, the neoliberal man-machine, is a species of human whose every aspect of living is, in one way or another, synthesized toward its ability to work, tapped as a reservoir of useful abilities, enframed by the standing-reserve as a matter of preserving individual freedom, happiness, and hope for the future. But the haziness of these objectives points to the nihilistic possibility that, "We pursue the development of our potential simply for the sake of further growth" (Dreyfus 306). Here *Ge-stell* reaches its own end, the culmination of its possibilities, the human use of human beings having become an end in itself.

Human capital, the source of a worker's self-enterprise, is composed of and modified by those things that are not necessarily part of classical economic theory: the social, psychological, and biological aspects of human activity. The various apparatuses

of what Foucault calls "governmentality"—institutions of education and training, programs for healthcare and public hygiene, organizations of security and policing, and so on—articulate a link between individuals and a population in the interests of managing collective well-being. Just as crucial is the cultivation of an ethics that "involves extending the economic model of supply and demand and investment-costs-profit so as to make it a model of social relations and of existence itself, a form of relationship of the individual to himself, time, those around him, the group, and the family" (242). Together, these institutions and ethical relations are "so many elements which enable us, first, to improve human capital, and second, to preserve and employ it for as long as possible" (230). In order to maintain the vigour of competitive production, a neoliberal society must seek to optimize the milieu within which a population of entrepreneurs may invest in their lives as stocks of capital. It must promote, as a moral obligation toward caring for one's life, the adoption of what neoliberal economist Gary Becker refers to as "utility-maximizing, forward-looking behavior" (Becker 386).

The "moral economy of hope" Rose speaks of in relation to the "spirit of biocapital" appears as the very condition of possibility for the functioning of a neoliberal economy. Extrapolating from the arguments presented by both Foucault and Rose, I argue that the hope-fuelled engine of innovation ensures the ongoing dynamism of the bio-techno-political environment in which the various collectives of humans and nonhumans, living and nonliving entities, commingle and compete. In a dense passage near the end of his lecture on human capital, Foucault refers to Joseph Schumpeter's argument that technical innovation corrects the tendency for profit rates to fall over time. For Schumpeter, it is specifically the entrepreneur and his capacity for invention that

drive capitalism against the grain of economic entropy. Innovation may not, however, precipitate from a capitalist spirit summoned out of the necessity for continued stimulation of the free market, or from a biocapitalist spirit invoked in the commitment to improving human health. According to Foucault, neoliberal economists suggest a more complicated genesis of this phenomenon:

> [T]hey say: We cannot halt at this problem of innovation and, as it were, trust in the boldness of capitalism or the permanent stimulation of competition to explain this phenomenon of innovation. If there is innovation, that is to say, if we find new things, discover new forms of productivity, and make technological innovations, that is nothing other than the income of a certain capital, of human capital, that is to say, of the set of investments we have made at the level of man himself. (231)

Foucault proceeds to illustrate that neoliberal economics accounts for the growth of nations through analyses of the "composition" of a population's human capital and the specific ways in which such investments at the level of humanity itself have been made: the factors of human life that have been "augmented" or optimized, the orientation of social, cultural, and educational policies in relation to the enhancement of health, the acquisition of skills, and so on (232). The discrepancy between a developed and a developing nation—and the relative inability for the latter to realize progress—would thus be interpreted in terms of deficient investments in human capital.

At the same time, any deficiencies in the human capital of a given population would be taken to persist on account of the heavy risk involved in ventures where general well-being is poor in the first place. For instance, Becker makes mention of a study that

reveals that "high death rates, especially from AIDS, of young males in many parts of Africa greatly discourage investments in human capital there" (Becker 393). Ingenuity takes place when people are already physically and mentally healthy, already socially active, already cared for within a community, when they are already able to augment their skills through education, training, and research. Progress occurs as the result of a positive feedback loop in which the material and monetary yield on human well-being is reinvested back into human lives, thus stimulating further growth. Innovation is therefore the effect of a governmentality specifically tuned to organizing the environment in which a population of autonomous individuals may enhance or optimize their lives, insofar as those lives constitute the machinery of so many self-enterprises. If we do not see many innovative discoveries surfacing outside of the developed world, it is in part because innovation is insular and insulating. With these issues surrounding innovation and entrepreneurship in mind, I wish to return to Brooks in order to rough out the bio-techno-political stakes in certain predictions he makes on the growing prevalence of robotic technologies in our "everyday lives."

Eyes and hands

> In all important respects, the man who has nothing but his physical power to sell has nothing to sell which it is worth anybody's money to buy.
>
> —NORBERT WIENER, *The Human Use of Human Beings*, 154[1]

If Brooks has enjoyed a certain degree of popular as well as academic attention, it would be due, perhaps in large part, to his successes as a technological innovator and entrepreneur.[2] *Flesh and Machines* plainly highlights his enterprising ambitions, with generous portions of the text devoted to musings on the marketability of robotic technologies, especially in the consumer electronics sector. For instance, he spends the majority of the chapter, "Machines to Live With," outlining two of his own forays into saleable robots. He first recounts in detail the elaborate give-and-take process of design, financing, and marketing that went into the production of My Real Baby, the robotic doll iRobot developed in partnership with Hasbro in 2000. To round out the chapter, he then describes the prototype for what became the highly successful Roomba autonomous vacuum cleaner, released to the consumer market the same year *Flesh and Machines* was

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1. This quotation repeats a sentiment Wiener expresses in *Cybernetics*, where it is much broader and more devastating in scope. Speaking of the "second industrial revolution," or what we would now call the "information revolution," and its socio-economic impact, he casts his sights beyond physical labour to include intellectual labour, "at least in its simpler and more routine decisions" (*Cybernetics* 27). In this case, his dire prediction affects more than the man of physical labour, in this case it is "the average human being of mediocre attainments or less [who] has nothing to sell that it is worth anyone's money to buy" (28).

2. In "Intelligence without Representation," Brooks' brief introduction to those GOFAI loyalists who hold on to the hope of eventually piecing together "the full gamut of human intelligence" form research in specialized subproblems ends in a wry jab that indicates the workaday considerations that run alongside his intellectual ones: "Amongst the dreamers still in the field of AI (those not dreaming of dollars, that is), there is a feeling that one day all these pieces will fall into place and we will see 'truly' intelligent systems emerge" (140). As Brooks sinks the lofty ideals of traditional AI to the foolish idealism of so many "dreamers," whose fantasies may inadvertently "fall into place," he simultaneously betrays, by way of this snide, parenthetical aside, a governing concern behind his particular approach: a successful financial enterprise resulting from more "realistic" conceptions and goals.

published. This is how robotic and AI technologies "have crept into our lives without our realizing it" (101): in the form of household cleaning robots, interactive toys, and more sophisticated artificial "pets" like Sony's AIBO, not to mention less concrete instances like video game opponents and obnoxiously solicitous PC assistants such as Microsoft's infamous Clippit. If Brooks summarily dismisses the fantasy of a hostile, Hollywood-style rise of the machines, it is because the "robotics revolution" will simply continue to proceed, as it has so far, through a surreptitious proliferation of intelligent technologies driven by the quotidian "creep" of consumer adoption.

It befits his bottom-up thinking that these initial revolutionary "entities" are quite humble, though he assures us that "they are the forerunners of those that are soon to be released into the same ecology that we all inhabit" (103). Though he implies that this wildlife release program for artificial creatures will more or less escape explicit notice, he is explicit that the robots involved belong to a class of what he calls "disruptive technologies," which he describes as "those that fundamentally change some rules of the social game we live with" (100). Participating in our game-playing, inhabiting our habitats, technology for Brooks is about a more encompassing steersmanship that shifts the relations between people and technologies and in turn transforms the social and economic milieu in which human beings may act.

Brooks addresses the more ambitious concerns that lie behind his most recent startup, Heartland Robotics, in a brief talk he delivered as a guest speaker at the 2009 Bay Area Maker Faire. Responding to the theme of the event, "Remaking America," Brooks proposes to innovate robotic technologies in order to make U.S. manufacturing more productive. The impetus for his proposal has everything to do with the global labour

market. After a brief rundown of his own academic and commercial credentials, he recalls how American corporations have repeatedly shifted the bulk of their outsourcing as wages steadily rise in each market—from Japan to South Korea, then to Taiwan, now to China, and perhaps after China, to Vietnam. "Well, pretty soon you run out of places to exploit with low-cost labour," he remarks. He also cites the problems he sees as endemic to globalized manufacturing: long supply chains and attendant transportation costs, lack of control over intellectual property and quality of components, and so on.

New robotic technologies, Brooks argues, would help short-circuit this risky, nation-hopping race to the bottom. What he proposes is not an increase in automation as such, with more production lines and more of the sort of bulky industrial robotics that have been in use since the early 1960s. Instead, he points to the dexterous, adaptive, and intuitively interactive robots that are currently seeing more and more success in laboratories. Such robots would become partners for factory workers, enhancing the productivity and even intelligence of their human coworkers. They would do the "dumb stuff," the simple tasks of manipulation and assembly that go into, for instance, mass market products of the sort currently outsourced to China. This partnership would "free workers to be smart"—free to be retrained, reeducated, and given more "intelligent" jobs. What Brooks suggests, then, is not a means of replacing human workers with cheaper, more efficient machine labour, but a more complex economic "merger" of flesh and machines that would involve an investment in human capital.

Brooks gives a much more specific account of his vision for the future of robotic labour in an article he wrote in 2004 for a column on "the future of computing" in MIT's *Technology Review*. In this text he announces, boldly (and in the title no less), "The

Robots Are Here." He immediately admits that he has "staked [his] own financial success" on this arrival (30). But this announcement, he goes on to argue, also portends a global economic shakedown. The sort of technology that iRobot strives to innovate with its robots—namely, autonomous mobility and navigation—is one vital component of a "broad future" he delineates, a future determined largely by the establishment and growth of markets for specific technological products. While developments in mobile robotics may just be gaining a foothold, he posits that the industry is "just a couple of research advances away" from realizing "growth in a whole new set of markets," which will ultimately bring the robotics industry to the same level of saturation as the computer industry. He offers agriculture as his flagship example, pointing to North American and Western European reliance on migrant labour to perform tasks like picking grapes, or pushing dirt up around asparagus tips so they turn white. The Polish, North African, and Latin American labourers to whom he refers in this connection all "use their eyes to identify the plants and their locations and their hands to manipulate them. In short, a multibillion-dollar market awaits robots that perform these kinds of tasks" (30). The "in short" makes the presence of a market for robotic workers an obvious consequence of the simple physicality of these sorts of jobs, their already machinelike technicality. Brooks breaks down migrant labour to its barest of physiological requirements: eyes and hands, "visual perception and manual dexterity" (30).

Of course, the abilities of eyes and hands pose problems that continue to stand among the most troublesome in robotic engineering and Artificial Intelligence. It has proven extraordinarily difficult to build vision systems able to pick specific objects out of a group and to create manipulators able to adapt to various shapes, sizes, weights, and

delicacies. Yet Brooks is confident that recent advancements in programming, equipment, and computational horsepower mean that solutions to these problems are just around the corner. A worldwide upset would then ensue, not due to the superior intelligence and tireless strength of autonomous machines, but due to their mundane, even infantile capabilities. He declares that it will be robots that possess "the vision capabilities of a two-year-old and the manipulation capabilities of a six-year-old" that will prove most "disruptive to our way of life." These juvenile robots will be disruptive first and foremost to the global labour economy: "They will reorder the world labor markets that have developed over the last 50 years. They will change immigration patterns and the massive shift of labor from developed to developing countries" (30). In other words, robotic eyes and hands will steer transnational flows of working bodies away from the North and West, meaning that flows of capital remain within the circuitry of the developed world.

In this respect, Brooks' scenario points to one of the roles innovation plays in the bio-techno-political processing of bodies and lives, one that is disruptive in the precise meaning of the word. The wholesale reordering of labour markets that he imagines implies a breaking apart that separates migrant workers from a source of income (however exploitative) and a certain degree of relative well-being (however tenuous and erratic). A logic of exception lies behind the vague "change" to immigration patterns Brooks predicts, the displaced of the developing world inhibited from movement into other territories by force of marketplace competition. These workers are subject to a second-order displacement, abandoned to a non-place outside of commerce, their abilities-machines outmoded. Brooks' agricultural robots will be released into a

neoliberal "ecology" shaped by the distribution and development of human capital along racial and national lines. If the innovation of robots that do the work of migrant labourers represents a return on investment in the human capital of developed nations, it concomitantly signals a disinvestment in the human capital of those on the periphery. The innovation and optimization of certain lives has its correlative in the exception of the unoptimized and obsolete.

The space or state of exception is Giorgio Agamben's name for the geographical and conceptual zones that rest at the very limits of the privileged place of modernity (*Homo Sacer*). The camp is the paradigmatic figure of the state of exception for Agamben: those sites of detention, slavery, and extermination where, he argues, biopower is absolute. The migratory non-places of refugee settlements and the extermination camps of the Nazi Reich are Agemben's privileged examples, though I would also consider the squatter settlements on South African landfills, the e-scrapping villages in the costal regions of Eastern China and Western Africa, and so on. Within these *topoi*, where the "hidden paradigm" of modern politics is enacted, life is stripped to its most "naked" or "bare" form (123). Biological existence stands within the state of exception at its most animal and, what amounts to much the same thing in modern metaphysics, its most machinelike. In other words, these are the sites at which *Ge-stell* reveals the lives of human beings, in their bare physicality and according to the dangerous logic of technological thinking, to be material for rendering, consumption, and disposal. As Athena Athanasiou writes, one of the results of modernity's functioning is the "broken organicity" of life as it is "processed" by essence of technology (134). *Ge-stell* makes the world work, but the complement of a working world is the world's

inevitable "becoming-waste," the scrapping of human and nonhuman bodies and lives "figured as final products, mere effects, of a technological inevitability, vestigial (or skeletal) residues of *physis* in . . . the wastelands of modernity" (135).

There is more at stake here than a simple antagonism of human and machine. From a neoliberal economy of optimization and innovation emerges a more encompassing ecology that has to do with circulations of biocapital and human capital and the disruptions these circulations spell for individual and collective lives, both human and nonhuman. To proclaim, "the robots are here," raises a question of biopolitical divisions engendered by the insular techno-logic of innovation. The statement may not portend, for Brooks, a violent uprising of superior machines and the annihilation of the human species; however, it does speak to potentially violent shifts in the delineation, maintenance, and security of the boundaries of everyday life. What is most unsettling is the seeming attempt to ensure the integrity of certain lives over and above others through an operative logic of isolation or, more accurately, of immunity.

Commune

> Life is a window of vulnerability. It seems a mistake to close it. The perfection of the fully defended, 'victorious' self is a chilling fantasy.
>
> —DONNA J. HARAWAY, *Simians, Cyborgs, and Women*, 224

Roberto Esposito claims that the organization of biopower in modernity responds in the first instance to a "paradigm of immunization." As a biopolitical concept and strategy, immunization institutes a "negative protection of life" that "makes of individual self-preservation the presupposition of all other political categories" (*Bíos* 9). As such, immunity stands in "contrastive symmetry" to community; it is, etymologically as well as

conceptually, the inverse and negation of community—community turned inside-out. Each denotes an opposing relation to a *munus*, a gift or tribute by which one assumes an onus or duty toward others, a gift one has an obligation to give:

> Tracing it back to its etymological roots, *immunitas* is revealed as the negative or lacking *[privativa]* form of *communitas*. If *communitas* is that relation, which in binding its members to an obligation of reciprocal donation, jeopardized individual identity, *immunitas* is the condition of dispensation from such an obligation and therefore the defense against the expropriating features of *communitas*. (50)[3]

If a community is that which draws its members together through a compulsory dispossession or expropriation, then immunity is that which secures the establishment of property, cultivates a proper self in relation to what is other, and consequently defines what counts as an appropriately "livable" life.

The logic of immunization thus becomes a strategy to mitigate the compromising experiences of vulnerability and finitude. It seems a mistake to close off these experiences because a life so impervious to the communicability of difference can only become immured in itself, subject to a frightful inertia in which it would be vulnerable only to itself, to its own immuno-logic, gradually succumbing to the self-affliction of an

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3. See also the opening pages of Esposito's *Communitas*:

> [T]he *munus* that the *communitas* shares isn't a property or a possession [*appartenenza*]. It isn't having, but on the contrary, is a debt, a pledge, a gift that is to be given, and that therefore will establish a lack. The subjects of community are united by an 'obligation,' in the sense that we say 'I owe *you* something,' but not 'you owe *me* something.' This is what makes them less than the masters of themselves, and that more precisely expropriates them of their initial property (in part or completely), of the most proper property, namely, their very subjectivity. . . . [T]he common is not characterized by what is proper but by what is improper, or even more drastically, by the other; by a voiding [*svuotamento*], be it partial or whole, of property into its negative; by removing what is properly one's own [*depropriazione*] that invests and decenters the proprietary subject, forcing him to take leave [*uscire*] of himself, to alter himself. (6-7; original italics)

auto-immunity. This does not mean we should commit ourselves to a postmodern or posthuman free-for-all, where all boundaries fall away in the final dissolution of all immunity. This, too, is a victorious fantasy that dispenses with finitude. Immunity is "the 'nonbeing' or the 'not-having' anything in common" (51), but it is also the structural condition of being-in-common. Esposito points out that, without the interposition of boundaries, without restrictions as to who or what may be introduced, incorporated, or communicated into a collective, there can be no discernible community, no mark of difference. The task is to retain a vulnerability that preserves difference in the very transgression of boundaries, that draws distinctions between self and other by virtue of a continuous process of their reconstruction and re-delineation. The boundaries of community are always vulnerable, permeable, and therefore iterative, their finality always open to reevaluation and reinterpretation.

The merger of flesh and machines thematizes a modern attitude in the sense that it does little to modify the ways of thinking and feeling that produce and maintain the closed community of a privileged "us" that is in command of itself and its constitution because it casts off and immunizes itself against any threats to its integrity and autonomy. If the organic body is figured in technological terms, as a biomolecular and economic machine of production and reproduction, it is not to undermine but to emphasize the autonomy held by very specific groups of human individuals over the functions and functionality of life itself. The de-differentiation of robots and organisms, of biological and artificial life, proceeds according to a political *ēthos* whose foremost problem is no longer just to "'make' live and 'let' die," as Foucault once said (*Society Must Be Defended* 241), but to maximize vitality, to innovate continuously upon the utility of life,

all life, toward exclusively human ends.

Nevertheless, the crossover of robotic and biotechnological engineering at the heart of Brooks' speculations always threatens to subvert notions of a purely human "us" in favour of a wider community of human and nonhuman beings bound in reciprocal relations of redesign and reengineering. In order to illustrate how this crossover can play out at its most radical, Brooks details experimental research conducted at MIT's AI Lab by Tom Knight and Ron Weiss, who "started to turn genetically engineered living *E. coli* cells into little tiny robots" (234). To effect this transformation, they modified their bacteria with a gene "stolen" from the Japanese pinecone fish, which possesses bioluminescent organs on its lower jaw. Using this gene, Knight and Weiss manipulated the bacteria's "menu of sensors and actuators" (234) so they would luminesce in the presence of certain molecules as well as other *E. coli*: "Already Knight and Weiss have produced beakers full of robots, billions of robots of two different species, communicating with each other and switching on and off luminescence displays in response to messages from other robots and the concentration of signalling molecules in the solution" (235). The behaviour of the two species of *E. coli* is the product of a cybernetic exchange of messages in a nonlinear, open-ended dynamic between an organism and its environment. The direct link of sensing and action plays out in a bacterial light show that is full of significance as messages flow among the two species of *E. coli* robots and the molecules of their milieu. With the proper engineering, Brooks remarks, the capabilities of these cells could be widened to detect specific aspects of pH balance, light, electric charges, magnetic fields, simple molecules, and so on, which could then be linked to controls for flagellar activity, enzyme production, even cellular death.

Brooks tells the reader that, in order to create these bacterial robots, the researchers must "impose a digital discipline onto these cells" (235). The DNA they inserted into the cells caused RNA transcription to operate as a Boolean NOT gate, the basic element for building the more complex operators that occasion digital processes. From intestinal flora, the fundament of digital computation. The discipline that makes this possible betrays a further experimental violence, apparent in Brooks' enthusiastic descriptions of the *E. coli* being "hijacked" so that "complex computations can be forced to happen inside the living cell" (235). Computation is here more than simply a metaphor that governs a set of truth claims; it is a concrete technology of biopower whose very material effect is the prokaryotic pyrotechnics put on courtesy of a forced genetic reprogramming. In case there was any doubt, Brooks writes, "What is important here is that computation ultimately controls some of the processes of a living cell" (235). Extrapolating from this research, Brooks foresees the possibility of incorporating "programmed cells within living organisms, and even within ourselves" (235). Gene manipulation allows for the manufacture of organic artificial life, biological robots to be incorporated into living bodies in order to control the processes of life itself and guide the pathways of evolution.

Yet the presentation of genetically engineered bacteria-bots as a privileged model for the merger of flesh and machines hints that the "us" Brooks repeatedly invokes might not necessarily be a solely human collective. Franklin argues that the body of knowledge giving rise to the concept of evolution "results in the production of an epistemic system focused upon the underlying connectedness of all living things. These connections, envisaged as a system of genealogy, in turn produce the conditions enabling the

emergence of the concept of life itself" (193). According to the Darwinian model, the history of life unfolds along a vertical axis, the prime significance of which is so frequently construed as a progression (despite the image of radiation and ramification inherent to Darwin's Tree of Life). Thus, Franklin writes, "it appears life itself has always been inextricable from its invocation as a story, if not *the* story"—a family saga that speaks to living beings of their "shared, primordial ontology" (197; original italics). For Franklin, this narrative of consanguinity and genealogical unification reaches a turning point with the biotechnologies of genome mapping and genetic engineering, which disrupt the conception of a linear trajectory of succession with their ability to induce lateral exchanges of genetic material and rearrange lines of descent.

The unquestionable acts of violence that such biotechnological machinations perpetrate upon organisms force unexpected ties between entities, engendering strange new collectives and kinships among disparate life forms, such as those Knight and Weiss have introduced between strains of *E. coli* and the pineone fish. Such collectives also draw profound ties to the technological implements and practices that target bodies at the molecular level and enable the invasions and interventions that alter those bodies and their capabilities. "Biotechnology actually heightens the experience of complex inseparability between the living and the nonliving," Mackenzie argues. Because of this intensified entanglement of living and nonliving entities, biotechnology complicates the humanist assumption "that something living animates technology." Instead, life becomes "a kind of design, and a kind of engineering, but a designing that intimately associates living and nonliving elements" (175). The violence of this association only highlights the notion that biology and technology stand irreducible to yet inextricable from one another,

held in a tension that ensures neither can be taken on its own.

If it remains true that "modern man is an animal whose politics places his existence as a living being in question" (Foucault, *History* 143), it is surely in part because of the intense investment in and innovation upon the technicity of that animal's life. However, the flip side to the *ēthos* of contemporary biopolitics is that it actively cultivates the vulnerability of bodies, exposing life to nonliving elements in the interests of (human) enhancement. What Rose calls the "political vocation" of the life sciences can be accomplished only through the exposure of the organic body to the communicability of technology. Of course, the belief that thoroughgoing technical enhancements of human life are not only possible, but inevitable, also drives the political, commercial, and academic vocation of the *artificial* life sciences, which put forward the power of intelligent technology to effect such enhancements through partnerships and mergers with machines, whether at the social or somatic level. But the attitudes, practices, and innovations that push societies to the threshold of modernity not only push human and animal life to their limits; they place the existence of technological objects as nonliving beings in question as well.

PART 3

Chapter 5

Anaesthetic animals and animated machines: That lifelike feeling

It felt

> It remains a problem in itself to define ontologically the way in which the senses can be stimulated or touched in something that merely has life . . .
>
> —MARTIN HEIDEGGER, *Being and Time*, 396

Brooks' attempts to undermine our allegiance to an overanthropomorphized sense of human "specialness" draw in large part from a scientific rationalism that reduces the organic body to "a highly ordered collection of biomolecules," a machine that operates according to the necessity of physical and chemical laws (*Flesh and Machines* 172-73). At the same time, his conviction that a genuine artificial life is a possibility derives from the reversibility of the organism-as-machine analogy. If living beings are highly complex machines, it stands that machines can be living beings—they just need to be sufficiently complex. The logic of molecular biology generates a discursive indeterminacy between the living and the nonliving that researchers in AI and ALife are more than happy to take up to support their own claims.

Yet Brooks also draws his arguments from a decidedly less scientific angle. Indeed, he explicitly insists, "we must become less rational about machines in order to get past a logical hangup that we have with admitting their similarity to ourselves" (175). Becoming less rational for Brooks involves a turn to the ambiguities of feeling, both

emotional and perceptual. In one interview, he proposes that the successful creation of life in a machine might be judged according to what one felt in its presence: "[I]f we did have a machine which we felt uncomfortable turning off, then I think I would have succeeded in building a living system if it made me feel that way about it" ("Does Artificial Life Have a Mind"). To prompt an empathic response, Brooks seems to argue, is to cultivate the sense of life that he is after with his artificial creatures.

A different sort of feeling crops up in *Flesh and Machines* when Brooks describes Genghis, the robot he deems both his "most successful" (44) and his "most satisfying" (46). Brooks built Genghis in 1988 with a young entrepreneur named Grinnell More and then-undergraduate Colin Angle, the latter of whom co-founded iRobot with Brooks and Helen Greiner in 1990. A six-legged robot able to "scramble easily over quite difficult surfaces" (45), Genghis becomes in Brooks' depiction a predacious bug that "walked like a slightly ungainly stick insect" (46). It would use its "beady array" of infrared sensors to spot the invisible glow of mammalian warmth and then "ruthlessly" chase people down with a "wasplike personality" that carried a sense of "mindless determination" (46). With all the brazenness of a modern Prometheus, he continues, "When it was switched off, Genghis was a lifeless collection of metal, wire, and electronics. When it was switched on, it came to life! . . . It acted like a creature, and to me and others who saw it, it felt like a creature. It was an artificial creature" (46).

The exclamatory confidence that announces the coming-to-life of this insectile creature from a "lifeless collection" of parts is certainly less than rational, but it is the *feeling* that accompanies its creaturely activity that I find most intriguing. To claim that a construction of "metal, wire, and electronics" not only acted like an animal, not only

simulated or imitated an animal's vitality, but felt convincingly so, ruffles the common-sense authority of empirical judgment that would attest to the contrary, unsettling the reasoned understanding of machines as rational compositions of inanimate parts.

What does it mean for technology to feel alive, to make its animated (and animating) presence felt? The vibrancy with which Brooks often portrays his inventions imbues them with a creaturely vitality that is obviously aesthetic, having both to do with the skilful artifice in their coming-to-life and the "style" of feeling, sensation, or perception they evince. His robots are creaturely in that they are technologies of touch and being in touch, tapping into a tactility Marshall McLuhan insisted was the primary characteristic of electronic media.[1] In the course of this chapter, I will explore how the figurative reversal of the animal-machine trope carries the mutually implicated aesthetics of eros and pathos. Desire and tenderness, longing and sympathy: these are qualities that turn upon finitude and the relative abilities and disabilities beings have with respect to communicating and connecting, assembling and interacting, encountering and engaging—in short, in coming together and getting into touch, in pleasure and in suffering. There is an ethics involved here that I am most keen to elaborate upon, which has in the main to do with reimagining our relations to nonhumans, both living and (ostensibly) nonliving, and with rethinking the communities and collectives to which we belong on account of those relations.

To work through the ethical implications posed here, it is important to consider the ambivalence around our tangible propinquity to both animals and machines. This ambivalence is distinctive to humanistic strains of modern thought. When a machine

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1. On the tactility of electronic media, see Marshall McLuhan's *Understanding Media*.

feels, however briefly, like a creature, the liminality of its artificial life inspires an apprehensive vacillation of attraction and withdrawal that throws the certainty of our relationships to both artifice and life into confusion. On the one hand, the hint of animism roused by a lively machine attracts or seduces—one could even say enchants; it invites a certain recognition and familiarity, conjures an impression of chimeric kinship, one that reaches between species of being. On the other hand, the discerning apprehension that this quickening is a machination effects a distancing and withdrawal; it defamiliarizes and delimits, placing restrictions on the kinds of contact that may reasonably transpire between subjects and objects. In the three chapters that make up this part, I will specifically thematize the play between recognition and misrecognition, familiarity and estrangement, uncanny apprehension and empathetic allure, affects which bear upon the aesthetics of artificial life in that they are both associated with uncertain boundaries and ambiguous border crossings—like those between self and other, subject and object, living and merely lively.

The technological life Brooks ascribes to his creatures is by no means unequivocal. For instance, in the paragraphs immediately following the fiat of feeling by which Genghis is creaturized in *Flesh and Machines*, Brooks retreats from the full implications of his exclamations:

> Genghis's physical form undoubtedly gave it some of its personality, although that had not been a conscious design decision made by Grinnell, Colin, or me. More importantly, its software gave it "life." It acted in ways that appeared lifelike—it acted as a creature might act in similar circumstances.
>
> Of course, software is not lifelike itself. But software organized the right

> way can give rise to lifelike behavior—it can cross the boundary from machinelike, which is how we normally think of software, to animal-like. (46)

The Promethean confidence in the previous exclamation, "it came to life!" has now given way to a certain diffidence: in the scare quotes around "life"; the repeated qualifier, "life*like*"; the shifts to the subjunctive mood with "*might* act" and "*can* give rise."

Brooks often sways like this from intentionally brash statements to measured qualifications as to the life of his machines. But even his qualifications point toward the possibility of transgressing our "logical hangups." What he calls our "dances with machines"—which in his writing are also intimate dances with *animals*—turn between conviction and doubt to produce the uneasy tension between recognition and misrecognition, rational knowing and uncanny unknowing. This tension evokes an uncertainty or indeterminacy concerning the lively performances and lifelike appearances variously possessed by machines, animals, and human beings—the latter being those animals intimately involved with and fundamentally animated by their machines.

In touch

On one level, the behaviour-based robotics Brooks helped pioneer and the implications it holds for considering the nature of human consciousness and intelligence suggest a "Cartesianism turned upside down" (Hayles 203). As I have discussed above, his approach was in many ways a rejoinder to a paradigm of AI research he saw as having erred too far into problems of linguistic and symbolic representationalism in its grail quest for human-level intelligence. The GOFAI faithful pursued their object through exercises in mathematical calculation, games with formalized rules, linguistic parsing, and so on—operations of intelligent cogitation that are, if not immaterial, then at least not

medium-specific. The Cartesian abstraction of the mind from the body is plainly one of the foremost philosophical principles upon which the "in principle" argument for the instantiation of intelligence within a computer is conceivable in the first place.

Brooks counters this agenda with a focus on the brute basics of sensory-motor experience, building layers of stratified behaviour in an incremental fashion, adding complexity from the bottom-up.[2] This evolutionary approach conceives "human level intelligence" to be epiphenomenal, the emergent result of layers upon layers of primitive reactions to the material world. "I don't believe it's possible to have a disembodied intelligence without a physical connection to reality," he remarks in Morris' *Fast, Cheap, and Out of Control*. "Everything we think, everything in our thought processes is built around being in touch with reality. Even the word 'touch.'" While an intellect so grounded in touch and touchability certainly contrasts with the rarefied *res cogitans* Descartes identifies with the human subject (*Discourse*, part 4; 1: 126-31), Brooks' conceptual appeal to touch as an essential characteristic of animal existence entices me to take a more detailed turn to Descartes.

With the seventeenth-century thinker we find that the problematics surrounding flesh and machines have as much to do with human relations to animals as to high technology. It is well known that Descartes conceived all living bodies, including those of human beings, to be automata (*Discourse*, part 5; 1:131-41). As John Cottingham points out, this means simply that a body is self-moving, and that its activity is explicable from the intricate, interlocking structure of its physical components (Cottingham 553). Yet the general ethical implications of this conception have to do with the subjugation of

2. The conceptual uprooting or demolition of traditional learning and subsequent return to square-one is, of course, an eminently Cartesian methodology.

nonhuman animals within a technological framework whose industrial character, in the past two centuries or so, has meant the introduction of many species to large scale cycles of production, reproduction, rendering, and consumption as food, entertainment, experimental equipment, and so on.

Georges Canguilhem, commenting upon Descartes within the context of a wider discussion on mechanical theories of the organism, places the question of the beast-machine squarely in the context of instrumental rationality: "The theoretical mechanization of life and the technical utilization of the animal are inseparable." He continues to argue that this relationship of dominion by "technical utilization" can ensue only if man "can consider all of nature, including, apparently, animate nature—except for himself—to be a means" (84). Canguilhem argues that, under the aegis of such a technologized knowledge, the modern humanist subject finds itself able to "take control of its destiny and transform its being into a duty," thereby realizing, in a generalized anthropology, the "condition for anthropogenesis" (19). This anthropogenetic duty is very much the ground of contemporary bioethics as biopolitics, whose objective is to instrumentalize fully the processes of "bare" life as a means toward the progressive cultivation of properly human living. The metaphorical formulation "organisms are machines" participates, then, in a discursive regime that opens animal bodies to countless forms of human machination, integrating them ever more seamlessly within increasingly mechanized processes of production whose foremost product is the human itself.

I propose a return to Descartes in order to flesh out the characteristically modern problem at play in the figurative rendering by which animals turn into machines. In a significant way, Descartes represents the modern attitude of domineering,

anthropocentric instrumentalism that continues to characterize our inertia relative to the ecological crises that devastate our planet and its inhabitants. Yet the same rhetorical torsion that turns animals into machines in his writing also turns machines into animals. The set of problems involved in this equivocal turning has its warp and weft in feeling and knowing the differences between these conceptual entities and the impossibility of feeling and knowing such differences with all rigour and certainty. The host of presumptions and errors in recognition that inevitably occur as we grapple with the organism-machine analogy impinge upon the lives of humans and nonhumans alike, and demand repeated ethical negotiations. With that in mind, a return to the philosopher of beast-machines and thinking things can at the very least offer a fuller sense of what it means to point to a machine and say, "It felt like a creature."

The monkey and the machine-beast

> Had Descartes, who opposed the human being as the embodiment of intelligence to the animal as a "machine," known about present-day electronics, he might well have spoken of the machine as an "animal."
>
> —ANDRÉ LEROI-GOURHAN, *Gesture and Speech*, 258

Descartes draws his decisive analogy between animals and machines in the final paragraphs of the fifth part of the *Discourse on Method*. At this moment of what he calls his "fable" about the proper direction of reason (1: 112), a palpable anxiety exists as to the observed similarities between humans, animals, and machines, and the danger that they might be, by dint of some artifice, confused with one another. Even though he is careful to indicate that the machinery of a natural body, "having been made by the hands of God, is incomparably better than any machine that can be devised by man," an epistemological dilemma presents itself as soon as he suggests the comparison: "[I]f any

such machines had the organs and outward shape of a monkey or some other animal that lacks reason, we should have no means of knowing that they did not possess entirely the same nature as these animals" (1: 139). Are we looking at the apings of an automaton, or just an ape? Significantly for my own argument, Descartes suggests that we would not be able to tell the difference because of its performativity: as long as the mechanical monkey was fashioned according to the proper form and possessed of the right components, it would both look and behave in a suitably persuasive way, such that its "nature" would be judged to be that of an actual monkey. By virtue of such a performative ontology, machines are just as animalistic as animals are mechanistic. The Cartesian beast-machine is, from its very inception, shadowed by a machine-beast.

The more pressing concern for Descartes has to do with the question of whether or not we could similarly be fooled by the performances of automata ingeniously contrived so as to resemble human beings. He immediately assures us that, should one happen upon such uncanny constructs, there would in fact be "two very certain means of recognizing that they were not real men" (1: 139-40). First, such machines would not be able to give "appropriately meaningful answers" to whatever questions we asked of them. Second, they would not be able to "act in all the contingencies of life" that "real men" encounter and adapt to every day (1: 140). Both machines and animals, so the argument goes, share a lack in the sort of versatile intelligence and rational understanding that human beings possess. Without the "universal instrument" of reason, their behaviour remains purely physical, and thus proceeds according to a more or less rectilinear causality of discrete reactions, which follow by necessity from the structural arrangement of their parts: "these organs need some particular disposition for each particular action"

(1: 140). Animals do not act according to self-possessed will or intention; rather, "it is nature which acts in them according to the disposition of their organs" (1: 141).

Descartes' formulation of the animal-automaton functions as an integral component in his project to confirm the exclusivity of man as an intelligent being, and to secure at the same time a place for God as the fabricator and guarantor of the rational soul, which has to be "specially created" for man in order to vouchsafe him the intellect that is properly his. Only man possesses the universal *organon* called thinking that unbinds him from the kinesiological disposition of his organs. This is modern Man, the "embodiment of Western logos" in Haraway's words (*Simians, Cyborgs, and Women* 173)—though "embodiment" is the wrong word for a being whose quintessential existence is entirely apart from the body, as Descartes repeatedly insists. This *logos* is not a word made flesh but just a word, one that names, judges, and controls, one that apprehends without touching. This is why intimate couplings with the flesh and physicality of animals and machines is key to learning "how not to be Man."

The age of iatromechanical reproduction

For all his emphasis on thought and the rational soul, Descartes' writings are often remarkably visceral in their focus, and exhibit a zeal for the practice of anatomy. He returns again and again to comprehensive and detailed descriptions of the body and its parts: the *Discourse* contains a protracted illustration of the heart and the circulatory system that takes the bulk of part 5; in *The Treatise on Man*, he imagines himself fabricating fictional men piece by piece to inhabit the "new world" he engineered in *The World*; his unfinished *Description of the Human Body and of All Its Functions* endeavours to provide exactly what the title promises, entering into an embryological

study to deduce the significance of its various functions from their seminal formation; *The Passions of the Soul*, his final published work, explains the physiological causes and effects of the passions as a therapeutic against their excesses. He was thus an enthusiastic participant in early modern Europe's "culture of dissection" (Sawday), a culture whose theatrical, textual, and diagrammatic displays of fragmented bodies were summoned at once on two fronts. First, they were encouraged by a humanism that entreated man to know himself from within and without. Second, they were urged by a new *scientia* that raised the call to question the received knowledge of the scholastics toward a more practical philosophy, to penetrate empirically the secrets of nature, and thereby assert the authority of Man over her dominion.

The humanist enterprise behind natural philosophy in general and anatomical study in particular is, moreover, for Descartes of paramount importance toward devising technical means to improve the body in order then to refine the human soul. In Part 6 of the *Discourse*, he submits that, if we could know the "power and action" behind the untold phenomenon of the world, including those that govern the body and its interactions with the world, it would be

> desirable not only for the invention of innumerable devices which would facilitate our enjoyment of the fruits of the earth and all the goods we find there, but also, and most importantly, for the maintenance of health, which is undoubtedly the chief good and the foundation of all the other goods in this life. For even the mind depends so much on the temperament and disposition of the bodily organs that if it is possible to find some means of making men in general wiser and more skilful than they have been up till now, I believe we must look for it in medicine.

(1: 143)

In this *avant-la-lettre* bioethical initiative, whose goal is to optimize men's individual skills and knowledge through the invention and application of "innumerable devices," the crossover between bodies and technologies becomes clear as a moral focus. For Descartes, as for us today, the pursuit of this biotechnical agenda involves an uneasy bargain, of which the uncanny possibility of artificial life and its attendant confusions is one of the more intriguing figurative manifestations.

In the dissecting theatre, the human body, its interior exposed to the anatomist, the gentleman philosopher, the draughtsman, and so on, revealed itself to be disquietingly nonhuman. Laid bare to inexhaustible analysis, this body was patently comparable, in the regularity and autonomy of its functioning and its seemingly purposeful design, to the increasingly sophisticated, self-moving devices of the seventeenth century: the various clocks, mills, and fountains which, Descartes observes in the *Treatise on Man*, "the skill of man can construct with very few parts" (1: 139). The body became known and knowable as a complex architecture of hydraulic circuits and mechanical structures. Such rationalized segmentation was the consequence of a knowledge made for cutting, as Foucault would say: a discourse of segmentation and classification, whose most valuable tool was a language that named parts and designated their character with mathematical exactitude.[3]

Beginning with Andreas Vesalius' *De humani corporis fabrica* of 1543, the exuberant printing of richly illustrated anatomical texts reproduced, in precise graphic detail, the human body as tidy *écorchés*, orderly skeletons, and meticulous inventories of

3. On the primacy of classification to early-modern natural history, see Foucault's *The Order of Things*.

parts. An anonymous normalization of human physiology precipitated from the power of mechanical reproduction. If the "aura" that constitutes an object's uniqueness and authenticity is, as Walter Benjamin conceives it, the function of distance and a certain mysterious inaccessibility, then the orthographic exhibition of the body's interior—which makes the interior accessible, bringing it to the surface—pries from the body any authority it may have afforded in distinguishing individual men from one another.[4] The gradual standardization of anatomical form and function from the inside out made it difficult to locate the unique self as an indwelling feature of the physical body, prompting a turn to the unoccupied no-place of metaphysical existence.[5]

More unsettling, perhaps, was the sense that this standardization extended across species. Reading Descartes, the resemblance between human and animal anatomy, especially where mammals are concerned, is for him both obvious and propitious toward understanding the functions of the human body—at least those functions which do not

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4. On proximity and the aura, Benjamin writes

> Namely, the desire of contemporary masses to bring things 'closer' spatially and humanly, which is just as ardent as their bent toward overcoming the uniqueness of every reality by accepting its reproduction. Every day the urge grows stronger to get hold of an object at very close range by way of its likeness, its reproduction. . . . To pry an object from its shell, to destroy its aura, is the mark of a perception whose 'sense of the universal equality of things' has increased to such a degree that it extracts it even from a unique object by means of reproduction" (223)

5. David Hillman argues that the "profusion of anatomical texts" in early modern Europe was driven, in part, by a "desire for absolute knowledge of the body's interior," opening it to an exacting anatomical gaze. The result was a certain technological standardization of the anatomical form:

> The rise of anonymous, normative models of the insides (models that, in spite of individual variations, all human bodies supposedly approach) led to a 'technologizing' of the interior and a gradual move away from the location of the self within the body and toward a Cartesian or purely mechanistic understanding of the relation of self to standardized corpus. (84)

This "technologization" of the human body reaches its Enlightenment culmination with La Mettrie's *Machine Man* and, in a more gruesome vein, the writing of de Sade. Indeed, one of the defining characteristics of de Sade's terrifying world, Marcel Hénaff argues, is that the body becomes only its anatomy, to be used at the whim of a libertine's pleasure: "Take a (human) body, strip it of all its symptoms, free this impassive matter of all expression, give a detailed description of its parts, just as you would a machine's, and connect it to other bodies, for no grander purpose than sexual gratification" (Hénaff 18).

depend upon the rational soul, those which we seem to share with the unreasoned beasts. For instance, part 5 of the *Discourse* contains a rather protracted "explanation of the movement the heart and the arteries," which the text offers as the mechanical starting-point for thinking about the body's functions as a whole, since it is "the first and most widespread movement that we observe in animals" (1: 134). Worrying over the difficulty of this highly technical section, Descartes asks "anyone unversed in anatomy" to put the book down immediately and, in the interests of comprehension, "to take the trouble . . . to have the heart of some large animal with lungs dissected before him (for such a heart is in all respects sufficiently like that of a man), and to be shown the two chambers or cavities which are present in it" (1: 134).

Apparently Descartes regarded this "sufficient likeness" to be increasingly self-evident over the course of his writing career. In the *Description of the Human Body*, written a decade or so after the *Discourse*, he writes, "Everyone already has some knowledge of the different parts of the human body." He makes this assumption precisely because of the visceral affinity between humans and animals: "Indeed, we have all at some time or other seen various animals cut open, and been able to look at the shape and arrangement of their insides, which very much resemble our own" (1: 315). No longer worried about the anatomically unlettered, he now takes for granted a universal intimacy with cut-open bodies of all sorts. Not only this, the casual sight of animal innards is now adequately propaedeutic to what he is about to say about the human body, a grounding in everyday experience that makes the resemblance between the two that much more familiar.

This familiarity is a nagging source of anxiety for Descartes. Man is so

undeniably similar in the flesh to the animals he employs and consumes that he must not only differentiate himself from the machinery of the world, but also justify the unhindered use and modification of that machinery toward his own material and metaphysical well-being. While a great many creatures may be "sufficiently like" man in physiological organization and function to warrant their presentation as working analogues of the human body, it nevertheless remains that the flesh cannot suffice as a medium by which to found a strict fellowship with beasts. In the fifth set of the *Replies*, for instance, the meditator roundly disdains his critic for thinking himself akin to a dog on account of a carnal similitude: "Seeing that a dog is made of flesh you perhaps think that everything which is in you also exists in the dog" (2: 248).

To imagine that the flesh one shares with a dog constitutes any form of kinship puts the existence of man's own immortal soul at stake, bringing one uncomfortably close to the realm of atheism. As he closes part 5 of the *Discourse*, Descartes writes, "For after the error of those who deny God . . . there is none that leads weak minds further from the straight path of virtue than that of imagining that the souls of the beasts are of the same nature as ours, and hence that after this present life we have nothing to fear or to hope for, any more than flies and ants" (1: 141). Insects simply "perish" (to use Heidegger's terminology). They are barely living, forms of existence just this side of rocks and stones, which disappear into the mutable flux of the inhuman temporality of matter and therefore cannot participate in the salvation.

These worries over our deaths relative to those of flies and ants have their flip side in the more immediate, ethico-juridical matter of killing. Descartes addresses this matter by way of an almost confessional statement in his letter to Henry More of 5

February, 1649: "My opinion is not so much cruel toward animals as indulgent toward human beings—at least to those who are not given to the superstitions of Pythagoras—since it absolves them from the suspicion of crime when they eat or kill animals" (3: 366). Descartes expresses a lingering misgiving about the conduct of human beings toward animals, a suspicion they must be absolved of by way of an indulgence on his part. In a certain sense, Descartes' opinion comes as a response, a concession after-the-fact, to the troubling indictment, ever-present or ever-returning, that killing animals is a crime.

Considering the confusions that can and do arise on account of the body, its sensuality, and its sympathies, it is morally imperative that he propose a rigorous distinction by way of the *res cogitans*. With the flesh so misleading, even criminally indicting, Descartes turns to the reassuring authority of language to mark the presence of the rational soul and thereby differentiate man from the animal-automata to which he otherwise bears such a morally unsettling resemblance. The certainty of the *cogito*, by which man proves to himself his distinct (and distinctly human) existence, is first and foremost, a spoken or signed certainty. For an exultant "I am" to proceed from the deductive reasoning that "I think," it must be *said*. More to the point, it must be said to one's fellows, in their company. After all, if we hold the ability to "use words, or put together other signs," something neither the most ingenious automaton nor the most incredible monkey or parrot could ever achieve, it exists "in order to declare our thoughts to others" (1: 140). As Derrida points out, it is the declaration that there is thinking going on that lends credence to the goings-on of thought. Through language, the human subject can bear witness to the "autobiographical truth" of his indubitable self-knowledge (*The*

Animal 76-78). Animals, on the other hand, are unfit to give such testimony. Even if there are certain creatures, like parrots, monkeys, and magpies, that "can utter words as we do," Descartes maintains, "they cannot show that they are thinking what they are saying" (1: 140). While thinking is declared in the saying, the saying itself does not necessarily show the presence of thinking.

There is a disjunction at this point between representational and performative ontologies that comes down to an anthropocentric self-positioning. In the letter written to Reneri for Pollot in April or May 1638, Descartes concedes that we often judge animals to possess thoughts, intentions, and feelings—in short, a soul—because of the actions we see them perform. "All of us are deeply imbued with this opinion by nature," he writes, giving nature a curious role in so misleading us (3: 99). This sentiment seems so natural that "it is hard to say publicly how the case stands without exposing oneself to the ridicule of children and feeble minds" (3: 99). In any event, this childish and feebleminded opinion is predicated on a mistaken ascription of something inside from what appears on the outside: "We base our judgement solely on the resemblance between some exterior actions of animals and our own; but this is not at all a sufficient basis to prove that there is any resemblance between the corresponding interior actions" (3: 100).

Early on in the *Meditations*, he famously wonders if the men he sees crossing the town square are real men, or robots in disguise: "[I]f I look out of the window and see men crossing the square, as I just happen to have done, I normally say that I see the men themselves. . . . Yet do I see any more than hats and coats which could conceal automatons? I *judge* that they are men" (2: 21; original italics). While this passage is clearly an expression of Descartes' suspicion of the senses, he is also brought up short by

what he would "normally say," what he would say automatically, without really thinking about it. Earlier in the same paragraph, he expresses amazement at the weakness of his own mind, finding himself "almost tricked by ordinary ways of talking" (2: 21). His own language is potentially deceptive, pushing him to ascribe empirical truth to something he only says he saw: "And so something I thought I was seeing with my eyes is in fact grasped solely by the faculty of judgement which is in my mind" (2: 21). Yet he promptly dismisses this fancy, shying away from the implications of his own "normal" reaction to what he sees. The self-same language by which he can be sure that he thinks and exists, and by which he sets himself apart from the beasts, may nevertheless trick him into the same fallacious judgement concerning the men outside his window that those of lesser faculties adopt concerning animals. Thus he admonishes himself as to the proper exercise of doubt, giving retrospective bounds to his fundamental methodology: "However, one who wants to achieve knowledge above the ordinary level should feel ashamed at having taken ordinary ways of talking as a basis for doubt" (2: 21). It is childish and feebleminded to follow a natural opinion and judge animals to possess an interiority based on what one can see them do, but when it comes to human beings, it is shameful not to trust what one would normally say about what lies beneath appearances.

Insensitive being

> . . . if there is a being, so to speak, steeped in feeling, it is the animal. Animals seem to have been paid completely in this coin, which (in another sense) so many men lack.
>
> —LA METTRIE, *Treatise on the Soul*, 52

Derrida emphasizes that, for Descartes as for an entire tradition of thought that runs up through Kant, Heidegger, Levinas, and Lacan, to testify to thinking, to declare "I think"

with sufficient credibility, is to be able to *respond* to questions asked. The freedom of response and responsibility is proper to man but unavailable to animals, the latter being purely physical things that can only react mechanically and unthinkingly (*The Animal* 83-87). Such is the "judgement," the "verdict" or "sentence" Descartes passes "concerning where the animal stops, the limit at which it comes to a halt, must stop or be arrested" (83). Defining the limits of animal life, and so situating the animal against the human (in opposition to, but also proximally, as in right up against), Descartes grants man the right to self-definition and self-positioning. Derrida argues that the testimonial utterance, "I say that I think therefore I am," a testimony which "in truth commands like a form of mastery over the animal," heretofore marks the philosophical tradition of modernity as "the discourse of domination" (89). This discursive mastery functions by way of a moral distinction whose logic is primarily sacrificial: "The animal (and even the animal in man) cannot be taken to be an end in itself, but only a means. It belongs to the purely sensible order of existence that must always be *sacrificed*" (100; original italics). Mortal, sensuous life, the life of touch and flesh: this is what is sacrificed in Cartesian cognitivism.

If the *cogito* functions so imperiously within modern thought, perhaps it is due to its ultimate insensibility. Though one *says* "I think," the *feeling of its being said* cannot point to one's being, even if it does give evidence of life. The breath by which one speaks certainly indicates the presence of life, as do the movements of the blood and the throbbing of the heart. The living body, moved as it is by the "very fine wind" or "very pure and lively flame" (Descartes 1: 138) of the animal spirits as they pass along the nervous system and move through the brain, is nevertheless "removed from the sacred

purview of the *pneuma*" (Judovitz 28). The body is less a material frame to house an inspiriting breath than a device driven by gas under pressure; the *pneuma* becomes pneumatics. Because the body's animating principle now falls squarely within the secular compass of physics, the automaticity of its living and breathing does little to mark the presence of a rational soul, and so cannot prove the existence of a fully human subject.

A philosopher of ghosts as well as animals, Derrida writes, "Even if it is not necessarily signed by a dead person, this *cogito ergo sum* should not, all the same, have anything to do with the self-affirmation of a life, of an 'I breathe' that would signify 'I am living, I have breath in me [*animé*], I am animal'" (*The Animal* 86). What does quicken such spectral subjects is a rarefied language, a model of communication John Durham Peters would refer to as "angelic," through which minds strive to know one another in mutual thinking, uncompromised by the confusions of touch. Such is the Cartesian revenant that returns so often in contemporary technohumanist and cyborg fantasies that envision human beings as messages in exchange, information that wants to be free, content in need of liberation from the clunky medium of biological life. These are the modern dreams that angelize the human, even as they brutalize the material, apparently nonhuman world.

The most ethically damaging problem we have inherited from Descartes might not be that organisms are philosophically and sophistically "reduced" to automata. Perhaps the reason beasts and bodies seem so alien to things that think is not because they are animated machines, but rather because humans are, as Daniel Heller-Roazen suggests, anaesthetic animals. In *The Inner Touch*, Heller-Roazen positions Cartesianism as a

turning point at which Western culture began to divest itself of sensation as the ground of ontological and ethical awareness. Beginning with Aristotle's discussions of the senses in *De anima* and *De sensu et sensibilibus*, he performs an archaeological excavation of the Peripatetic doctrine of *sunaisthēsis*, the "common sense," which was widely conceived, throughout antiquity and the Middle Ages, to inhere in all living beings as the general sensation by which they sensed their existence. It was by virtue of *felt* being that ethics was possible in premodernity: "The ancient thinkers all assumed that an ethical being is by nature a sensitive being, consigned from birth to a life in which perceptions, misleading or propitious, cannot be avoided" (271). To care for oneself, to know oneself, as the Delphic principle stated, and thus to care for and know others, was to be sensitive to the vulnerabilities of mortal existence, to be vigilant about the body, reflecting upon and cultivating its state of well-being through self-examination and training in preparation for the various afflictions it would inevitably suffer.[6] The basis for ethical comportment toward others was thus characteristically *tragic*: coming together in friendship or in love (*philia*, *eros*, *caritas*), was predicated upon compassion and sympathy (*pathos*, *affectus*, *compassio*). By no means was Descartes indifferent to human vulnerabilities—to errors of judgement, to the sway of the passions, to various diseases and disabilities and their effect on the soul—and he certainly expresses an ethical concern for the sensitivities of the body—in the hopes for medicine he expresses near the end of the *Discourse* and elsewhere, the psycho-physiological study he undertakes in *The Passions*, and so on. But his solution is ultimately to withdraw from the sensual world and to focus all attention on the cultivation of reasoned intellect.

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6. Foucault points out that the injunction to "know yourself" was in fact meant as an admonishment: "Do not suppose yourself to be a god" ("Technologies of the Self" 226).

That which lies withdrawn from the senses is what is definitively human about our being for Descartes. When he asserts the capacity "to declare our thoughts to others" through a language of words or some other system of signs, he makes sure to stipulate that it is not enough simply to produce the noise of speech. A few lines later, he emphasizes the point with a cautionary distinction: "And we must not confuse speech with the natural movements that express passions and which can be imitated by machines as well as animals" (1: 140-41). By way of illustration, Descartes imagines an automaton "so constructed that it utters words, and even utters words which correspond to bodily actions causing a change in its organs," then proceeds to sketch out some telling examples of how it might operate: "if you touch it in one spot it asks you what you want of it, if you touch it in another it cries out that you are hurting it, and so on" (1: 140). Be it to inquire after another's desires or to protest the infliction of pain, to react to a touch does not indicate conscious awareness; it merely demonstrates the necessity of the natural laws that govern all extended things. And, of course, we owe nothing to the laws of physics. It is in the context of such ethical anaesthesia that Heller-Roazen writes, "Any ethics worthy of the name must confront the promise and the threat contained in the sensation that today we may no longer, or may not yet, sense anything at all" (290).

Even so, thought makes for a touchy subject. Descartes writes, "To grasp something is to embrace it in one's thought; to know something, it suffices to touch it with one's thought" (letter to Mersenne, 27 May 1630; 3: 25). One interpretation of this comment could very well point to the thorough abstraction of touch. The only touch that suffices for one to know something, it seems to suggest, is ultimately incorporeal. However, I sense in Descartes' turn of phrase the tenacity of the tangible, the inability for

the subject of the *cogito* to know, to think, and therefore to be, without reference to some form of contact.

Heart-to-heart

> We have the impression, and it would be difficult to avoid this feeling, that a substitution can be made for all the senses except touch. What I see can be replaced. What I touch cannot, or in any case, we have the feeling, illusory or not, that touch guarantees irreplaceability: hence the thing itself in its uniqueness.
>
> —JACQUES DERRIDA, *Echographies of Television*, 124

Descartes' turn away from the endless speculations of the Schoolmen toward a more "practical" philosophy hinged upon *expériences*, the detailed observations of experience and experiment. Such observations absolutely presupposed physical presence, even if that presence was to be mediated by so many methodological, discursive, and technical apparatuses. For instance, Descartes' request to his readers that they witness an actual dissection in order to follow his presentation of the heart in the *Discourse* does not simply indicate a subscription to the efficacies of multi-modal learning; it has to do with an insistence that true causes be discovered according to reasoned deductions from concrete observations. Note, too, that it is not enough just to observe by looking. While the visual was the privileged datum of sense for scientific witnessing, there was still a place for the tactile. Descartes suggests that, to apprehend the form and function of the cardiovascular system and appreciate the "force of mathematical demonstrations" that illustrate the "true reasons" behind its operation and structure, one needs examine the arrangement of chambers, vessels, and membranes; see how the blood differs in colour and density as it passes through the heart; but also feel the warmth of the heart with one's fingers (1: 136).

A much more vivid reference to the virtues of tangible *expériences* occurs in the *Description*, where he mentions a "striking experiment" that invites the observer to probe the heart's movements in an even more intimate way: "If you slice off the pointed end of the heart in a live dog, and insert a finger into one of the cavities, you will feel unmistakably that every time the heart gets shorter it presses the finger, and every time it gets longer it stops pressing it" (1: 317). The most striking aspect of this experiment is undoubtedly its gruesome tactility, which ultimately overflows any demonstrative purpose and brings us back, with visceral force, to the resemblance that exists between our bodies and those of nonhuman animals. It casts into relief the vulnerabilities suffered by the flesh a dog is made of: the flesh Descartes cannot deny we share in kind with a dog, even if he wishes to assert that the *cogito* fundamentally sets us apart. More to the point, the pathos that invites us to recognize ourselves in this vivisection suggests that, whatever the "mathematical" congruence of heartbeats and blood flows among species, the likeness between a man and a dog is a *felt* one.

This is a likeness that cannot *but* be felt, considering the extraordinary violence that forcibly broke open the animal's thorax for Descartes' inquisitive fingers, a violence that remains palpable despite the discursive erasure of the details surrounding the demonstration's painstaking execution. One could easily charge Descartes with brutish cruelty toward this unfortunate creature, whose violation was justified on the grounds that it was simply an automaton. Which is to say, by virtue of the common-sense associations we hold today about the sensitive qualities of machines, that the dog did not feel anything at all. True, the body of a living being, including that of a man, is mechanical—in other words, knowable in terms of the physio-kinetic relations of cause and effect among its

various organs—but this is not to say it is devoid of feeling for Descartes.

Feeling dogs the thinking thing—sensation is the inescapable supplement of intellect. At the end of part 5 of the *Discourse*, having proven to his satisfaction the means of distinguishing "real men" from the beast-machines, Descartes further contends that the rational soul—"specially created" for man and in no way resulting from "the potentiality of matter"—must nevertheless be coextensive with its body (1: 141). The vehicular imagery that often lurks behind expressions of mind-body dualism in ancient and medieval thought is untenable for Descartes. He writes that the soul cannot be "lodged in the human body like a helmsman in his ship, except perhaps to move its limbs"; on the contrary "it must be more closely joined and united with the body in order to have, besides this power of movement, feelings and appetites [*des sentiments et des appétits*] like ours and so constitute a real man" (1: 141). In this appeal to a comprehensive self-steersmanship, Descartes casts the body as more than simply an instrument to be used by a soul on its way to more perfect things, creating a unity that points in no small way toward a secularization of the soul. Yet the constitution of a "real man" is suddenly distinguished, not by a rational soul expressing itself through appropriate responses in language or action, but instead by an embodied, *sensitive* soul possessed of feelings and appetites—one that, being touched or moved, would presumably ask what is wanted of it, or exclaim that it is being hurt in some way.

The ancient nautical metaphor for the dualistic self returns in the *Sixth Meditation*, once again cast aside in favour of a more intimate, though likewise thoroughly ambiguous, coupling of body and soul. In this text, Descartes uneasily confronts the insistent sensations of pain, hunger, and thirst, which bring him up against

an "insoluble worry" about the body's involvement with the mind, and betrays "the uncuttable knot in the centre of Cartesian metaphysics" (Cottingham 559). These various sufferings indicate that the body is lacking something, is ill or has been otherwise violated. These feelings and appetites are teachings, Descartes writes, from his "own nature," which vividly impress upon him the fact that he has a body that belongs indubitably to him:

> Nature also teaches me, by these sensations of pain, hunger, thirst and so on, that I am not merely present in my body as a sailor is present in a ship, but that I am very closely joined and, as it were, intermingled with it [*arctissime esse conjunctum, et quasi permixtum*], so that I and the body form a unit. If this were not so, I, who am nothing but a thinking thing, would not feel pain when the body was hurt, but would perceive the damage purely by the intellect, just as a sailor perceives by sight if anything in his ship is broken. . . . For these sensations of hunger, thirst, pain and so on are nothing but confused modes of thinking which arise from the union and, as it were, intermingling of mind and body. (2: 56)

The same nature that misleads us to the opinion that brute animals have some form of interiority once again provides some ambivalent pedagogy. However, here the confusion is not so much infantile or idiotic as it is indispensable for bodily self-awareness and mortal survival. The rational soul is not so angelic as to be wholly disinterested in the body's various pangs and afflictions: "For if an angel were in a human body, he would not have sensations as we do, but would simply perceive the motions which are caused by external objects, and in this way would differ from a real man" (letter to Regius, January 1642; 3: 206). The everyday pathologies of fleshly being ensure that, as the I

intermingles promiscuously with the body and thoughts get mixed up with feelings, even the most cameral of thinking things cannot ignore a body in pain.

Which brings me back to the hapless dog of the *Description.* If this creature is "sufficiently like" a man so that to understand the physiology of the one is to understand that of the other, then the pain of the one must be "in all respects" like that of the other. Needless to say, it is impossible to know from his treatise the sentiments this dog's vivisection impressed upon Descartes, aside from the curious matter of the heart's palpitations. I cannot help but wonder, nonetheless, what sort of "confused modes of thinking" might have arisen for Descartes after the demonstration of this striking experiment, when he came home to his own dog, Monsieur Grat, whose very name (Mister Scratch) evokes an affectionate tactility. The fact that a dog is a machine made out of flesh may not mean that everything we possess is likewise possessed of a dog; yet there is little to prevent us from being in touch with such an animal. Despite his attempts to abstract the human away from the dumb automaticity of the body and the confusions of touch, the sense that man feels like an animal at heart was one Descartes could not shake. Ironically enough, we can learn one lesson about how not to be Man from Descartes himself. For it is with his writing that the Man of modernity, in one of its most canonical formulations, issues from so many close encounters with dead, dying, and dumb animals, sensitive automata that want only to know what is wanted of them, and why they are in pain.

Brutalization

> For it is precisely that strong analogy which forces all scholars and true judges to admit that, however much those haughty, vain beings—who are more distinguished by their pride than by the name of men—may wish to exalt themselves, they are basically only animals and vertically crawling machines.
>
> —LA METTRIE, *Machine Man*, 35

In his rejection of the strict dualism of soul and soma by way of the reductionism of molecular biology and his appeal to the emergent potentialities of organized matter to account for the genesis of more immaterial aspects of existence, Brooks does engage an anti-Cartesian metaphysic. Yet the ground for his claim is little more than a radicalization of the mechanical theory of the organism at the molecular level. No special place is allotted for the singularity of human consciousness or reflective thought, or for the unique creativity of the human spirit with its unparalleled depth of feeling. These residues of our sense of "tribal specialness," which Brooks insists is a primitive refuge from the fear and anxiety of unknown circumstances, come under direct attack in *Flesh and Machines*. "We are machines," the roboticist polemicizes, "as are our spouses, our children, and our dogs" (173). Though this blunt statement represents an "unshakable belief" for him, he acknowledges a deliberate rhetorical consideration in its expression, confessing to have chosen the word machine in order to "brutalize the reader a little" (174). While the substance of the analogy simply means that we are "at heart . . . much like the robot Genghis" (174), his reference to brutality highlights that the trope is a violent one. The ease with which the comparison of animals to machines becomes a strict identification occludes material differences in favour of analytical generalizations that are easily operationalized. Perhaps it is the violation of difference inherent to the

logic of analogy that precipitates the anxieties we sense when our species is named just one among so many machine-beasts.

In this provocative brutality, Brooks inherits a modern attitude that runs up to the contemporary life sciences through the materialism of La Mettrie's *Machine Man*. Published just over a century after the *Discourse*, the quasi-satirical polemic against dualism and its vain anthropocentrism presents the living body as the anatomist's body, to be wondered at in its intricate operations, but no different in material composition from even the most wretched animal. "What was man before he invented words and learnt languages?" La Mettrie asks, and answers with a direct challenge to the logocentrism of Descartes' marks of genuine humanness: "old or young, a perpetual child, he stuttered out his feelings and his needs like a starved or restless dog who wants to eat or go for a walk" (13). Children and distressed dogs once again serve as exemplars of brute, mechanical matter, nevertheless possessed of a sensitivity whose pathos demands recognition and affinity.

Leaving Man stuttering, starved, and restless, *Machine Man* squeezes the metaphysical space deduced for a "specially created" soul out of human ontology. A sort of proto-emergence informs La Mettrie's thought, in which the intricacy of material organization gives rise to movement, feeling, and finally intellect. Less an outright rejection of Descartes' thought, however, this is his natural philosophy pressed to its logical extreme. La Mettrie simply substitutes the earlier thinker's certainty about the existence of the immortal soul for ignorance as to the extent of matter's potential. Indeed, he takes pains to express his debt to Descartes, who "understood animal nature

and was the first to demonstrate perfectly that animals were machines" (35).[7] Yet La Mettrie's materialist stance leads him to an expansive, ultimately very Christian ethic of compassion that contrasts sharply with his cognitivist predecessor's solitary pursuit of knowledge: "The materialist, convinced, whatever his vanity may object, that he is only a machine or an animal, will not ill-treat his fellows. . . . Following the law of nature given to all animals, he does not want to do to others what he would not like others to do to him" (39). In its brutalization of human and nonhuman animals alike, the forceful analogy between machines and organisms holds the potential to foster a sense of humility and respect and create a relationship of belonging that draws together humans and other life forms by virtue of the capacity to feel and the concomitant potential for suffering to be found in any embodied being.

7. La Mettrie even contends that Descartes may not have compromised his philosophy and his science "if he had been born in an age which he did not need to enlighten, and had consequently understood both the value of experiment and observation and the danger of straying from them" (34-35).

Chapter 6

Cybernetic organisms; or, The tortoise and the pussycat

Life in the cybernetic fold

In the second chapter of *Flesh and Machines*, Brooks offers a rough-and-ready chronicle of "The Quest for an Artificial Creature." He begins with the very genesis of human image-making practices with the cave paintings at Chauvet Pont D'Arc and Lascaux, then proceeds to describe the hydraulic and pneumatic devices of antiquity, the extravagant clockwork automata of the eighteenth and nineteenth centuries, and, finally, the electronic machines of the twentieth century. According to Brooks' account, the peregrinations of the quest follow a definitive line of progress, the evolution of technology resulting in a steady advance of creaturely "realism." Successive advancements in the materials and techniques by which people built artificial creatures afforded increasing capacities for autonomous operation, culminating with the advent of electronic switching elements such as electromagnetic relays and vacuum tubes, which "provided a means for changing behaviors based on signals received from sensors" (16-17). Electronic components allowed for artificial creatures that could not only act in the world, but also respond to environmental provocations, introducing the vital element of spontaneity, the primary marker of convincing animal-like behaviour.

In order to illustrate this breakthrough, Brooks devotes a number of pages to a discussion of W. Grey Walter, whose book *The Living Brain* he happened upon as a teenager, inspiring him to build his first robotic creature, Norman. Walter becomes an

important touchstone as he moves his discussion to the more celebrated accomplishments of Shakey and the Cart, neither of which was "hardly an artificial creature in the way that Grey Walter's creations were" (23). In "Intelligence without Reason," Brooks situates Walter's work within the context of early cybernetics, making reference to Norbert Wiener's and Ross Ashby's introductory volumes to delineate the theoretical concerns of the field. For Brooks, cybernetics as a discipline shared roughly the same goal as Artificial Intelligence—namely, to construct and study "useful intelligent systems" as well as to understand human intelligence (147). By virtue of its methods of analysis and the technological components of the period, however, cybernetic theory did not entail notions of symbolic representation in its modelling. The primary focus, then, was not the simulation of a humanist rationality: "Much of the work in Cybernetics really was aimed at understanding *animals* and intelligence" (148; my italics). Toward this goal, the cyberneticists modelled animals as machines and then studied those models in order to explore how animals changed their behaviour to adapt to their environment. Brooks writes that they quickly recognized "that an organism and its environment must be modeled together in order to understand the behavior produced by the organism—this is clearly an expression of situatedness" (148). Walter stands out in this account because he brought the crucial aspect of embodiment into the mix, having conducted experiments that involved the activity of physical robots rather than "abstract demonstrations of homeostasis" (148). Brooks thus positions Walter's tortoises as direct antecedents to his own artificial creatures, casting them as prototypical exemplars of the principles behind his engineering methodology.

In many ways, Brooks is a particularly faithful inheritor of the cybernetic project.

In *The Cybernetic Brain*, Andrew Pickering argues that cybernetics is "alive and well in Brooks' lab at MIT" (61), even if it had, by the late sixties, largely "fizzled out" as a specified field of research due to its lack of disciplinary and institutional foundations. A collaborative investigation located, as Norbert Wiener puts it, on "the boundary regions of science" (*Cybernetics* 2), cybernetics encompassed disciplines as diverse as electronic engineering, theoretical biology, neurophysiology, psychology, sociology, mathematics, and communications and information theory, while never quite becoming a discipline unto itself. Eve Kosofsky Sedgwick and Adam Frank refer to this moment of disciplinary and theoretical promiscuity as the "cybernetic fold," a moment when the scientific grasp of organic and cognitive processes "was marked by the concept, the possibility, the imminence, of powerful computers, but the actual computational muscle of the new computers wasn't available yet" (508). This period between the initial promises of computer machinery and its material reality were marked by an exceptionally rich "technological imagination" that manifested across the sciences and in popular culture.[1]

Pickering writes that cybernetics, at least during these heady years of rich imagination, might best be considered "*a form of life*, a way of going on in the world, even an attitude" (9; original italics). Through a socio-biographical investigation of several prominent British cyberneticists, including Walter, Pickering inquires after the

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1. Sedgwick and Frank write,

> The prospect of virtually unlimited computational power gave a new appeal to concepts such as feedback, which had been instrumentally available in mechanical design for over a century, but which, if understood as a continuing feature of many systems including the biological, would have introduced a quite unassimilable level of complexity to descriptive or predictive calculations. Between the time when it was unthinkable to essay such calculations and the time when it became commonplace to perform them, there intervened a period when they were available to be richly imagined. (509)

"attitude" of cybernetics as it was expressed in the speculations and experiments undertaken by its practitioners. Especially compelling for him is how the cybernetic "form of life" was embodied and enacted in the material devices many cyberneticists imagined, designed, and built, all of which "explicitly aimed to be sensitive and responsive to changes in the world around them, and this endowed them with a disconcerting, quasi-magical, lifelike quality" (7). To use another one of Pickering's expressions, there is a certain "glamour" to such adaptive machines and mechanisms, a seductive spell that unsettles or transgresses common-sense apprehensions of the animate and the inanimate.

In this chapter, I explore some of the implications the cybernetic "form of life" holds for a nonhumanist pedagogy. First, I turn to a number of Wiener's founding texts on cybernetic theory in order to interrogate the broad theoretical significance of cybernetics, highlighting the performative communicability and environmental situatedness that lie at its core. I am most curious to examine a clowder of felines that inhabit Wiener's writing, which the cyberneticist calls upon to illustrate the mechanism of feedback and the role it plays in spontaneous living. Wiener's cats dramatize a disappearance of animal life into the machine, each one becoming in his discourse more or less an adaptive servomechanism. This disappearance, however, only sets the stage for a "quasi-magical" return of the animal as a spectre residing in the lifelike behaviour of the cybernetic machine. With this in mind, I turn next to Walter and his lively tortoises. With these machines, Walter explicitly thematizes the glamour of cybernetics, describing the "imitation of life" they perform as "an interesting blend of magic and science" (*The Living Brain* 125), an admixture that conjures a curious, if uncomfortable, familiarity.

Together, Wiener and Walter offer a glimpse of a strange kinship we share with cybernetic organisms and artificial creatures, a relationship in which we depend on our own creations to recognize ourselves at all. If there is a glamour to artificial creatures and cybernetic organisms, it is because they betray a structural non-mastery in our relations to technology at the same time they imply that our technical practices always carry unforeseen reinventions of human life.

Of playful felines and black boxes

Under the purview of cybernetic theory, both animals and machines figure as organizations of information whose behaviour is governed by the nonlinear exchange of messages. Organisms and automata are alike in the sense that they couple up with their environments materially and meaningfully to form an inclusive system of significant interactivity. The metaphysics in question here is communicative and performative rather than mechanistic and deterministic. As Gregory Bateson argues, cybernetics is about the investigation of "sequences which resemble stimulus-and-response rather than cause-and-effect" (Bateson 409). Though stimulus-response circuits do form chains of causation, "Such systems . . . are always open" because "events within the circuit may be influenced from the outside or may influence outside events" (410). Cybernetics is interested in the processes of communication between a relatively plastic, organized system—whether an organism or a mechanical *organon*—and a dynamic milieu.

According to Wiener, cybernetics is first and foremost an investigation into the overlaps between physiological and electro-mechanical processes by way of a theory of messages. Animals and machines alike pose a unified "set of problems centering about communication, control, and statistical mechanics" (*Cybernetics* 11), problems to do with

how information governs the activity of adaptive systems. For Wiener, life and information are inextricable from one another:

> Information is the name for the content of what is exchanged with the outer world as we adjust to it, and make our adjustment felt upon it. The process of receiving and of using information is the process of our adjusting to the contingencies of the outer environment, and of our living effectively within that environment. . . . To live effectively is to live with adequate information. (*The Human Use of Human Beings* 17-18)

Communicative exchange is about tangible contact: the reciprocation of *felt* changes in both an entity and its world. To live is to be awash with communication, to be kneaded by, and simultaneously knead, the messages of the world.

Information itself is neither matter nor energy (*Cybernetics* 132), but it is propagated through a communicative process that relies irreducibly on a world of expression that machines and animals transform spontaneously into concrete behaviour: "In such a theory, we deal with automata effectively coupled to the external world . . . by a flow of impressions, of incoming messages, and for the actions of outgoing messages" (42). As Terranova argues, information is about opening "fields of action"; it is "not just about the successful delivery of a coded signal but also about contact and tactility" as well as the "dynamic modulation of material and social energies" (19). This more textured understanding of communication touches upon Gilbert Simondon's concept of "transduction." Mackenzie explains that transduction is about reciprocal becoming, where entities emerge out of their co-relating and "the intersection and knotting together of diverse realities" (Mackenzie 13). No one individual is the being that it is without

being in contact with the others of its milieu. To shift to an ethical register, transduction is about apprehending the partners of a collective as responsive to and responsible for each other and for the mediations that bind them together in their difference.

As Bateson repeatedly stresses, information is the "difference that makes a difference" (Bateson 315). A message is only significant, is information, insofar as it constitutes statistical rarity: "That is, the more probable the message, the less information it gives" (*Human Use* 21). Information resists noise, which Wiener equates to entropy, the universal trend of systems to become less differentiated as energy is diffused throughout a system and made unavailable for meaningful work. For Wiener, the uniform state of heat death that occurs as the end result of entropic decline is chaos, the state of absolute disorganization where no difference can make a difference. Wiener explicitly equates organism and message on this account:

> Organism is opposed to chaos, to disintegration, to death, as message is to noise. To describe an organism, we do not try to specify each molecule within it, and catalogue it bit by bit, but rather to answer certain questions about it which reveal its pattern: a pattern which is more significant and less probable as the organism becomes, so to speak, more fully an organism. (95)

Life continuously produces difference in spite of the overwhelming possibility for uniformity. A living being is a meaningful message, a significant signification, communicating itself from out of a deluge of noise, where noise is understood not to be not an active force of interference, but a mere absence of difference, organization, and purpose.[2] An organism is more fully an organism, so to speak, the more surprising it

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2. Wiener is fond of pointing out that this opposition is based on an Augustinian morality rather than a

becomes.

Spontaneity, the capacity for surprising activity, is therefore an essential marker of life, and lies at the forefront of cybernetic inquiry. This does not mean that cybernetics is concerned with arbitrary phenomena. On the contrary, as a theory of communication and *control*, cybernetics is structured around the description and formalization of "teleological," "purposeful," or "predictive" behaviour, activity in which a certain goal or tendency gives direction to behaviour as it occurs in the present. Thus the importance of the concept of feedback, the touchstone of cybernetic theory. In "Behavior, Purpose and Teleology," which Wiener wrote in collaboration with Arturo Rosenblueth and Julian Bigelow, the authors restrict their focus to *negative* feedback, which signifies "that the behavior of an object is controlled by the margin of error at which the object stands at a given time with reference to a relatively specific goal. The feed-back is then negative, that is, the signals from the goal are used to restrict outputs which would otherwise go beyond the goal" (19).[3] When picking up an object, for instance, one's muscles are controlled by a continuous reflex in which the failure to grasp the object is the impulse that guides the hand until it reaches the goal. This is the basis for voluntary activity, though the positive force of conscious will is traded for an autonomous process of correction based upon a quantitative determination of a task's failure, its degree of unaccomplishment.

Feedback is a powerful concept, not only for making sense of goal-oriented

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Manichean one. Curiously, Peter Galison's critique of Wiener takes him to task on his adherence to a Manichean morality, which neglects entirely the Augustinian aspect and its crucial link to the concept of entropy.

3. Hayles considers this paper to be the agenda-setting "manifesto" for cybernetics, the field's "founding document" (*Posthuman* 93; 97)

activity, but for prediction as well. Although much has been made about the role of Wiener's wartime research into automated anti-aircraft guns in his formulation of cybernetic principles (DeLanda 42-43; Kittler 259-60; Galison), animals haunt his writing on cybernetics at least as much as ballistics, perhaps even moreso. "Behavior, Purpose, and Teleology" mobilizes a small menagerie to support the authors' arguments. Snakes, frogs, flies, a bloodhound, rats, electric fish, and even amoebae all serve as examples in their discussion. Cats are most favoured by the authors, however, garnering several mentions in the short paper. Indeed, it is a cat chasing a mouse that introduces their discussion of predictive behaviour, since the cat must extrapolate from the movements of its prey and pounce toward the mouse's future position.

A feline also plays a crucial role in the first chapter of *Human Use*. In order to illustrate the spontaneity afforded by the sending and receiving of messages within a relatively open system, Wiener contrasts "blind, deaf, and dumb" music-box dancers, automata that are capable only of a deterministic communication from the mechanism to the dancing figures, with "the behaviour of man, or indeed to any moderately intelligent animal such as a kitten" (22). His kitten is able to receive and send messages as readily understood communicative acts, most obvious when the animal acknowledges his calls with an upward look, or sounds "a pitiful wail" when it gets hungry. A much more involved exchange occurs, he tells us, when the kitten plays with a spool:

> The kitten bats at a swinging spool. The spool swings left, and the kitten catches it with its left paw. This time messages of a very complicated nature are both sent and received within the kitten's own nervous system through certain nerve end-bodies in its joints, muscles, and tendons; and by means of nervous messages sent

> by these organs, the animal is aware of the actual position and tensions of its tissues. (22)

What is crucial here is the communicative relation to the world in which the kitten is situated, the animal's involvement with the spool and its motion, which enfolds its nervous activity in an exchange of messages. The kitten affects its perceived environment, which in turn modulates its activity relative to the change, and so on in overlapping feedback loops, its liveliness arising out of its spontaneous reactions to environmental provocations.

Aside from a vague mention as to animal's proprioceptive awareness, there is little in the passage that hints toward a centralized locus of information processing; no mediator intervenes between stimulus and response. For Wiener, cybernetic theory is most elegant and applicable for Wiener when it deals with motor activities that do not rely on the activity of an intentional consciousness or deliberative reflection. Cybernetics describes relations of exteriority, such as the distance in time and space between paw and spool. This is why, in this narrative account of simple motor dexterity, his kitten falls into relief behind an exploded view of nerve endings, muscles, joints, and tendons. These organs are certainly important, but only insofar as they delineate the communicative interface between the animal and its surroundings. Cybernetics asks what a body can do, what performances it is capable of, though this is a body opaque to itself and guided in the first instance by its errors.

A cat of a different stripe crouches in the closing paragraphs of "Behavior, Purpose, and Teleology," where the authors discuss what a "behavioristic analysis" versus a "functional study" of animals and machines reveal about their differences. This

section culminates in a speculation as to how one might go about modelling an animal's behaviour: "If an engineer were to design a robot, roughly similar in behavior to an animal organism, he would not attempt at present to make it out of proteins and other colloids. He would probably build it out of metallic parts, some dielectrics and many vacuum tubes" (23). While the movements of the robot could likely be magnified in speed and power over the original creature, cognitive faculties like learning and memory "would be quite rudimentary" (23). They then imagine "future years" during which "future engineers" might use their advanced knowledge of proteins and colloids to build a robot similar to a mammal in both behaviour and structure. In any event, the rationale for building a robotic animal is clear: "The ultimate model of a cat is of course another cat, whether it be born of still another cat or synthesized in a laboratory" (23). For this group of men, the most salient task remains to model behaviour, the broader classes of which, they argue, are largely the same in the machine as in the flesh. Whether its parts be metallic or meaty, what a cat does or can do will not differ, even if the *how* of its actions might.

This attention to performance is the principle behind the "black box," a crucial concept in early cybernetic discourse. A black box is any device or process whose outputs can be observed as the product of certain inputs, but whose inner workings are not open to observation. Pickering argues that the cybernetic form of life is governed by a "Black Box ontology," which casts a "performative image of the world" (*The Cybernetic Brain* 20). Contrary to the general agenda of modern science, which seeks to open all black boxes in order to discover the true causes of things as a matter of representation, cybernetics makes a detour around representation in order to explore the

world as a "dance of agency" (20), where things act, react, and interact without explicit knowledge. What is cogent to Pickering about this ontology is its image of a materially involved and inflected world: "We are indeed enveloped by lively systems that act and react to our doings, ranging from our fellow humans through plants and animals to machines and inanimate matter, and one can readily reverse the order of this list and say that inanimate matter is itself also enveloped by lively systems, some human but most nonhuman" (20). This is another way to speak about transduction. The world and its inhabitants are enveloped in dynamic relations of mutual becoming; they come alive in their performative communicability, their errant contact among diverse realities. It is by virtue of such an animated ontology that Walter's cybernetic machines take on a life of their own. I turn, then, to Walter's tortoises and their peculiar form of life.

Machina speculorum

> Now that certain analogies of behavior are being observed between the machine and the living organism, the problem as to whether the machine is alive or not is, for our purposes, semantic and we are at liberty to answer it one way or the other as best suits our purposes.
>
> —NORBERT WIENER, *The Human Use of Human Beings*, 31-32

As Brooks points out, the foundations of cybernetic theory lie in the modernist trope of the animal-machine. But the black-box ontology it entails, in its performative image of the world, animates machines as much as it mechanizes animals. For Wiener, to determine the nature of life is an entirely semantic affair that inevitably brings one up against ambiguous phenomena such as viruses or "life-imitating automata" (*Human Use* 31-34). As one example of such mimetic devices, Wiener explicitly names W. Grey Walter's tortoises, whose crucial aspect to consider was their communicative

involvement with the environment through responsive sensors and effectors. Such automata, he writes, "lend themselves very well to description in physiological terms. It is scarcely a miracle that they can be subsumed under one theory with the mechanisms of physiology" (*Cybernetics* 43). With this in mind, it seems "scarcely a miracle" that Walter, a neurophysiologist with a knack for electronics, would turn to electric machines in service to his trade.

Walter's tortoises constitute a behaviour-based robotics *avant la lettre,* emerging from his home workshop in the years immediately following World War II. Roboticist Owen Holland of the University of Essex goes so far as to argue, "They were in fact the first biologically inspired robots, as well as the first behaviour-based robots; perhaps more importantly, the insights they gave into both robotics and biology are exactly those towards which the new robotics community has been struggling for the last fifteen years" (Holland 351). Following a "wartime talk" with Kenneth Craik, a prominent psychologist who was, like Wiener, employed by the British government to work on the problems of automated anti-aircraft gunning and goal-seeking missiles, Walter designed the bumbling machines according to early cybernetic principles in order to model neurophysiological processes. I will focus on two texts in which Walter describes the design and activity of his robotic creatures in some detail: his book *The Living Brain*, and his *Scientific American* article "An Imitation of Life." In these texts, Walter depicts the tortoises with a whimsical vitality that highlights their spontaneity and strange liveliness in a way that pushes them beyond imitation, prompting the figurative *detournément* from beast-machines to machine-beasts. I argue that the reversibility in the way organisms and machines turn upon one another, the renewed inflection of animal and machine, conjures

in Walter's writing an uncanny familiarity through which the human appears in kinship with the nonhuman.

Walter's career as a clinical neurophysiologist revolved around the "search for the objective and physiological concomitants of our most intimate and spiritual desires," his general philosophical concern being to "dissolve the boundary between the spiritual and the material life" (Hayward 622). For Walter it was an incontrovertible truth that the electrochemical impulses traveling along nerve fibres account for "All the gradations of feeling and action of which we are capable" (Walter, "Imitation" 42). His primary tool in this materialist endeavour was the electroencephalograph, of which *The Living Brain* is in many ways an extended panegyric. Indeed, the entirety of his career centred upon this machine, and he played a pivotal role in its technological development, clinical application, and scientific and cultural legitimacy in Britain during the years surrounding the second World War.

In one of many poetical gestures, Walter considers EEG records to constitute "the bits and pieces of a mirror for the brain, itself a *speculum speculorum*" (*The Living Brain* 60). Tellingly, Walter also refers to his tortoises using this same image: they, too, are "part of a mirror for the brain" (131). Walter was gifted with electronics, and his intimacy with electric machines deeply informed his scientific and clinical work. Claiming that the bulk of his knowledge came from tinkering with old "crystal sets" in the days of wireless (Bladin), he not only designed and built his famous tortoises, he also constructed his own EEG apparatuses in the early days of his clinical research and even attempted to emulate conditioned reflex behaviour according to a Pavlovian model with a machine called CORA. The tortoises, which he constructed in the late 1940s with the

help of his first wife, Vivian, were able to demonstrate spontaneous reactions to stimulus, goal-seeking, and, in conjunction with the CORA circuit, rudimentary conditioning. Less an image or representation of neuro-electric activity, however, it was their animal-like behaviour that constituted their specular function for Walter: "Not in looks, but in action, the model must resemble an animal" (*The Living Brain* 120). Their embodied performances serve as concrete reflections of biological processes whose basis lay in the conduction of electrical signals throughout a densely interconnected and communicative network.

The first tortoises, affectionately named Elmer and Elsie (ELectro MEchanical Robots, Light-Sensitive, with Internal and External stability), were relatively simple affairs made up of "two functional elements: two miniature radio tubes, two sense organs, one for light and the other for touch [i.e., a photocell and a contact switch], and two effectors or motors, one for crawling and the other for steering" ("Imitation" 43). All this was wrapped in a bakelite or perspex shell, giving the resemblance to the family *Testudinidae*. Despite this simplicity, the creatures displayed a complexity of behaviour that emerged from the interplay of their functional elements and their exploratory, mobile interaction with their environment. It is the latter quality that prompted Walter to dub this "species" with the mock-Linnaean classification, *Machina speculatrix*—for their active watchfulness and curious, speculative engagement with the world around them.

When it was switched on, a motor continuously drove *M. speculatrix* forward. The photocell was situated on the front of the shell and connected to the steering mechanism. In the absence of a light source, this mechanism was activated such that the robot followed "a cycloidal gait, while the photocell 'look[ed]' in every direction in

turn." Once the "eye" detected a moderate source of illumination, the steering would lock, causing the robot to move toward light. If the brilliance exceeded a certain intensity, however, the steering mechanism turned back on with double speed, "so the creature abruptly sheer[ed] away and [sought] a more gentle climate" (44).

Light is more than a mere prompt for the phototropic creatures, however. Their tropism is itself a trope, opening up a rhetorical play that turns upon the robots' liveliness: "One of the advantages of making a moderate light a positive stimulus is that this can be used as a sign or symbol for the energy which the creatures require for their sustenance—electricity" (*The Living Brain* 129). Inside what he called their "hutch," which was simply a box where they recharged their batteries, Walter placed a 20-watt lightbulb so that the tortoises would enter "of their own accord" and engage the charger contacts (129). The jump to a rhetoric of sustenance and shelter makes it almost innocent for Walter to write of this space as a "home" where they could recoup between their "adventures" ("Imitation" 45). But it is through this figurative play that the robots begin to speak to Walter of their self-will, as well as their "appetites" and "desires."

One of the most intriguing experiments occurred when Walter introduced either a mirror or another tortoise into the mix. Part of each machine's design included a small flash bulb fitted into the head that was also connected to the steering mechanism. Originally, this light was meant to indicate if the steering-servo was on or off: the bulb lit up whenever the mechanism was engaged, and shut off whenever it locked. Walter discovered that, when the creature encountered its reflection in a mirror, the photocell would sense this light and shut down the steering to head toward it, which would subsequently turn the light off. The darkness caused the robot to begin steering again to

resume its exploration, and so the light would come back on. An oscillation would thus ensue that caused Walter a great deal of excitement. With characteristic enthusiasm and propensity for overstatement, he writes,

> The creature therefore lingers before a mirror, flickering, twittering and jigging like a clumsy Narcissus. The behaviour of a creature thus engaged with its own reflection is quite specific, and on a purely empirical basis, if it were observed in an animal, might be accepted as evidence of some degree of self-awareness. In this way the machine is superior to many quite 'high' animals who usually treat their reflection as if it were another animal, if they accept it at all. (*The Living Brain* 128-29)

A similar oscillation would occur if two of the machines encountered one another face to face. This would also cause a "distinctive" flickering and shuffling and, eventually, a "stately retreat." A frustrated eroticism presents itself to Walter in this situation: "Two creatures of the same type, attracted by one another's light, both extinguish the source of attraction in themselves in the act of seeking it in others" (129). In the absence of any other light source, the couple "cannot escape from one another; but nor can they ever consummate their 'desire'" (129).[4] This oscillating dance of attraction and retreat draws the machines into a "sort of community, with a special code of behaviour" (129), though it is one that breaks down into a "competitive struggle" should a new light source be introduced, a scene that, he laments, "imitates almost embarrassingly some of the less

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4. Hayward elaborates upon the erotic valence in Walter's scientific investigations and technological inventions and how the politics of identity and desire are transformed by encounters with electro-physiology and its intimate relationship with burgeoning cybernetic theory. Hayward suggests that, for Walter, these machines "demonstrated how our most profound and intimate needs and actions could be imitated through the motorized movements of twin-valved machines" (624).

attractive features of animal and human society" (130).[5]

Walter concedes that the appearance of his tortoises' clumsy self-recognition and their awkward attempts to touch a recognized other may seem like "tricks," but his aim with these models is not to establish strict epistemological truth. Indeed, he argues that, should the same behaviour be observed in true animals, "a biologist could quite legitimately claim it as evidence of true recognition of self and of others as a class" (130). What is important is the "ecological situation" in which a "reflexive mechanism" reacts spontaneously to significant environmental provocations, in this case prompting behaviours that "seem, at least, to suggest self-consciousness or social consciousness" (130). The black-box ontology to which Walter adheres in his interpretation of the tortoises highlights the performances that emerge from their communicative interactivity. What appears to be a kind of self-recognition is the result of a certain misrecognition on the part of the observer, which drives a wedge between what is seen and what is known.

One could also object that these attributes of the tortoises are nothing more than the product of the observer's rhetorical indulgences. Brooks himself points to the language that accompanies Walter's accounts, but regards it as a crucial feature of their success: "An observer finds it easier to describe the behavior of the tortoises in terms usually associated with free will—'it decided to go into its hutch'—rather than with detailed mechanistic explanations of the *particular unknowable details* of exactly what its sensors reported when" (*Flesh and Machines* 21; my italics). The faulty words of the

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5. Walter continues on to say that, as the maker, he is at fault for this occasional embarassment, and that he could "easily endow his creatures, as man is endowed, with a discriminatory recognition circuit that would function in an emergency, a 'women-and-children-first' reflex" (*The Living Brain* 130-1). This appeal to a civilized morality, which could be installed without much seeming effort, certainly speaks to the strong sense of anthropomorphization in Walter's descriptions of the tortoises. While I do not deny that this is in play, I offer an alternative reading below.

observer betray the feeling of something familiar, of something recognizable in the machine's lifelike performance, a feeling that is, as Brooks' words suggest, a product of what is unknowable.

Undoubtedly, there is something of a conscious, active un-knowing at work here—a willing suspension of disbelief that the author attempts to cultivate in the reader. But the rhetorical scene works both ways. Despite detailed descriptions of the electrical apparatus and explanations as to how and why it works as it does, in the end there is only the exterior communication of physical behaviour. The black box speaks a language of familiar gestures and movements that persuades the observer to ascribe qualities traditionally proper to living beings. Ultimately, to open the black box, to know the makeup of the system, is to destroy its performance: "It is a curious fact that although the machine is man-made, the experimenter finds it impossible to tell at any moment exactly what the machine's circuit is without 'killing' it and dissecting out the 'nervous system'; that is, switching off the current and tracing out the wires to the relays" (Walter, "Imitation" 43; cf. *The Living Brain* 124). Without its unknowability, the "imitation of life" is no longer recognizable, even as a misrecognition—the specular function is lost.

The sort of unfulfilled, unfulfillable, and yet inescapable "desire" Walter writes about with regard to his creatures, the clumsy self-recognition and impossible attempt to touch a recognized other, especially as all this takes place in a communicative dance before a mirror (or the mirror of another), is redolent of Lacanian psychoanalysis. Lacan's "The Mirror Stage" offers a first step toward an interpretation of the role cybernetic organisms play in the ontological constitution and recognition of our own humanity as nonhuman. To recall briefly, Lacan uses the scenario of an infant learning to

recognize himself in the virtual image of the mirror in order to theorize the psychic process by which an individual comes to imagine himself as an integral subject with a distinct ego. The mirror stage initiates the child into the Imaginary order as he develops and subsequently assumes his ego ideal, or *imago*. This process is ongoing and ever lacking, as it relies entirely on a "*Gestalt*" in which "the subject anticipates in a mirage the maturation of his power," that is, the full differentiation and determination of the embodied self and its conscious agency, "in contrast with the turbulent movements that the subject feels are animating him" (2). Considering the consistency in psychoanalysis between childhood and the "primitive," it is not surprising that Lacan illustrates the function of the specular *imago* with a few premodern analogies:

> Thus, this *Gestalt* . . . symbolizes the mental permanence of the *I*, at the same time as it prefigures its alienating destination; it is still pregnant with the correspondences that unite the *I* with the statue in which man projects himself, with the phantoms that dominate him, or with the automaton in which, in an ambiguous relation, the world of his own making tends to find completion. (2-3)

Statues, phantoms, and automata are totemic mirrors that, it would seem, at one time anchored selfhood. Though we have apparently surpassed these "ambiguous" relations in our modern sophistication, their animistic power "still" impregnates the apparatus of metal-coated glass.

Setting domineering phantoms aside for a moment, it is telling that Lacan's specular subjectification occurs, in this passage, through technical "imitations of life." Human technical capacity sets the ground for a series of reflections from which emerge a reflexivity that individuates human subjectivity. The mirror, whatever form it takes, is a

prosthetic apparatus, a machine for producing an intelligible selfhood. From a humanistic point of view, the subject is truly "of his own making," fashioned dialectically through his "projections" onto the material world, which in turn constitute his *imago*—alien and ambiguous perhaps, but nevertheless his. This is operating in Walter's thinking at one level: his work in piecing together a mirror of the brain, whether through electro-mechanical creatures or the EEG, one component in a therapeutic program intended to offer some degree of mastery over psychic phenomena by way of their recognition, or misrecognition, in the activity of electric machines. Walter's clinical neurophysiology is not unlike psychoanalysis in this respect—though the *graphe* under scrutiny in the course of the "talking cure" is of a decidedly different sort from that of the electroencephalograph.

The ambiguous projection of a recognizable self, though at the level of the species, is precisely the function of the "anthropological machine" Agamben describes in *The Open*. Reading Linnaeus' *Systema Natura*, Agamben finds that the image produced of a distinctly identifiable *anthropos* is as much a mirage as the psychoanalytic *imago*: "man has no specific identity other than the *ability* to recognize himself" (26; original italics). The specificity of humankind as a species resides, not in its apparent structure, but in the Delphic injunction, *nosce te ipsum*. In its very taxonomic placement among living beings, Agamben suggests, the human becomes subsumed by the specular technology of its own mirror stage: "*Homo sapiens*, then, is neither a clearly defined species nor a substance; it is, rather, a machine or device for producing the recognition of the human" (26). This recognition is produced as the result of a visible difference, seen in an inverted or negative image. Agamben writes that the anthropogenetic,

anthropological machine emerging in of the age of Enlightenment is "an optical machine constructed of a series of mirrors in which man, looking at himself, sees his own image deformed in the features of an ape. . . . *Homo* is a constitutively 'anthropomorphous' animal . . . who must recognize himself in a non-man in order to be human" (27). A double irony arises here in that one's failure to make this recognition, to see one's humanness in the nonhuman, disqualifies one's humanity: "In Linnaeus' optical machine, whoever refuses to recognize himself in the ape, becomes one" (27). *Homo sapiens*, during its very taxonomic invention and placement on the table of living beings, is far from secure in its self-knowing mastery. It appears only as a disappearance, is recognized only ironically, receding into a machine of mirrors that reveals it to occupy only an empty space, a default of being for which it must be technically compensated.

Bernard Stiegler makes a clear nod to Lacan in *Technics and Time 1* when he identifies a "mirror stage" through which the human is individuated in an ambiguous relation to its own technical implements. As I discussed in chapter 3, the human is ontologically incomplete in and of itself for Stiegler; its essence is to have no inherent essence: "The being of humankind is to be outside itself" (193). Stiegler's theory of technics is not, however, about the exteriorizations of a preceding being. Rather, it is about how the human's "extensions" constitute its being in the first place. It is our prostheses—those techniques and technologies by which we conduct our life "by means other than life"—that guarantee our existence as human beings, despite our default of essence: "The prosthesis is not a mere extension of the human body; it is the constitution of this body *qua* 'human'" (153). The human in itself is vacuous, dependent upon the things of the world it lives with and lives through for its very ontological appearance.

This prosthetic constitution should not be thought of in terms of a naïve technological determinism. Neither technology nor humankind is complete in itself and able to exert a unilateral transformative influence over the other. Human and prosthesis "are differentiated together, in one and the same movement. It is a question of a singular process of structural coupling in 'exteriorization,' an instrumental maieutics, a 'mirror proto-stage' . . . in which one, informing itself in the other, is both seen and deformed in the process, and is thus transformed" (176).[6] That we can only discover our humanity in the mirrors of animals, automata, and other prostheses, that we can only recognize ourselves, come to be ourselves, in and through what we are not, means that our very identification as that particular being we name "human" can only ever be a misidentification.[7] What Stielger's work offers, enmeshed as it is in the tradition of poststructuralist thought, is a profound deconstruction of the human, an effacement of the image of Man, in favour of an entity whose being is contingent upon its iterative couplings to the material world.

I maintain that it is precisely this sort of deconstruction that the products of ALife, AI, and cybernetics figure for contemporary culture: hence the unsettling feelings conjured by robots and other artificial life forms. In the epigraph Walter chooses for the

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6. In *Gesture and Speech*, Leroi-Gourhan suggests that the transformation of human beings by technics is a bestial metamorphosis—at least figuratively speaking:

> If the hand of the earliest anthropoid had become a tool by adaptation, the result would have been a group of mammals particularly well equipped to perform a restricted series of actions: It would not have been the human being. Our significant genetic trait is precisely physical (and mental) *non*adaptation: a tortoise when we retire beneath a roof, a crab when we hold out a pair of pliers, a horse when we bestride a mount. (246; original italics)

7. Stiegler argues,

> From the absence of unity in the human, it would be better to conclude instead that the human can only be defined negatively, by the trait of this technical inhumanity that allows it to be differentiated without, however, permitting its identification. This impossibility of anything but a phantasmatic identification is 'the mirror stage.' (*Technics 1* 157)

chapter of *The Living Brain* that deals with *M. speculatrix*, he references the scene from part 2 of Goethe's *Faust*, in which Mephistopheles assists in the alchemical animation of the Homunculus, quoting the devil's exiting lines: "The fact is, we remain dependent on/ the creatures we ourselves have made" (Goethe 2.7003-04).[8] We depend upon our prostheses, our technics, to become the beings that we are, and to recognize ourselves as such. As I will now suggest, Walter's writing hints that such a dependence on the artificial other might allow us to glimpse a forgotten kinship with things, and recover a reverence for forms of life of all sorts.

Totem and tortoise

The "strange richness" of activity the two-element design of Walter's tortoises afforded and the "eerie impression of purposefulness, independence, and spontaneity" they gave (44; 45), communicated a vitality that was no less animated for its inorganic origin. In his writing, Walter clearly delights in these qualities of his creatures, regarding them, in part, with a childlike wonder: "As toys they refresh the spirit of the laboratory children we all are, leading us to familiarity with more and more elaborate mechanisms" (*The Living Brain* 132). Where the electro-mechanical "life" of his tortoises is thought along more seriously scientific lines, the familiarity discovered through play also means they serve as reliable devices for scientific experimentation and speculation: "As tools they are trustworthy instruments of exploration and frequent unexpected enlightenment" (132). Their enlightening performances are in this sense not simply simulacra, but "diagnostic

8. Walter gives no indication as to the location of these lines. What is more, he leaves them in the German, which is somewhat odd, considering it is the only epigraph in a language other than English. This is doubly odd, since he quotes Goethe again in the epigraph to chapter 10, which appears in translation.

of living processes" ("Imitation" 42). But there is something much less trustworthy and instrumental at work in Walter's writing, something less rationally diagnostic than gnostic in a quasi-mystical sense. Every enlightened exclusion invites a shadowy return of the strange and eerie. Caught up in the glamour of his creatures, Walter's writing stages such an uncanny return in a way that draws cybernetics into the region of animism.

At the beginning of both "An Imitation of Life" and his chapter on the tortoises in *The Living Brain*, Walter whisks the reader back to a pre-electric "dark ages" in order to speak of the image-making practices of nonmodern peoples: sorcerers, witches, idolaters, peasants, children, and other primitive sorts with their "hopeful but bewildered" animistic beliefs. This is similar to Brooks' references to the protohistoric paintings at Lascaux and the articulated statue of Ammon in ancient Thebes, illustrating an evolution of sorts as to the function and purpose of artificial life. One could easily argue that Walter's strategy is one of a clear demarcation between scientific inquiry and the mystifications of magical practices, an assurance that his "intense modern interest in machines that imitate life" ("Imitation" 42) is just that: modern, enlightened, rationally motivated, sincere—a scientific attempt to open the black box of life. Yet this sentiment is not at all so cut and dry for the electroencephalographer, who notes, "Idolatry, witchcraft, and other superstitions are so deeply rooted and widespread that it is possible even the most detached scientific activity may be psychologically equivalent to them" (42). In *The Living Brain*, he points out, likely with a tinge of amusement, that Roget's *Thesaurus* places "electrobiology" under "Sorcery" in the section grouping religious acts (114). Hence the eerie strangeness that accompanies the observation of his tortoises, which are themselves "an interesting blend of magic and science" (125).

Because they are so scientifically ensorcelled, the tortoises take on a totemic significance that complements their roles as toys and tools. With a language of quasi-religious sentiment, Walter writes, "As totems they foster reverence for the very life they have so laboriously been made to mime in such a very humble fashion—and still would foster it even should they, creatures of 'sorcery' peering into the dim 'electrobiological' future in search of a *deus ex machina*, look up at us and declare that God is a physiologist" (132). "An Imitation of Life" echoes this profession of reverence in its own final sentence, though with an added suggestion of humility vis-à-vis the status of human beings in relation to nature: "Perhaps we flatter ourselves in thinking that man is the pinnacle of an estimable creation. Yet as our imitation of life becomes more faithful our veneration of its marvellous processes will not necessarily become less sincere" (45). In a certain sense, these unassuming electromechanical creatures take part in the quest for artificial creatures in a continuity with image-making practices that seek to represent the divine or spiritual valences of life and living beings. To be sure, the life of Walter's tortoises is no less no less spirited, if perhaps a little less alive, for being artificial. They are conjurations, apparitions invoked through the sorcery of electrophysiology as pious explorations of life, an act of faith as much as faithful imitation. The grandiose rendering of the human in the image of a god remains, but the image is nevertheless an artificial and arbitrary one, a *deus ex machina*, as Walter suggests, and perhaps overly familiar.

Walter's suggestion that the humble *M. speculatrix* functions with a totemic significance evokes something of a counter-modern attitude. A totem is less strictly an object of worship, as Walter suggests, than it is a marker and regulator of kinship relations. While discussing the creative potential for reading works of art through a lens

of totemism rather than fetishism or idolatry, W.J.T. Mitchell recalls that "totem" is an Ojibwa word meaning roughly "he is a relative of mine," and is "associated with ideas of animal, vegetable, and sometimes mineral 'tutelary spirits,' and thus with destiny, identity, and community" (Mitchell 175). As a conceptual term, it is "virtually synonymous with the rise of anthropology as a discipline" (99), serving as a discursive means to demarcate modern from nonmodern religious practices: "the totemist is a member of a vanishing race left behind in an evolutionary progression to modernity" (99-100). For Mitchell, totemism stands against idolatry and fetishism as a means of engaging with images and artifacts that sidesteps the all-too-modern approaches to visual and material culture that seek to eradicate or debunk the ideological "truths" behind artistic practices. Since it is something nonmodern, an indicator of a "primitive," animistic beliefs and thus something we moderns have supposedly surpassed, totemism is difficult to map onto a system of values and hierarchizations commensurate with a modern "world picture." Totemism thus opens a critical framework for Mitchell that "addresses the value of images . . . as a game between friends and relatives, not as a hierarchy in which the image must be adored or reviled, worshipped or smashed" (106). It opens a "social" and "conversational" relationship with images and artifacts that establishes a kinship with *things*.

Extending Mitchell's argument to include artificial creatures, Walter's project suggests a way of thinking through a kinship matrix between animals, machines, and humans. Animals and machines are familiar beings with which we dwell, sharing the world and, in some cases, our homes. They are also, in a sense, familial, establishing ties between human individuals in totemic or quasi-totemic fashion. Yet this familiarity is

uncomfortable for a humanism that posits the purity of the *anthropos* and conducts an overanthropomorphic anthropology whose fundamental question, "What is Man?" is an empty one, the answer having been always determined in advance. Our kinship with the nonhuman is something modern humanist thought has pained itself to defamiliarize, making it an eerie *revenance* that troubles metaphysical attempts to determine a human subject that stands apart from those objects in its environment, a subject appropriate and appropriated to itself despite the things thrown in its way. *M. Speculatrix* thus stands for me as a totemic quasi-animal, an electro-mechanical familiar in which to seek an image of human identity that coalesces in community with a surprisingly animate world.

The cat came back

It remains for me to address the dark correlative to the quasi-magical liveliness of cybernetic machines. The indeterminacy of life conditioned by a black-box ontology cuts both ways: the appearance of life in the nonliving means at the same time the disappearance of the animal into the inanimate. The cybernetic organism does not supplant the old beast-machine, as if the latter were obsolete; instead, it is haunted by the spectre of the beast-machine. I would like to take a look at one more of Wiener's cats, this one found lurking in the opening pages of *Cybernetics*. Wiener uses this cat to illustrate once again the conception of physiological behaviour as an exchange of nervous messages, citing a collaborative investigation between himself and Arturo Rosenblueth: "we decided to take a nervous problem directly from the topic of feedback and to see what we could do with it experimentally" (*Cybernetics* 19). This cat, however, is not quite as lively—nor even *alive*, in the fullest sense of the term—as the playful kitten of *Human Use* or the mouser of "Behavior." In the experiment Wiener describes, he and

Rosenblueth first decerebrated the animal under ether, then rendered it spinal with a cord transection in the thoracic region. After this, they cut the cat's quadriceps muscle and attached it to a lever under a certain tension in order to record its contractions. (Disquietingly, these steps appear in reverse order in the text, the decerebration and thoracic transection of the spinal cord appearing after what Wiener considers to be the more salient points of the procedure.) He adds that, as they repeated the experiment, they would often administer strychnine in order to accentuate the muscular reflexes. These preparations made, they would then increase the tension on the lever "to the point where a tap would set [the muscle] into a periodic pattern of contraction." Thereupon, they observed "the physiological condition of the cat, the load on the muscle, the frequency of oscillation, the base level of the oscillation, and its amplitude. These we tried to analyze as we should analyze a mechanical or electrical system exhibiting the same pattern [of oscillation]" (19). Following this grisly passage, the cat as such disappears entirely from the text, whereupon Wiener elaborates upon the mathematical conclusions he and Rosenbleuth derived from their experimental data.

Of course, paying attention to the cat as a cat is beside the point of the experiment or Wiener's account. Under the analytic gaze of his cybernetic physiology, the animal becomes just one more "mechanical or electrical system," subsumed into the servomechanism it resembles by virtue of its analogous activity; it is another black box, observable only through the outputs it produces from certain inputs. Because this sort of black-box engineering draws an analogical equivalence between living bodies and machines that privileges performance over material structure, Hayles argues that cybernetics in general, and Wiener in particular, tended "to erase from view the very real

differences in embodied materiality, differences that the analogues did not express" (Hayles 99). Of course, the effacement of embodied difference has been one of the prime tactics for continuing structures of dominance in Western societies, both between groups of humans and between humans and nonhumans. Wiener's cat, rendered undead in order to satisfy the needs of scientific inquiry, is proof positive of a moral calculus that values the advancement of human knowledge toward human ends over and above nonhuman life.

Nonetheless, the material and semiotic rendering of the acephalic cat into a reactive servomechanism precipitates from an experimental and rhetorical violence that foregrounds the embodied being of the unfortunate creature and demands respect for its suffering and what that suffering produces. Following Haraway's discussion of laboratory animals in *When Species Meet*, I approach this instance as an opportunity to think through issues of response and responsibility, rather than a simple denunciation of Wiener and Rosenbleuth's cruelty or a straightforward advocacy of animal rights vis-à-vis scientific experimentation and laboratory testing. Haraway refuses to cast laboratory animals as victims, Others separated from us by an insuperable abyss and sacrificed in the name of humankind. Instead, she stresses that such animals are *workers* whose labour both responds to and demands response from their human partners. People and animals foster mutual, though certainly not symmetrical, responsibilities: capacities to respond that, she writes, "can be shaped only in and for multidirectional relationships, in which always more than one responsive entity is in the process of becoming" (71). In attending to such relationships, she resists a detached criticism of instrumental rationality in favour of a "muddier," more worldly position:

> I am arguing that instrumental relations of people and animals are not themselves the root of turning animals (or people) into dead things, into machines whose reactions are of interest but who have no *presence*, no *face*, that demands recognition, caring, and shared pain. Instrumental intra-action itself is not the enemy; indeed . . . work, use, and instrumentality are intrinsic to bodily webbed mortal earthly being and becoming. Unidirectional relations of use, ruled by practices of calculation and self-sure of hierarchy, are quite another matter. (71; original italics)

Under these considerations, laboratory animals become for Haraway "significantly unfree partners" (72), beings whose suffering is a matter of concern, something that exhorts response and a recognition of response, since their painful, most often fatal, labour is consequential to each of our lives.

The difficult argument that Haraway makes has to do with an ethics of killing responsibly:

> The problem is actually to understand that human beings do not get a pass on the necessity of killing significant others, who are themselves responding, not just reacting. In the idiom of labor, animals are working subjects, not just worked objects. Try as we might to distance ourselves, there is no way of living that is not also a way of someone, not just something, else dying differentially. (80)

To speak of a respect for or responsibility toward life does not have to be to speak of life's sacredness.[9] Instead of living by the law, "Thou shalt not kill," she proposes amending the commandment to read, "Thou shalt not make killable." (80). The argument

9. After all, to "make sacred" is, etymologically, a sacrifice.

here is that no life should become "bare life" in Agamben's sense, to be treated with impunity because it resides outside the bounds of the political. Following Derrida and Levinas, Haraway suggests that killing responsibly means that our obligation toward the other is always in excess of our capacity to meet that obligation, thus "we will not cease to require forgiveness we cannot exact" (81).

Wiener and Rosenbleuth are not innocent of engaging a "unidirectional relation of use" with respect to the cats they turned into undead things and merely reactive machines. I have trouble even grasping the usefulness of their experiments, which followed from the desire simply "to see what we could do." The fate of the creatures appears little more than an afterthought of scientific inquisitiveness, rendering the animals killable in the name of knowledge production. It would be a mistake, however, to deny the multidirectional relationships at play or the consequential lessons cybernetic cats teach us about ourselves and the liveliness of machines.

While the human animal does not suffer the same physical violations as Wiener's felines, it is no exception to the same sort of mechanical anatomizing and conceptual disappearance. Human physiology is just as readily defined as an assemblage of feedback devices. In one of the more striking passages of *Cybernetics*, Wiener considers the collective physiological apparatuses that comprise "our homeostatic mechanism." Cases in which feedback operates within the human body, he tells us, are not only numerous, but "absolutely essential for the continuation of life," because the "conditions under which life, especially healthy life, can continue in the higher animals are quite narrow" (114). In order to survive, the body requires strict maintenance of internal temperature, blood pressure, hydrogen-ion concentration, heart rate, toxicity levels,

leucocytes and other immune-system components, calcium metabolism, sexual cycles, and so on. "In short," he concludes, "our inner economy must contain an assembly of thermostats, automatic hydrogen-ion-concentration controls, governors, and the like, which would be adequate for a great chemical plant" (115). The embodied human being is a cybernetic machine, but a tenuously balanced and readily manipulable one. Where the figure of the cyborg so easily conjures ominous techno-fantasies of power in its popular figurations of bodies augmented and enhanced, the cybernetic organism appears instead fragile, finite, and definitively mortal.

Human life figures as a permeable hub of informatic exchange, as opposed to an inalienable core of being. Free will itself becomes the sum of countless feedback loops, occurring in much the same fashion as the phototropic behaviour of Walter's tortoises: "for in man we consider that a voluntary action is essentially a choice among tropisms" (*Human Use* 166). It is within the space opened up between the autonomy of "choice" and the automaticity of "tropism" that the human use of human beings can become an irresponsible enterprise in domination: "When human atoms are knit into an organization in which they are used, not in their full right as responsible human beings, but as cogs and levers and rods, it matters little that their raw material is flesh and blood. *What is used as an element in a machine, is in fact an element in the machine*" (185; original italics). An ironic caveat similar to that of Linnaeus seems to echo here: namely, whoever does not recognize herself in the machine, becomes a machine. If to live effectively is to live with adequate information, that is, to live in contact with a world of significant difference, then the bioethical implications of cybernetic theory begin to resolve into view.

As cybernetic organisms necessarily coupled to the external environment, our own inability to recognize ourselves for the fragile machines that we are has left us with a grave problem of adaptive feedback. In *Human Use*, Wiener argues that the "lucky accident" of life's continuation on earth is dependent upon an environment whose resources are quickly being exhausted by human consumption: "We have modified our environment so radically that we must now modify ourselves in order to exist in this new environment. We can no longer live in the old one. . . . It seems almost as if progress and our fight against entropy intrinsically must end in the downhill path from which we are trying to escape" (46-47). Though he is silent on exactly how we must modify ourselves, it is clear from his indictment of progress that he is not looking ahead toward an alteration of the human species by technical means, but is instead advocating a more conservative approach: "The simple faith in progress is not a conviction belonging to strength but one belonging to acquiescence and hence to weakness" (47). The finitude we share with the world and its inhabitants has global consequences that, over half a century after the publication of *Human Use*, we still fail to address with anything other than an acquiescence to the hopes offered by technoscientific innovation. Without a lived apprehension that we ourselves are responsive entities in the process of mutual becoming with a shared world, without a respect for our own "significantly unfree" partnership with the nonhuman beings of which we make use, we are little more than decerebrated creatures, unresponsive to any but our own impulses.

Cybernetics thus holds intriguing possibilities for thinking through forms of ethical care based upon *felt* communicability and extended notions of ecological collectivity, rather than upon the rights of human individuals alone. Where life proceeds

through errant contact among diverse realities rather than upon a unified "world picture," on the basis of contingency and performativity rather than epistemological certainty afforded by the intentional application of reason, the humanist subject may find it difficult to assume the measure of all things. Where we share suffering, where we respect the vulnerability and finitude we have in common with both human and nonhuman others, "no one gets to be Man" (Haraway, *When Species Meet* 82). In fact, in such a context, the human finds itself dependent upon nonhumans, not only to recognize itself, but to live in the first place. Perhaps we would live more effectively if we broadened communication, not just among ourselves, but among nonhuman beings as well, if we multiplied our contacts with diverse realities and allowed ourselves to be touched in turn. We could certainly live more responsibly.

The modern Epimetheus

> I never act; I am always slightly surprised by what I do. That which acts through me is also surprised by what I do, by the chance to mutate, to change, and to bifurcate, the chance that I and the circumstances surrounding me offer to that which has been invited, recovered, welcomed.
>
> —BRUNO LATOUR, *Pandora's Hope*, 281

When Brooks describes his creatures' coming to life, he frequently highlights their surprising performativity, which overtakes what he knows about how they work, and throws into relief what they do. Early in Morris' *Fast, Cheap, and Out of Control*, he describes a "dramatic moment" while building a robot at MIT: "One night, the physical robot actually moved. I mean, it was what I was working on for days, but it completely surprised me. It moved! It had that magical sort of thing. It worked. And the best part was, that it completely surprised me. I had forgotten that this physical thing was what I

was trying to get to work, and then it happened." Conceivably, Brooks was so wrapped up in the abstractions of programming and circuit design that the machine's embodied presence withdrew into the background of his attention. Suddenly, an unexpected movement thrusts the machine's physicality into focus, suspending rationality for a moment. The robot overtakes him, seizes his thoughts in spite of his apparent mastery over the process of its invention. His understanding of the robot's inner workings, the days spent building its hardware and software, are momentarily black-boxed, un-known in an uncanny play of forgetting and deferred remembering that brings its spontaneous activity to the fore. There is something of a double forgetting involved here, a forgetting to forget those modes of knowing that modern scientific practice ostensibly precludes. Here, in the night, the roboticist forgets about the machine as a mechanism, no longer recognizes it for the inanimate thing it was a moment ago. Its sudden movement overtakes him, moves him with its strange blend of magic and engineering.

It is in his openness to surprise that Brooks inherits the attitude of early cybernetics. The ontology to which cybernetic theory adheres is, in the first instance, performative. Its focus centres upon what things can do in advance of what is known about them. Accordingly, cybernetics "assumes an *ontology of unknowability*, as one might call it, and tries to address the problematic of getting along performatively with systems that can always surprise us" (Pickering 23; original italics). Indeed, surprise is precisely the sticking point, since it can only be addressed retrospectively, in response to its effects.

Stiegler finds this problem endemic to technoscience in general, which he defines specifically as "science in the service of the development of technology" (*Technics 3*

202). This inversion of the commonly held relation of science to technology means that science *qua* technoscience "becomes the fiction of a science that is no longer what could be called the real, but rather that which *invents the possible*" (202; original italics). With priority placed thus upon invention, the question of knowing reality is an afterthought to that of engineering artifacts and engendering fictions. The ways in which we apprehend and comport ourselves toward the world come to be governed by contingency and accident. Stiegler likens this situation to the condition of Epimetheus, who "*asserts* (though always *too late*) the *performative* (and uncontrollable) consequences of his actions" (203; original italics). To be able to affirm the consequences of invention only after it is too late certainly carries ominous ramifications, but there is, Stiegler writes, a certain "careless care" trammelled up in the forgetfulness of *ēpimētheia*. To take note after the fact implies a respect for our finitude and fragility. Our propensity for error and the necessity of correcting for past faults nevertheless guarantees an open future. To live only by foresight and a will to mastery, to foreswear surprise and the lessons it teaches about vulnerability, to strive only for innovation without attending to the unforeseen traces it leaves behind, is to acquiesce to a frightful inertia.

The Promethean paradigm, taken alone, leads to irresponsibility and solipsism. Such is the lesson of Mary Shelley's *Frankenstein*, the tragedy of which lies, not in Victor Frankenstein's hubristic creation of an artificial life form, but rather in his inability to respond to the creature after the fact of its animation and his refusal to act responsibly toward it when it turns out to be unexpectedly unrecognizable. Catherine Waldby argues that the mutual destruction of Victor and his creature is the result of Victor's ethical failure to think about how his invention could transform human ontology. For Waldby,

to contemplate the birth of artificial creatures suggests

> ways to think about how major transformations in technical systems . . . upset the putative stability of the category 'human' and send its naturalized modes of being into disarray. . . . [A]ny shift in the logic of technical systems changes the material terms in which the human takes place. Such shifts open human being up to unforeseen possibilities for new modes of embodiment and translation, extension, supplementation, and loss. They suggest new forms of entanglement between human, technical, and animal life, new forms of enablement and disablement. (Waldby 36)

The cybernetic attitude suggests that we are enabled and disabled in our attachments to the world, attachments which our inventions and interventions alter and multiply. The cybernetic organism might teach us ethical lessons about dwelling and belonging together, about forms of communication and contact that fold together the diverse realities to which we are bound and whose disruptive effects can only come upon us by surprise, and might thus become a figure for an ethics based upon a creative, ecological and ecophilosophical framework..

Chapter 7

Unhomely at home:
Dwelling with domestic robots[1]

Domo sapiens

The sequestered labs of industrial engineering firms or technical research institutions like MIT are not the only places where life is springing forth to animate the previously inanimate, conjured through the diligent labour of scientists, designers, and engineers. Mitchell's ominous slogan, "things come alive," has become the rationale behind a growth-industry in redefining domestic appliances and the functioning of the home itself. As advertised on perennial episodes of the Discovery Channel's *Daily Planet* or PBS's *NOVA*, in the fabulous world of tomorrow (endlessly deferred such that it remains, now as ever, right around the corner), domestic labour recedes ever further into the background, shifting away from the experience of labouring bodies toward bodies of information. As growing interest in domotics—the technologies of home automation—brings cybernetic communication and control to the intimacy of everyday familial dwelling, researchers are envisioning ways to put the house more in touch with its occupants. It seems to me, however, that it could be hard to feel at home when your home begins to feel back. That mysterious feeling known as the uncanny accompanies this newly lively home life, an un-homely sensibility that speaks out from the etymology of the German *unheimlich*.

In this chapter, I interrogate the significance of two domestic robots, iRobot's

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1. This chapter has been revised from "Unhomely at Home: Dwelling with Domestic Robots," which was published in *MediaTropes* 2.1 (2009): 37-59.

Roomba, the renowned autonomous vacuum cleaner, and Chibi-Robo, the heroic homunculus from Nintendo's offbeat video game series of the same name. I wish to address our present in its noncoincidence with the "just now" of modernity. These robots stand for me as curious figurations of technological living, each participating in both the actualities and speculative fictions of everyday dwelling with artificial creatures. I wish to question the uncanny as a feeling particularly symptomatic of living with the *ēthos* of modernity and the products of modern technoscience—a timely unhomely. As technoscientific practice accelerates cultural life to the very limits of its own presence, its own present-ness, modernity may be buckling under the strain of its own structured regime of permanent invention and innovation, effectively disinventing itself and its attendant humanism. The domesticity of domotic technology bears a disorienting feeling of "not-being-at-home" with technological life that points to moments of breakdown in the attitude of modernity. What emerges from this feeling is a kind of animistic thinking that confuses commonplace sensibilities as to what constitutes the living as opposed to the nonliving—a mode of thought that we are supposed to have overcome in our enlightened ascent to the status of Man. I argue that to adopt a "strategic" animism may help cultivate a sense of radical belonging, an ethical comportment attuned to the host of lively nonhumans that animate everyday human living.

Roomba and the pucksters in the electronic bioreserve

Brooks has devoted a large portion of his career toward domesticating, in the literal sense, the potentials of artificial life. The contemporary home has been the focus of iRobot's mainstream attentions, and seems to represent, for Brooks, an exceptional niche for exploring the boundary zones of life and living. The admirably successful Roomba

vacuum cleaning robot is only the first element in a comprehensive vision of cybernetically enhanced domesticity. The Scooba wet floor scrubber, Dirt Dog shop sweeper, Verro pool-cleaner, Looj gutter router, and ConnectR virtual visitor are consecutive robotic salvos refashioning the domestic "machine for living in" as something, perhaps paradoxically, more organic. The cybernetic theory in LeCorbusier's architectural mantra comes to the fore on the backs of artificial creatures.

An important section of *Flesh and Machines* depicts a complex system of interacting household robots, beginning with a detailed description of the Roomba prototype Brooks developed at MIT (117-19). Once switched on, the thirteen-inch disc "bumbles" around, cleaning as it goes. It follows a largely random trajectory, redirecting its course when it bumps into obstacles to head off in another direction. As it sucks up debris from the floor, a laser sensor in the suction tube indicates the relative density of the dirt flowing into the machine. If it happens upon a particularly dirty area, it lingers until things are fairly clean before scooting off somewhere else. If it senses that its batteries are running low, it quits its cleaning duties and heads for a recharging station. Roomba's abilities are clearly not very complex, nor are they meant to be. Designed according to Brooks' behaviour-based design methodologies, the robot never knows where it is, where it is going, nor where it has been. It simply moves about, reacting according to input from the environment to modulate its behaviour, directing, redirecting, and containing its activity. The robot is entirely embedded in its surroundings, an embodied, situated creature that does not rely on symbolic or representational model-making. That your living-room floor gets clean is an epiphenomenon of Roomba's largely random wanderings, not part of any intentional procedures built into the machine.

This outcome emerges as the result of simple, layered interactions with the immediate physical world.

But Roomba is only one component in a more elaborate vision. Brooks soon jumps from the Roomba prototype to imagined robots he dubs "pucksters": "small, hockey-puck-sized robots with small legs that they use to slowly, slowly drag themselves around" (119). As Roomba bumbled around the house, cleaning the larger, open areas of each room, these smaller machines would get into all the nooks and crannies, along the baseboards and in corners, collecting dust with some sort of electrostatic device and filling their bellies with the detritus. When full, they would linger until they heard the larger vacuum approaching and rush into the middle of the room, whereupon they would dump their payload and crawl a short distance away. The larger species would blindly avoid the pucksters like any other obstacle, and treat the pile of dirt as it would normally.

The fantasy Brooks offers, a fantasy that seems to be coming true as iRobot launches each new product, is that of a household "ecology of robots" in which the various machines cue independent behaviours in each other to create a network of interactions that, in turn, emerge into productive behaviour:

> This is a very organic sort of solution to the housecleaning problem. It is not a top-down engineered solution where all contingencies are accounted for and planned around. Rather, the house gets cleaned by an emergent set of behaviors, driven by robots that have no explicit understanding of what is going on, nor of how to accommodate gross breakdowns in the expected ecology. It is a balance, robust over a wide range of conditions, which the designers have conspired to make work. That conspiracy allows very simple robots, and therefore very cheap

> robots, to work together to get a complex task done. (120)

Soon this fantasy includes robots that clean the kitchen and dining room tables, scrub windowsills, clean the television screen, pick up the laundry, get the groceries, do the dishes, and so on. The home becomes an extensive ecosystem, an electronic bioreserve. And, as befits his engineering mantra, housework becomes fast, cheap, and out of control.

Not entirely *beyond* control, of course. The creatures' emergent behaviour is governed by the "soft" control discussed in chapter 2. This mode of control does not entail a direct application of force, but has to do with the careful engineering of a design conspiracy that modulates the environment as a whole such that the robots are able to act autonomously as they engage in a "spontaneous productivity." Soft control is "concerned with fine tuning the local conditions that allow machines to outperform the designers' specifications, that surprise the designers but spontaneously improve upon them, while also containing their possible space of mutation" (119). Artificial creatures must produce in excess of their design, beyond what has been invested in the system. The excessive value created through this nonhuman vitality may be expressed, Terranova writes, with the autonomist Marxist notion of a "biopower of labour," which she describes as "a power of making and remaking the world through the reinvention of life" (129). If the household ecology is successful in this reinvention, it is because it remains open and reactive to the overwhelming probability for error, and can thus adapt to changing environmental conditions.

Though the potential of this creative labour that the autonomists seek to explore is staunchly anthropocentric, I maintain that Brooks' creatures, as a technical reinvention of life in themselves, certainly speak to the political stakes involved in engineering

nonhuman intelligence. Despite the marketing claims, Roomba and its cousins are not so much about increasing the leisure time of individuals by having more machines to do the work of everyday living. The labour they perform is much more productive than that. They reorganize the form-of-life, the *bios*, in the home: remapping the domains of labour, reorganizing the speeds and potentials of the household's day, adjusting the affective climate within its four walls. With innovations in household appliances that offload more and more of the physical tasks comes an increased emphasis on less "visible" tasks, such as the emotional and interpersonal labour involved in managing a family, especially in terms of childrearing and education (Gardiner 211-12). The adoption of domotic technologies is thus also an investment in human capital, since their spontaneous productivity can inform the productive potentials of the family. A household's lively ecology invigorates its economy.

The timely unhomely

Allow me to return once again to the Heideggerian "essence" of modern technology, and address Brooks' domestic robots as agents of biopolitical investiture in a neoliberal economy whose governing attitude is "enframed" by a morality of optimization and enhancement. Of course, that modern technology is our primary means to the end of "extending our useful and enjoyable lives" (*Flesh and Machines* 238) is something we all know deeply and sincerely. This is a knowledge that endures in modern thought, no matter how critical we may be of the direction of technological progress or the character of certain technological practices. In "The Question Concerning Technology," Heidegger suggests that the word *technē* has a primordial link to the word *epistēmē*: "Both words are names for *knowing* in the widest sense. They mean to be *entirely at home in something*,

to understand and be expert in it" (*The Question* 13; my italics). While the dream of domotic technologies is that they will make us more comfortably "at home" in our dwelling places, they nevertheless carry the potential to defamiliarize our knowledge of technological artifacts and their function in our everyday lives.

According to the *Oxford English Dictionary*, the word "uncanny" is derived from an older form of the verb "to know," related to the Dutch *kunnen* and the German *können*. "Uncanny" was thus at one time used to denote notions of carelessness, mischievousness, or deception—those things that result from the unknown, i.e., ignorance, or its exploitation. During the late eighteenth century, the term was applied more properly to people, and began to take on connotations of the occult: the sinister figure of the stranger or the outsider, the one nobody knows, was evoked in this usage. The term began to take on the sense it carries today in the mid-nineteenth century, when it became common to use the word "uncanny" to describe things that are supernatural, mysterious, or otherwise strange—things that seem to elude rational understanding.

Freud's well-known formulation of the uncanny has everything to do with knowledge as well; for him it is "that class of the frightening which leads back to what is known of old and long familiar" (Freud 220). From a psychoanalytic standpoint, the uncanny betrays peculiar cracks in the ego's repressive function; it is a startling encounter with something that has been actively, if unconsciously, un-known. More than this, however, Freud claims that the nature of this encounter is that of a conflict between our rational, modern sensibilities and primitive "residues" left over from an "animistic conception of the universe" (240). He writes that, though we have "surmounted" such animism, "we do not feel quite sure of our new beliefs, and the old ones still exist within

us ready to seize upon any confirmation" (247). In the course of our modernization, we have forgotten animism in the interests of less "savage" beliefs, burying it within a cultural unconscious that nevertheless eagerly haunts our quotidian dwelling.

These are thoughts that have their condition in a particular cultural and technological milieu. The invention of modern communications media in the mid-to-late nineteenth through the early-twentieth centuries opened ubiquitous conduits to the uncanny.[2] These new technologies realized, in everyday experience, many of the "primitive" beliefs that Freud describes throughout his essay, what with machines and automata that acted well beyond human intervention, light from the wall activated by the merest of gestures, voices of the departed courtesy of wax cylinders and shellac discs, sounds extracted from the ether, images of the distant or dead—whether disquietingly still or silently active—brought forth of a lantern, and so on. Not to mention a certain talking cure that purported to alleviate the deleterious effects the power of thoughts themselves could have on one's life. We could very well say the uncanny is a class of the frightening particularly symptomatic of modernity, at least a modernity that is characterized by machines, media, and a fairly newfound interest in the powers of a language largely autonomous from consciousness and the soul. More correctly, it is symptomatic of the breakdown of modern thinking as a solution to the problem of the world.

Our society has since wagered its life and livelihood on the political strategies of increasingly frenetic mediascapes and highly systematic processes of technoscientific invention. Yet the precise workings and interrelations of the high-tech mediations and

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2. This is very much John Durham Peters' argument in *Speaking into the Air*.

services we dwell amongst are generally obscure to everyday apprehension. The means by which technoloscientific practices affect human capacities for action escape comprehensive understanding or precise management. In our most anxious moments, the recalcitrance of those things supposedly of human invention and our frustrated inability to penetrate the black boxes of their operation, lead us to believe something "known of old and long familiar": namely, that technology has a life of its own.

This line of thinking is the spirit of a strategic animism, by which the dynamic agency of the nonhuman becomes an acceptable object for ethical and political thought. An imaginative encounter with various forms of life-as-it-could-be inspires forms of bioethics and biopolitics that take the indeterminacy of life as a positivity, an affirmative and affirming uncertainty. This uncertainty as to what counts as a living being thus becomes an analytical device for reevaluating biopower in terms beyond the strictly human. It is also in this uncertainty that new forms of gathering take shape, new imperatives for belonging arise, and new forms of dwelling disclose themselves.

Heidegger argues that the ancient meaning of dwelling implies the activities of preserving and safeguarding; it is about "saving the earth," which can only happen in "a staying with things" ("Building, Dwelling, Thinking" 148-49).[3] If this is so, then perhaps it is in the cultivation of an *unheimlich* mode of dwelling, a way of being at home that is "known of old and long familiar," that we might catch a glimpse of Heidegger's "saving power": the potential held in technology and its "essence" to reveal the ways in which we

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3. In "Building, Dwelling, Thinking," Heidegger writes:

> Mortals dwell in that they save the earth. . . . Saving does not only snatch something from a danger. To save really means to set something free into its own presencing. To save the earth is more than to exploit it or even wear it out. Saving the earth does not master the earth and does not subjugate it, which is merely one step from spoliation. (149).

are given over to the nonhuman to become the beings that we are. Yet the "hope" Heidegger identifies with the saving power is a humble one, to be fostered, he writes, "Here and now and in little things" (*The Question* 33). With this in mind, I wish now to turn to a particular little thing in the form of Chibi Robo.

A little robot goes a long way

> He will change your life forever!
>
> —*CHIBI ROBO!* HOMEPAGE[4]

As domotics continues to enter the popular imagination, it is odd that we are so frequently invited to perform the mundane tasks from which we are promised future alleviation in our playtime. Amidst the hype of automated homemaking, video games that simulate domestic labour have surfaced to astonishing success. *The Sims* franchise is probably the best known and most lucrative example, its publisher, Electronic Arts, having sold well in excess of 100 million units worldwide since the first game's release in early 2000.[5] A "people simulator" that takes the form of an interactive dollhouse, *The Sims* and its two sequels demand players to micromanage the home-lives of their pixelated avatars, attending to the trivialities of placing trash in the trash can, mowing the lawn, and mopping up any messy puddles made should they neglect their Sims' "bladder motive." It seems curious that the things we are loath to do in real life, like picking up after ourselves, are things that many of us now seek to occupy our moments of leisure.

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4. When the paper that would become this chapter was written and subsequently published in 2009, *Chibi Robo!* had a website at <http://www.chibirobo.com/gcn> (last accessed 17 June 2008). Unfortunately, due to the ephemeral nature of both the Internet and the games industry, this site no longer exists, and any attempts on my part to track down a mirror site or an archive have proven impossible.

5. <http://www.nytimes.com/2008/04/16/arts/television/ 16sims.html?_r=1&oref=slogin> (last accessed 11 Feb. 2011).

Now consider *Chibi-Robo!*, the 2006 adventure for Nintendo's GameCube. Though a rather obscure title compared to *The Sims*, its fictionalized articulation of the domestic and the robotic nevertheless serves to highlight the unhomely biopolitics of technological life we have been exploring thus far. Nintendo of Canada's website declares: "Chibi-Robo is not your typical video game hero. For one thing, he's less than a foot tall. For another, he spends most of his time cleaning up around the house. His main objective is not to recover magical crystals or to overthrow an evil tyrant. For Chibi-Robo, success is simple. His goal? To Spread the Happiness!" A birthday gift for eight-year-old Jenny Sanderson, Chibi-Robo's "sole purpose is to bring happiness to Jenny and her family . . . by picking up trash, scrubbing the floor, smoothing over family drama, and other everyday tasks."[6] The player's job is to take on the role of Chibi and perform these "everyday tasks" while exploring the house and observing the activities of its occupants. In many ways, playing *Chibi-Robo!* is like experiencing a day in the life of one of Brooks' household robots, though with a diversification of function that reflects the imaginative ends of the sci-fi fantasy in which those technologies participate.

More than a cleaning robot, however, Chibi labours upon every moment and particular of the Sandersons' lives: monitoring their gestures, utterances, and moods; watching and reading the occupants for signs of their needs or desires; anticipating and providing pre-emptive solutions to problems barely even communicated; fulfilling needs they may not even have known they had. This largely entails the workaday matters of picking up after the Sandersons' messy relationships. The latter aspect gets a much more frank description in a review of the game on ign.com than on Nintendo's website: "We

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6. <http://nintendo.ca/cgi-bin/usersite/display_info.cgi?id=2541788&lang= en&pageNum=5> (last accessed 17 June 2008). Unfortunately, this webpage has also been lost since I initially wrote this article.

eventually learn that the Sandersons are financially troubled and worse, completely dysfunctional. Not only is Mr. Sanderson a slob who has money-spending issues, but the missus has repeatedly kicked him out of the bedroom and often wonders why she ever married him."[7] Little Jenny, for her part, seems to have retreated into an autistic delusion in the face of her parents' emotional discord, dressing up as a frog and communicating only with ribbits.

Chibi becomes the Sandersons' majordomo, seeing to the health and happiness of their lives by regulating the social communications network that is their home. Delivering letters between Mr. and Mrs. Sanderson, sitting silently with the latter over a cup of tea as she vents her marital frustrations, returning lost rings to Jenny and allowing her to show you her crayon drawings (this last of which, over the course of the game, change from obsessive pictures of frogs to pleasant depictions of a happy family): these are the sorts of tasks that make up the game's bulk. The comedic structure of the game's narrative has to do with revitalizing the family from an entropic breakdown, a movement from stasis to happening. We could call this sort of work affective labour, after Michael Hardt and Antonio Negri in *Empire*: "This labor is immaterial, even if it is corporeal . . . in the sense that its products are intangible, a feeling of ease, well-being, satisfaction, excitement, or passion" (292-93). It is about producing, exchanging, and communicating affect, which must be understood not just in the sense of an emotion, but also in the Spinozian sense of *affectus*, i.e., a capacity for action, power to affect something, to make something happen. Happiness means more than warm feelings; it carries a connotation of overall health—in the case of *Chibi-Robo!*, the health of the Sanderson family. Spreading

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7. <http://cube.ign.com/articles/685/685694p1.html> (last accessed 11 Feb. 2011).

the happiness is a "caring labour," oriented toward the creation of "social networks, forms of community, biopower" (293). Hardt and Negri locate this production of affect in those particular services that provide (actual or virtual) "human contact," citing health services and the entertainment industry as their primary examples.

However, in singling out "human" contact, Hardt and Negri's description of affective labour falls short of the radical biopolitics I wish to suggest. They explicitly set apart affective labour from computer technologies and "computerizing" processes—a major blind spot, considering the massively productive role that digital machines have come to play in producing social networks and forms of community. This is not simply about computerized mediations between humans, either. By 2000, the year *Empire* was published, research and development was well underway to engineer humanoid robots to interact with humans in socially intelligent and emotional ways, specifically targeted toward the healthcare and entertainment industries. Cog, the slinky-playing, ball-tossing, humanoid robot designed by Brooks, and Kismet, a curious, blue-eyed, "sociable" robot, built by Brooks' protégé, Cynthia Breazeal, both developed in the mid-to-late 1990s, are just two isolated instances of this broad project. And one should not underestimate the affective labour performed even by the humble Roomba, which, according to its marketing hype, largely has to do with freeing time at home to spend with friends and family. Creating feelings of ease, well-being, satisfaction, excitement, or passion, doing the work of caring in the interests of overall health—in short, spreading the happiness—is not a strictly human affair, as any loving pet owner will tell you. Nor should we limit our imaginative inquiry solely to the organic. This is a biopower whose effects are felt, not only in the facilitation of human contact, but also in contact between humans and

nonhumans within a communicative social network that connects the lives of people and things.

In order to undertake the task of spreading happiness, the player-as-Chibi must come to understand the house as just such a network. For instance, at a point roughly midway through the game, the player discovers Mrs. Sanderson in her bedroom, lamenting over mounting bills and a missing receipt. The player must then draw a connection to the living room, where Mr. Sanderson can be spotted hiding a slip of paper in the couch. Recognizing this significance, the player-as-Chibi must grab the poorly hidden receipt when Mr. Sanderson is sleeping and deliver it to Mrs. Sanderson, who is grateful for the assistance. Many such observations, operations, and deliveries are necessary in order to succeed in the game. The player needs to undertake something of a systems analysis of the domestic functioning of family life as it takes place within a concrete, architectural structure amidst an interconnected multitude of relational objects, becoming a sort of a bio-hacker. She must come to know the house, its occupants, and its things as connective elements in this system, nodes in a network. She must acquire new items, abilities, and bits of knowledge in order to eliminate or bypass certain obstacles and increase Chibi's range of access. In the final instance, the player must come to influence the system on a micro level in an image of communication and control suitably tailored for the e+10 set. She must come to understand and tap into the family's collective and individual desires as algorithmic information flows to be controlled and manipulated as she comes to animate a diffuse network of microscopic (rather than panoptic) surveillance, encoding, and modulation. Now you're playing with biopower!

As cute and unassuming as he may be, Chibi is a biopolitical agent within an

allegorical vision of what Gilles Deleuze would call a "control society."[8] The game guides the player through a sort of cybernetic skills training in the dynamics of this new regime. What is being learned here Terranova refers to as the "computation of the biological," which, she argues, is "concerned with the power of the small" (Terranova 103). What *Chibi-Robo!* so ingeniously allegorizes is the *micropolitical*, power on the small scale, targeting the tiniest aspects of everyday behaviour, intensifying or blocking flows and fluxes of desire, producing conditions for action, opening or containing highly localized fields of potential on the sub- or pre-individual level for the creation of new modes of being and becoming—in this case, a negentropic production of happiness and familial harmony. Of course, Chibi's diminutive size is a most literal interpretation of something that is not so much about "size and weight in the metrical sense," as it is about a relativistic immersion in a densely networked system:

> Smallness is not measured by rulers and scales, but it is exterior and relational: it is described by an overall relation to a large number of variables, with no ultimate determination or central control. . . . What makes the components of an open system small is not their size but the fact that they are grasped in terms of their overall relation to a large number of interchangeable components that interact with each other by way of recursive feedback loops. (103)

This is a system able to handle surprise. Control power relies upon it, since the system's instability and mutability ensure its vitality, allowing new opportunities to arrive at an accelerating pace. The jittery affects that ooze from the anticipation of the unforeseen and the probability for future error are the side effects of producing the new.

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8. On control societies, see Deleuze's "Control and Becoming," and "Postscript on Control Societies" in *Negotiations*.

Interestingly, this could stand as a fitting description for much of contemporary game design, the so-called sand-box genre especially, whose main hook is the immersion of the player in a huge "open world" characterized by freedom of movement, a certain amount of choice when it comes to fulfilling objectives, and opportunities for setting one's own goals. This allows for a certain level of emergence to occur in the gameplay, since its go-anywhere-do-anything design elides the immediate perception of any "overall determination or central control." Arguably, the massive success of such flagship instances of this design tendency as the *Grand Theft Auto* franchise, *Fable*, and, to some extent, *The Sims*, is attributable to a cultural need for play that entrains individuals to a particular regime of power and its attendant forms of social conditioning and competition. The power effects that characterize societies of control do not find expression in the discrete, discontinuous images of spatial, temporal, and behavioural confinement that characterized the majority of video games until the mid-1990s (think of the planar mobility of the avatar in *PONG*, *Breakout*, or *Space Invaders*; the restrictive mazes of *Pac Man*; the right-to-left platform jumping of *Super Mario Brothers*). Rather, a control society manifests in increasing open-endedness and scale, freedom of movement, and the diversification of goals. Appropriately enough, contemporary game design is becoming more do-it-yourself, allowing the player to experiment, to react quickly to unexpected scenarios, and to innovate spontaneously.

The turbulent, open-ended system of biological computation allegorized in *Chibi-Robo!* is especially responsive to a soft mode of control, which is about "fine tuning local conditions" in the promotion of emergent, collective behaviours. It is oblique in its function, applying "a minimum amount of force," from the bottom up, as it were

(Terranova 119). Chibi only interacts directly with the Sandersons to gain information, or just to chat. He does not tend to act upon them directly, instead performing tasks that, more often than not, go unperceived. The player, locked into the perspective of the small, amasses knowledge of and gains control over the system at large as she gradually gains access to the house's various rooms. She never comes to apprehend it in its totality, from a transcendent, comprehensive viewpoint. Her capacity to affect the system is always immanent to it, involving the movement and transportation of information in the form of deliverable or usable items. She ties the home's localities and subjects to one another in an ever-more intricate web of tangled, communicative movements.

Not so much a disciplinary "cog in the machine," the relativistically "small" agent within a "gigantic," fluid network of soft control is much more flexible, autonomous, and mobile: for example, an electrical signal, a remote-control image, a tiny robot, of which Chibi-Robo is all three. The shift from a disciplinary order to one of control is the shift from machining forms of life and turning bodies into information, to creating forms of life from machines and conjuring bodies from informatic flows. It is the difference between, on the one hand, utilizing the materiality of the human body to "mould" the objective possibilities of life, and, on the other, operationalizing the transmutational capacities of (digital) communication to modulate potentials for animating human life through nonhuman agencies.

Dwelling well

Chibi-Robo! depicts a domestic setting that is animated in a way that we are perhaps not used to; it presents a vision of an imagined future in which life, or something like it, scurries about below our line of sight, subtly influencing the ways in which we dwell.

The sort of power that the game allegorizes contains positive possibilities, a productive capacity to create new conditions for acting. In the course of the narrative, the little robot transforms the domestic space and the familial relations in the Sanderson household. The house and its inhabitants metamorphose into an ecology buzzing with a dynamic potential for happenings—a fully animate milieu. Chibi is not the only nonhuman in the house who blurs the boundaries between the living the nonliving; animism abounds below the perception of the Sanderson family. When the humans are sleeping or out of the room, the many toys lying around come to life, animals of all sorts speak—even time-travelling aliens arrive on the scene. All of these lively things need Chibi's help in one capacity or another. In order to answer their entreaties, Chibi repurposes common household items: a toothbrush becomes a powerful floor scrubber, an upturned mug becomes impenetrable armour, a spoon becomes a shovel. Various costumes acquired in the course of the game allow Chibi to perform new actions and to interact in different ways with the peculiar denizens of the Sanderson home. Happenings unfold and fold together in emergent fields of potential. The home becomes a surprising milieu.

Control, as a mode of power that not only accepts, but actively produces surprise, is the key to all this. Brian Massumi suggests that control "is the powering-up—or powering-away—of potential" (Massumi 88). It is about cultivating dynamic ecologies of action through redefinitions of life itself. This has involved an explosion of meaningful connections and reconnections between humans, animals, and machines throughout modernity, connections that have become especially intense in the contemporary world, where cybernetic forms of life have allowed us to reflect upon life itself as something artificial, something synthetic, though to my mind something no less

hopeful. Life is something made, dependent upon things, an assemblage of diverse realities, a process that emerges in the interaction of innumerable techniques that are thoroughly nonhuman. Exploring the potential of artificial life is about the development of a bioethics of belonging that takes human beings as heavily interdependent entities.

What is at stake here is ecophilosophical, a reflection upon the *oikos*—the home in specific and dwelling in general. Something akin to what happens in *Chibi-Robo!* occurs on a much more complex, oblique, and imperceptible level in our everyday home lives. The nonhumans that surround us continually perform labour of both material and affective kinds, making our lives livable in specific ways, even if we do not notice it. As much as we animate and invent the things around us, we are invented and animated in our "staying with things." The individuated or differentiated self is a collective event, a transductive disruption or coup, in which we simultaneously socialize and are socialized by our environment as a dynamic medium of communication.[9] Communication animates community, conditioning modes of gathering and belonging together.

Learning how to dwell communicatively is part of our lesson in learning how not to be Man. We continue to place human life far above the life of any other entity on Earth, above the life of the Earth as a whole. What Brooks calls overanthropomorphization is the name for an ontological disability that gives us our politics of ecological destruction. We are far too at home with this anthropomorphic and anthropological conception of ourselves. Crucial to the political struggles of the twenty-first century is a forgotten sense that we belong to the world.

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9. "The medium of 'communication' . . . is the interval itself: the moveability of the event, the displacement of change, relationality outside its terms, 'communication' without content, communicability" (Massumi 86).

To imagine a domestic setting teeming with the animate activity of the inanimate is to affirm a feeling of not-being-at-home that might shake us of old humanistic habits and open us to a nonanthropocentric ethics. Such an affirmation may compel us to entertain an uneasy and uncertain kinship with a nonhuman world that seems ever more lively, and encourage us to cultivate a human life that seems ever more nonhuman. Even as our own powers of artifice appear to secure the sovereignty of the human-in-itself over the material world, they have at the same time forged labyrinthine connections between the natural and the cultural, the nonhuman and the human, the animal and the machine, thrusting the human into an uneasy relationship with itself as a contingent product of those connections. Such connections render the boundaries between living and nonliving uncertain, a disorientation that seriously troubles a conception of the human subject as unified and self-possessed. Human beings reveal themselves to be creatures of artifice, animated only in the context of an animistic thinking we are no longer quite at home with, but which reaches toward us from a mislaid belief in the world.

At the end of his discussion of control societies, Deleuze claims, "What we lack most is a belief in the world, we've quite lost the world, it's been taken from us" (Deleuze 176). One might say much the same thing about life, with the biopolitical techniques of the past two centuries engaged in a rationalization of life processes that, somewhere along the way, seems to have lost the notion of *living*. Belief leads us beyond those thresholds of modernity that privilege the power of knowledge over the potential of the unknown and forgotten. Could Brooks' robotic ecology and the communicative milieu of *Chibi-Robo!* constitute new landscapes for an uneasy belief in a lively world, where the human is merely one component in a dynamic organization of the organic and

inorganic? Our own suspension of disbelief has to do with recovering an un-known knowledge of the liveliness of things. There is something compelling in forgetting to forget old animistic beliefs, at least strategically. In a world where technoscientific invention and innovation makes animism nearly unavoidable, the life of the world rushes forth with a disquieting autonomy. Robots thus become startling representatives of the world as an enchanted artifice. They are the proponents of a creative, ecological bioethics that seeks to cultivate a "life-as-it-could-be," in which we might come to believe in happiness as a kind of dwelling well together.

Conclusion

Ethical robotics?

Giving humanhood

Brooks continuously emphasizes vulnerability as he works through his thoughts on the future of robotic technologies, returning persistently to the boundaries between humans and machines, humans and animals, humans and humans, to their contingency and susceptibility to redefinition. His reassuring claim that the robotics revolution will not ensue in a robot revolt is based upon the less soothing notion that these boundaries are both conceptually and materially vulnerable to the "invited invasions" of high technology, to the merger of flesh and machines. More to the point, in Brooks' writing these sorts of vulnerabilities become necessary to the self-preservation of the human species. However, his critique of our own "overanthropomorphization" and the correlative strategies he employs to undermine the ways in which we as human beings persuade ourselves that "we are special," ultimately serve to sustain the persistence of a recognizable "we." It would seem, paradoxically, that by disabusing ourselves of the very idea that we are special, we may remain precisely so.

Inherent in the precariousness of epistemological boundaries surrounding the question of what constitutes the human is a question of shifting ethics with regard to those deemed nonhuman. In a short section of *Flesh and Machines*, called "Ethical Slaves?" Brooks makes a troubled attempt to outline the ethical considerations we face on the cusp of the robotics revolution and the crisis it brings in determining what is special about ourselves. Specifically, he refers to the science-fiction-inspired "attraction"

to the prospect of robot slaves, which leads him to consider the implications this prospect carries with respect to the historical institution of slavery and the moral questions that arise as an obvious consequence:

> But what if the robots we build have feelings? What if we start empathizing with them? Will it any longer be ethical to have them as slaves? This is exactly the conundrum that faced American slave owners. As they or their northern neighbors started to give humanhood to their slaves, it became immoral to enslave them. Once the specialness of European lineage over African lineage was erased, or at least blurred, it became unethical to treat blacks as slaves. They, but not cows or pigs, had the same right to freedom as did white people. Later a similar awakening happened concerning the status of women.
>
> Fortunately, we are not doomed to create a race of slaves that is unethical to have as slaves. Our refrigerators work twenty-four hours a day, seven days a week, and we do not feel the slightest moral concern for them. We will make many robots that are equally unemotional, unconscious, and unempathetic. We will use them as slaves as we use our dishwashers, vacuum cleaners, and automobiles today. But those that we make more intelligent, that we give emotions to, and that we empathize with, will be a problem. We had better be careful just what we build, because we might end up liking them, and then we will be morally responsible for their well-being. Sort of like children. (195)

The first and perhaps most obvious difficulty with this passage is the enormous simplification of the histories of African-American slavery and of women's rights, the reduction of the vast social, political, and economic intricacies these histories involve to a

plain failure to recognize or to grant recognizable "humanhood." The facile account whereby the eventual recognition of blacks and women in their humanity results in their straightforward attainment of the "same right to freedom" as white men is certainly the result of this erasure of historical complexity. It could also go some way to explain the remarkably strained analogy between the working conditions of household appliances and the experience of slavery.

What I find troubling in this passage, however, is not Brooks' jejune treatment of the histories he refers to here, nor his deliberately provocative implication that there may be a type of slavery that is not unethical—even if his treatment of migrant labour I discussed in chapter 4 hints toward a naïveté (or, less charitably, irresponsibility) when it comes to thinking through matters of a more political import. What I do wish to critique is the humanist ethics he adheres to, even as he seems to be expanding the purview of ethical responsibility beyond the strictly human. His account of ethical "awakening" betrays a deep ethnocentrism and anthropocentrism, insofar as the "problem" of ethics only becomes a problem worth considering when an entity or group of entities begin to approach in likeness to a conceded-upon image of the human. According to the historical narrative Brooks offers above, Blacks and women were granted status above chattel, had humanity bestowed upon them, before empathy became a possibility and equitable right could be realized. More to the point, the ethico-moral "conundrum" follows when humanhood is "given" by those with epistemological authority. What first takes place is the exercise of a power to designate what counts as human, a power to name or rename "the human" in contradistinction to the generalities of "the animal" or "the machine." So too with Brooks' robo-abolitionism: once again, the "problem" follows only after

intelligence and emotion are *made* and then *given* to robotic life forms.

I do not wish to make the argument that humanness is something unmade or unconstructed, something intrinsic and inalienable, and therefore something no one has a legitimate right to "give." I am more concerned about the representation of this "gift" as one that endows the other with resemblance and the assumption that responsibility can only begin when the other is the same as, or at least familiar to, a particular image of being human. That *familiarity* is the *sine qua non* of responsibility and obligation—one might say, in a word, of justice—rings clear in Brooks' admonition that "we must be careful what we build" because our robots may end up "sort of like children." Setting aside the connotations of paternalism this comment brings to mind, especially with the analogy to African-American slavery and its aftermath so strongly in resonance, the implication seems to be that ethical comportment is undergirded by lineage, one shared by Africans, Europeans, and, later on, women—but not, as Brooks makes it a point to insist upon, cows and pigs. Only when groups of people become more alike do ethics and justice seem to become possible in Brooks' account. Only when robots come to possess intelligence and emotions (presumably to a degree over and above those of cows and pigs), qualities, moreover, they would possess by virtue of their being designed and built by human beings, only at this point would we be called to account for a "moral responsibility" toward them.

Ultimately, this is a matter of rights, though Brooks implies a conception of rights based on a highly problematic presupposition of likeness and, therefore, would-be likeability. If there is a failure in Brooks to propose an ethics adequate to the "broad future" of living in a world inhabited by increasingly animated machines (and, by

extension, of sharing a world with nonhumans of all sorts), he comes by it honestly. The logic and function of rights discourse is firmly entrenched in the tradition of Western liberal humanism, and its application in specific instances is often a superposition or transference of ostensibly "universal" human rights to a particular group of subjects. Of course, this has never been at all straightforward in practice, as the multiple and knotted histories of civil rights have demonstrated. The liberal humanist subject is, after all, based on a conceptual image of a human being that is privileged, white, European, and male.

The case is more blatantly problematic when it comes to the "rights" of nonhumans. Brooks himself devotes a number of pages in *Flesh and Machines* to a discussion of animal ethics, the principle of which ultimately comes down, for him, to a hierarchy of how much "humanness" we "grant" to various species, based on the facticity of their biological proximity to our species:

> We grant animals some level of similarity to ourselves at an emotional level. That level of similarity happens to correspond fairly well to how similar they are to us in evolutionary and physiological ways.
>
> Somewhere in that mixture of emotion and physiology we see enough similarity and have enough empathy that we treat animals that are similar to us in the moral ways that we have decided to treat other people. (154)

For Brooks, the question of ethical robotics is likewise a question of similarity, one of how much likeness we bestow upon future machines and how much recognition we are willing to offer before we realize a conundrum that requires us to undertake a moral decision-making.

Writers such as Haraway, Derrida, Rosi Braidotti, and Cary Wolfe, have all argued that animal rights discourse invariably proceeds as an extension of the juridical tradition of human rights to nonhuman "subjects," such that "nonhuman beings, in all their diversity, are now rendered not as fully complete forms of life that are radically irreducible to such a thin, idealized account of what counts as subjectivity but rather as diminished or crippled versions of that fantasy figure called the human" (Wolfe 45). Surely a hypothetical movement for robotic rights would be similarly troubled, and not a simple matter of granting status to those machines that express a sufficiently humanlike intelligence and emotional state. Rather than think through the possible implications carried by our "overanthropomorphization" and sense of "tribal specialness" with regard to the relations human beings maintain toward nonhuman entities, Brooks simply proposes an ethics based on the degree to which others, both human and nonhuman, may be anthropomorphized.

I certainly laud Brooks' insistence that we "had better be careful just what we build." The duty to take care, to take responsibility, in the work of engineering as a peculiar form of engendering, is vital to the formation of community. As sincere as he may be, however, such a recommendation is in many ways of a piece with the old Promethian-Frankensteinian admonition about the uses and abuses of technology that habitually informs what passes for an "ethics" of technology. To hearken back to Heidegger, this warning may be read as an expression of the anthropological-instrumental morality whose goal is to "'get' technology 'spiritually in hand'" (*The Question* 5). Brooks' injunction to "be careful," then, concerns the "proper" manipulation of technology as a means to an end. It expresses a "moral responsibility," not to the well-

being of potential artificial life forms, nor, more importantly, to the larger, common ecology that stands to be disrupted by their release, but to the security of the human creators, for whom technology ought to respond to the optimization of human vitality.

Difficult community

> The deep subtext of the adventures of 'communication' in modern thought, I argue, is confrontation with creatures whose ability to enter into community with us is obscure.
>
> —JOHN DURHAM PETERS, *Speaking into the Air*, 230

If a human being is never solely a human being—as I have intimated through the writing of Heidegger, Stiegler, Haraway, and others—then to act solely in response to the interests and welfare, to the rights, of human beings alone is, in a sense, fundamentally irresponsible. A nonanthropocentric ethics must ultimately derive, not from a discourse of rights, but of radical difference. In the series of lectures entitled *The Beast and the Sovereign*, Derrida outlines the stakes of such an ethics with a force and clarity that deserves to be quoted at length:

> A principle of ethics or more radically of justice, in the most difficult sense, which I have attempted to oppose to right, to distinguish from right, is perhaps the obligation that engages my responsibility with respect to the most dissimilar [*le plus dissemblable*, the least 'fellow'-like], the entirely, precisely, the monstrously other, the unrecognizable other. The 'unrecognizable' [*méconnaissable*], I shall say in a somewhat elliptical way, is the beginning of ethics, of the Law, and not of the human. So long as there is recognisability and fellow, ethics is dormant. It is sleeping a dogmatic slumber. So long as it remains human, among men, ethics remains dogmatic, narcissistic, and not yet thinking. Not even thinking the

human that it talks so much about. (108; translator's glosses)

To engage responsibility and extend justice beyond the human—or even the recognizably human-like—is an ethics "in the most difficult sense" because it implies making obligations without the guarantee of reciprocation or even acknowledgement. It demands that we become humble and hospitable toward the nonhuman, that we become, in Haraway's terms, "significantly unfree partners" and "companion species" to beings whose relations to us, whose abilities to affect and be affected, always exceed our cognizance. The principle of this ethics may not rest on an abstract identification of rights or an optics of fellowship, but it is, I wish to argue, founded upon the tangibility and contactility of community and communication.

As I mentioned at the end of chapter 6 in relation to Esposito's *communitas*, community, with its root in the Latin *munus*, carries connotations of sharing and imparting as well as obligation—a reciprocal gift-giving that is about the institution of binding responsibilities by way of expropriation. It is not about forming a mutually recognizable identity among others, but of relinquishing identity as a matter of mutual indebtedness. Communication, if taken as the act of making-common, becomes similarly inflected. John Durham Peters points out that the Latin terms *communicare* and *communicatio* were not about symbolic exchange or "the hope for some kind of mutual recognition. Its sense was not in the least mentalistic: *communicatio* generally involved tangibles" (7). Peters' governing concern has to do with renouncing the dream of unmediated communication between interiorities. For him, communication is always flawed, always breaking down, always incomplete. There is a hermeneutic exercise in any communicative act, which always involves the interpretation of traces left behind by

another. Even the "purest" of face-to-face exchanges between ostensibly free and equal human beings are troubled by an essential miscommunication: "At best, 'communication' is the name for those practices that compensate for the fact that we can never be each other" (268). The anticipation of a connection is always haunted by the unavoidable promise of a flawed understanding, since there is a structured delay in any communicative practice. Thus communication finds its ethical urgency. However, the crisis of our own indeterminacy and the apprehension that mutual understanding and any full disclosure of knowledge is, in the final instance, beyond our grasp, should not be grounds for a retreat into nihilistic solipsism, but an invitation to multiply connections and mediations with diverse realities.

One can never be the other, can never fully recognize the other, the other being a black box that can only be known through its responses to one's inputs. As a theory of communication, what cybernetics teaches is that "communication" is a function that cuts across the human, the animal, and the machine, bringing each reality into significant contact with the other. With respect to the "adventures" of communication in the late twentieth and early twenty-first centuries, Peters writes, "The prominence of communication as a description for our life with each other marks the breaking open of the dike to admit the floods of the inhuman" (227). Indeed, our intersubjective relations among other human beings only add to the deluge, since even the most communicatively rational discourse is necessarily mediated by the nonhuman environment in which we are situated, and haunted by the animal and mechanical aspects of our embodied, psychic, and cultural selves. We are black boxes surrounded by black boxes, essentially obscure, vulnerable, and error-prone. The artificial lives and creatures that we invent and involve

ourselves with are compensations for our essential disabilities in dwelling together. This is a difficult community, in which the interrelations and interdependencies of the actors cannot be sufficiently recognized, cognized, or adequately addressed.

While the Rodney Brooks of *Flesh and Machines* tries to tackle the "conundrum" of machine intelligence with a rather familiar turn to a discourse of rights and a faith in similarity, the one Errol Morris presents in his documentary speculates on the problem to a much more compellingly alien end: "This approach to building robots will eventually lead to robots as intelligent as human beings. Whether we will be able to interact with them as we interact with other human beings, I think is more open to question. Because it's unlikely that they will be embodied in the same way we are. They will have different physical experiences, and they will be aliens to us." A commitment to the body, to embodied life and situated intelligence, is a commitment to finitude and fallibility, which is concomitantly a commitment to singularity and difference. At the end of the day, I do not wish to weigh in on the likelihood or not of highly intelligent or "conscious" machines in the future, which, to me, is not the real matter at hand. Robots and other artificial creatures are a figure through which to probe the possibilities of connecting with extant creatures and things, those that we have made, those that we have not, and those somewhere in between. What Brooks' intelligent yet alien creatures suggest to me is that the question of how to act and interact toward the "most dissimilar" is not only open to question, but must remain so. A principle of a nonhuman ethics as a matter of dwelling well consists in apprehending that the experience of finitude and fallibility is not a deficiency in need of remedy, but an imperative to become with, to communicate, to gather together.

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