zoontologies

the question of the animal

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From Extinction to Electronics:
Dead Frogs, Live Dinosaurs,
and Electric Sheep

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Since the mid-1980s, the figure of the cyborg in literature and popular culture has received a great deal of critical attention as an important symbol through which hopes and anxieties related to recent technologies have been articulated. Most of these analyses have focused on the reconceptualization of the human body and human identity that the cyborg stands for, with its wide-ranging implications for the relationship between humans and "nature"—whether it be in a medical, military, or scientific context—and for considerations of gender and race.[1] Yet, in her seminal "Cyborg Manifesto" (1984), Donna Haraway had already pointed out that the fusion of human and machine also has important repercussions for other conceptual distinctions such as that between human and animal (151–52). In spite of this early suggestion, robotic or electronic animals have been discussed very little in studies of cyborgs, even though they, too, appear with some frequency in recent literature and culture, sometimes in combination with genetically altered animals. Brett Leonard's film *The Lawnmower Man* comes to mind, which features a chimpanzee being trained in virtual-reality gear, as do the cyborg dolphin Jones in William Gibson's short story "Johnny Mnemonic" and "Ratthing," the semielectronic, semiorganic watchdog in Neal Stephenson's novel *Snow Crash*.[2] Simulations of animals have also begun to appear in computer games: *SimLife*, one in a series of games that allow the player to

manipulate the evolution of complex environments, lets the user design and alter ecosystems that include multiple evolving plant and animal species; *SimAnt*, focusing on an ant colony, functions in a similar fashion; and in 1996–97, a wave of enthusiasm for "virtual pets" swept Japan, the United States, and Western Europe with the introduction of Bandai Corporation's Tamagotchi, a birdlike creature in an egg-shaped mini-computer that the player has to feed, clean, and entertain through a life cycle that can last more than three weeks.[3] Not infrequently, electronically and genetically engineered animals in literature and film appear alongside humans whose bodies and minds have been altered by similar techniques, and thereby raise complex questions about the relationship between humans, animals, and machines and their respective status in worlds where little that is purely "natural" is left.

Such representations of artificial animals touch upon a broad range of issues, from practical ones such as the domestication of animals, their use in scientific and military experiments, and their commodification in circuits of economic exchange, to more theoretical ones such as animal perception and cognition or the functioning of "natural" evolutionary mechanisms in the context of technological innovation.[4] It would be impossible to explore the full spectrum of these questions in one essay; rather, this analysis will focus on one issue that informs many of these recent representations of human-made animals, though it may be less obvious at first sight: namely, their relationship to the rapid loss of naturally occurring species in the second half of the twentieth century. Although in all of these investigations of artificial animal forms, important elements of pure play and freewheeling scientific imagination are certainly at work, I will argue that sometimes implicitly, and often quite explicitly, the extinction of real animal species crucially shapes the way in which the artificial animal forms are approached and evaluated. What underlies the imaginative exploration of artificial animals, then, is the question of how much nature we can do without, to what extent simulations of nature can replace the "natural," and what role animals, both natural and artificial, play in our self-definition as humans. Three very different artifacts will illustrate the narrative strategies and metaphors by means of which these questions have been addressed in American culture in the last few decades: Steven Spielberg's film *Jurassic Park*, Thomas Ray's computer-based Artificial Life project *Tierra*, and Philip K. Dick's by now classic science-fiction novel, *Do Androids Dream of Electric Sheep?*[5] All three explicitly relate the emergence of artificially created animals to the extinction of natural species; but each one takes a different perspective on this

relationship and, implicitly, on the significance of the natural in an increasingly technologized environment.[6]

Jurassic Park: Prehistoric Cyborgs

Steven Spielberg's *Jurassic Park*, based on a novel by Michael Crichton, and its sequel *The Lost World* address the issue of contemporary losses in biodiversity obliquely through their focus on the best-known historical extinction of an entire group of species, that of the dinosaurs. At first sight, both films seem to fit comfortably into the well-worn plot stereotype of the artificially created monsters that turn against their creators, as well as that of the overweening scientist who believes he can control nature only to find that such perfect mastery slips from his hands: from Mary Shelley's *Frankenstein* and H. G. Wells's *Island of Dr. Moreau* to the monster animals that populate 1950s Hollywood films, this formula is too well known to need any rehearsing.[7] But W. J. T. Mitchell, in the *Last Dinosaur Book*, places Spielberg's films into a somewhat different context when he notes that "the greatest epidemic of dinosaur images occurs in the late twentieth century, just at the moment when widespread public awareness of ecological catastrophe is dawning, and the possibility of irreversible extinction is becoming widely evident."[8] Mitchell does not discuss this aspect in any further detail, but his observation—derived from his survey of a long history of dinosaur representations—opens the way for an analysis of how the resurrection of a long-extinct group of species in *Jurassic Park* can be read not only as the horror and suspense device that it undoubtedly is, but also as an imaginative scenario that deflects possible anxieties over contemporary losses in species diversity.

Explicitly, this topic surfaces briefly early on in the film, when the visionary entrepreneur John Hammond presents his project, a natural history theme park with real dinosaurs re-created from prehistoric DNA as its main attraction, to a group of consultants consisting of three scientists and a lawyer. Contrary to Hammond's expectation, only the lawyer expresses enthusiasm about the planned park, predictably because of the profits it might earn. The three scientists all voice serious reservations vis-à-vis the attempt to put genetically engineered dinosaur species into an environment that only partially corresponds to the ecosystems in which they originally existed, and that they have to share with a species—humans—they had never previously encountered in their long history on the planet. Hammond, who is fundamentally more interested in the imaginative potential of his project than its financial possibilities, expresses deep disappointment that only the "bloodsucking lawyer" approves

of his project; if he were breeding condors instead, he notes in a dejected voice, the scientists would all no doubt back him with enthusiasm. What is the difference, he implies, between genetically reconstructing species that have recently gone extinct or are currently endangered, and re-creating a group of species that disappeared 65 million years ago? Why would the former be desirable and the latter objectionable?

This juxtaposition of prehistoric with present-day species, along with the scientists' warnings about the appropriateness of the ecosystems Hammond has devised, raises the question of how Spielberg's film conceptualizes the relationship of a species to its environment. In discussions of contemporary species extinction, this relationship is often envisioned as a threatening gap or lack: biologists often warn that the disappearance of even a small number of species invariably has consequences for the food chains and ecosystems of which they formed part—consequences that are hard to predict accurately and can sometimes be catastrophic. Unlike condors, whales, or panda bears, however, dinosaurs in a late-twentieth-century setting are figures of excess rather than lack; they are not missing from any existing ecosystem but exceed their environment and break all its bounds when they emerge from extinction. This excessiveness is emphasized again and again in both *Jurassic Park* and *The Lost World* through the dinosaurs' monstrous size, the insatiable appetite of the carnivorous varieties for human flesh, and their relentless persistence in hunting down their prey. Dinosaurs in these films seem out of proportion to their environment and barely containable by any natural or technological system. Hammond's suggestion that these creatures are comparable to present-day animals such as the condor, therefore, establishes a first association between contemporary endangered species and this visual rhetoric of excess.

A further link is created by the movie within the movie toward the beginning of *Jurassic Park*, which explains the mechanism of the genetic reconstruction. According to this documentary, the reconstruction was enabled by dinosaur blood found in the sting of a prehistoric mosquito embedded in amber (a detail that establishes a humorous parallel to the "bloodsucking lawyer," another parasite who wishes to make a living off dinosaurs). From this blood, DNA sequences were extracted, and the gaps in them supplemented with frog DNA (the documentary does not explain how a single discovery of dinosaur blood could have led to the reconstruction of as many different prehistoric species as are presented in the theme park later on). The dinosaurs in the theme park, therefore, are not genetically pure, but partially frogs. Not only does this genetic

mix turn them into creatures that are partially prehistoric and partially contemporary, it also associates them with another family of animals that is threatened by species loss. As it turns out, the composite DNA is crucially important because it is what allows the dinosaurs to procreate: Hammond had populated the park exclusively with females so as to prevent uncontrolled offspring, but when one of the scientists later discovers eggs from which young dinosaurs have hatched, he concludes that some of the adult dinosaurs must have changed their gender, an ability that, according to him, would have derived from their frog genes. This rather far-fetched turn of the plot becomes quite significant when we understand it as another strategy by means of which one group of species, many of which are currently endangered, turns out to be associated with the excess and havoc wrought by a quite different group of species in Hammond's theme park.

Perhaps even more important, the fantastic extrapolation of currently available genetic engineering techniques documented by the movie within the movie establishes a scenario in which species extinction is reversible and therefore no cause for concern: if minute amounts of DNA suffice to re-create a whole range of species, then no loss of biodiversity need be permanent, because extinct species can be brought back at will. The possibilities inherent in such a technology are so far-reaching that one might wonder why the visionary John Hammond, instead of fantasizing about a theme park, does not market his patent to any of the many institutions that would unquestionably be eager to use it, from pharmaceutical companies to agribusiness corporations and all the way to environmental associations. Such usage of his innovative technique of genetic engineering would seem to be a much more lucrative source of income than a theme park on an island more than a hundred miles off the coast of Costa Rica; but then, Hammond is portrayed as an entrepreneur driven by imagination rather than lust for profit, and the recuperation of a past that humans have never seen with their own eyes is clearly more attractive to him than merely practical applications of the technology. Yet it is precisely the ability genetically to return to the past that makes species extinction, in the world of *Jurassic Park*, a reversible and negligible affair.

Or so it looks at the beginning. Much of the film and its sequel, of course, are designed to show that resurrecting the genetic past is not as uncomplicated a project as Hammond imagines. Species restitution quickly reveals itself to be a dangerous and horrific enterprise as it turns into a persistent threat to human life: by the end, the two films seem to be suggesting that even if future advances in genetic engineering were to

make the re-creation of lost species possible, this would certainly prove to be thoroughly undesirable. This impression is centrally conveyed through the sense of excess mentioned earlier, which accompanies almost every appearance of dinosaurs in the two films. The sense of wonder that their gigantic stature at first evokes in both scientists and children vanishes quickly. Instead, the animals turn out to be persistently associated with uncontrollable fluids and repulsive body secretions: in both films, their appearance is accompanied by tropical storms that turn the islands into unnavigable swamps of mud. In *Jurassic Park* in particular, humans are again and again confronted with dinosaurs' bodily secretions, from the oversized piles of stegosaurus dung that the team's paleobotanist delves into, to the sticky black fluid that a small dinosaur squirts into a computer programmer's face before devouring him; and even an otherwise friendly brontosaurus ends up sneezing full force into Hammond's granddaughter's face just when she had begun to feel a bit of reluctant sympathy for the creature. Beyond this emphasis on the dinosaurs' physically repulsive aspects, both films foreground the carnivorous species and present them as perpetually hungry, aggressive, and violent predators who pursue humans into the most unlikely hiding places—from the park's computer control room to the restaurant kitchen and the basement where the central electric panels are located. As the plot unfolds, the viewer is less and less able to sympathize with the dinosaurs, except when they efficiently dispose of characters that the spectator has come to despise. But by the end of each of the two films, it is difficult not to conclude that species extinction may not be such a bad thing if the life of animals so persistently interferes with the well-being of humans. Extinct species, in other words, end up seeming expendable and undesirable, an excessive presence that humans are better off without.

Understood as an oblique reflection on contemporary species loss, then, *Jurassic Park* wards off potential anxieties over the decrease in biodiversity both by suggesting that advances in gene technology might make species extinction reversible and by presenting the return of extinct species as a dangerous excess rather than the filling in of a lack. Yet it would be too simple to reduce the film and its sequel to this perspective, dominant as it may appear. Clearly, there is also an obverse side to its depiction of dinosaurs as relentlessly aggressive and violent destroyers, which emerges in the leitmotif that is repeated through both movies, "Life will find a way." As a summary comment on the plot of *Jurassic Park* and *The Lost World,* this motto seems preposterous, both because life processes are constantly being manipulated by humans and because the

organisms that result are extremely destructive to other life-forms. But it does reveal a wishful thinking that underlies the two movies: the recurring images of gigantic creatures able to inflict significant damage on humans and their technological tools of mastery over nature may well express nostalgia for the return of a natural world that would be a match for human technology and not just a helpless victim. This fantasy may be the reason why Spielberg, in both films, shows extended sequences of dinosaurs battling not humans per se, but their technology, primarily automobiles: "If the dinosaur is the monstrous double of the skyscraper and the railroad, it also finds its counterpart in the world's largest consumer of fossil fuels, the automobile. *T. rex* can recognize a worthy antagonist when he sees one, so he attacks the park vehicle . . . and pushes it over a cliff" in a scene that, as Mitchell notes, is repeated and extended in *The Lost World* (222). This uprising of the animal world against technology comes to a climax when the velociraptors wreak havoc on the computer station that controls the functioning of the entire park. If the two films persistently foreground scenes in which extinct species come back to smash products of high technology, it is to show a natural world with the ability to fight back against the encroachments of a human civilization that leaves little that is "natural" in place. This struggle is, needless to say, temporary and doomed to failure, as is the fantasy that subtends it: the deadly rampage of a Tyrannosaurus rex through San Diego in *The Lost World* makes it clear that the cost—in human life as well as expensive equipment and urban structures—of seeing such a fantasy translated into reality is simply too high. Only when the excess of nature that the resurrection of extinct species represents is removed (by containing the dinosaurs on isolated islands far from human populations) can human society continue to function.

More broadly, such scenes can be understood as symptomatic of a certain mainstream interest in endangered wildlife that is sustained only so long as it does not interfere with human well-being (or what Western societies in the late twentieth century conceive of as such); extinction of other species becomes acceptable when they encroach upon human society. Yet it is worth remembering that the dinosaurs in these films, considered at another level, are of course *not* representations of the wildlife that humans usually encounter—not only because they are specimens of the fauna of a historical period in which humans did not exist, but also because they are products of computer technology; every step of the cloning process through which they are created is controlled and adjusted

by computers in a process that Mitchell calls "biocybernetic reproduction" (215–19). Hence,

> Spielberg's dinosaurs are pure creations of information science, at both the level of the representation (the digitally animated image) and the level of the represented (the fictional cloned creatures produced by biogenetic engineering). . . . The architectural and mechanical models of the organism give way to (and are absorbed by) informational models: the species becomes a message, an algorithm: the boundary between organism and machine, natural and artificial intelligence, begins to waver. (213)

Advanced digital technologies, in other words, become a means of, on the one hand, generating an artificial version of the natural and, on the other, re-creating a prehistoric version of the natural to which humans normally have no direct access. In this sense, Spielberg's prehistoric cyborgs are creatures that not only bridge the gap between widely separated time periods and disparate animal species, but also between the natural and the digital—between extinction and electronics. It is through this bridging that digitally orchestrated resurrection can become a response to natural extinction.

Tierra: Electronic Evolution

This attempt to revert to earlier stages of animal life on Earth is not pure cinematic fantasy; certain projects that are currently being undertaken in the field of computer science that has become known as "Artificial Life" or AL also aim at reproducing, in the digital medium, some of the organic processes that shaped natural life-forms on planet Earth. One of these projects, Thomas Ray's *Tierra* (Spanish for "earth"), hints by its very name at its objective of creating a computer-based equivalent of species evolution and biodiversity; moreover, Ray explicitly links it to biological preservation projects in Costa Rica—the country that already figured in the background of Spielberg's imaginary species resurrection. *Tierra*, however, forges a different type of link between contemporary species loss and the creation of artificial animal life.

In general, Artificial Life encompasses a wide variety of projects that attempt to simulate digitally the development and/or behavior of an organism, the evolution of a group of organisms, or the functioning of complex ecosystems. Some AL researchers view their work principally as an attempt to develop models for biological and ecological processes such as the flight patterns of birds in a flock or the cooperation among ants or bees. Others, however—Thomas Ray among them—make a much

stronger claim for the discipline in that they understand it as a synthetic biology, a biology that studies possible evolutions of life, in contrast to analytic biology, which examines actually existing organic forms. What this implies is that the self-replicating and evolving strings of computer code they design not only model forms and processes of "natural" biological life, but indeed constitute a life-form of their own, silicon- rather than carbon-based.[9] Clearly, this entails a very different understanding of the digital medium as not only a tool for representing and understanding nondigital phenomena, but as an environment that can function as an "alternative nature" with its own "ecosystems," "organisms," and "physical laws":

> in simulation, the data in the computer is treated as a representation of something else, such as a population of mosquitoes or trees. In instantiation, the data in the computer does not represent anything else. The data patterns in an instantiation are considered to be living forms in their own right and are not models of any natural life form. . . . The object of an AL instantiation is to introduce the natural form and process of life into an artificial medium. This results in an AL form in some medium other than carbon chemistry and is not a model of organic life forms. (Ray, "An Evolutionary Approach," 180)

Anthropologist Stefan Helmreich and literary critic Katherine Hayles have analyzed in some detail the philosophical assumptions that such claims rely on; centrally, they argue, this kind of hypothesis replicates the conventional Western assumption that form is more essential than matter in determining identity: the A-lifers' claim is precisely that their digital populations replicate the *patterns* of life rather than its specific material incarnations. Both Helmreich and Hayles strenuously object to what they see as the devaluation of the body and embodied life in such scenarios.[10] Whereas this may be true of the philosophy that underlies AL in general, Ray's *Tierra* establishes a complex connection between the natural and the digital that is not exhaustively described by this critique.

Among the wide variety of AL projects that have been undertaken since the early 1990s, with very different goals and terminologies, *Tierra* is particularly illuminating because it links digital concerns quite explicitly to species preservation. In this project, a string of code called the "ancestor" with a program for self-replication is allotted a certain amount of memory space and allowed to reproduce; in order to imitate the workings of natural evolution in the digital medium, certain instructions effect random changes in the code of the evolving "creatures" as an equivalent

to genetic mutations, and others mimic mortality by queuing the creatures up for erasure according to criteria such as age and success at performing their tasks. The functioning of sexual reproduction is simulated through the exchange of code segments between two creatures, who then transfer it to the next generation in their own replication process. When allowed to reproduce in this fashion over a period of time, an entire "population" of strings of varying lengths and composition develops that can be considered different species; these engage in complex relations such as "parasitism," one string using another's replication instructions to "procreate." In other words, in Ray's view, a veritable ecosystem with varied relations between different types of species evolves. Even though the biological terminology suggests animal-like organisms, there is no graphic representation attached to these entities that would make *Tierra* resemble computer games such as *SimLife;* the "creatures" are simply strings of computer code.[11]

Two aspects of this project are particularly noteworthy for the purposes of this analysis. First, Ray's plan is not to contain this experiment on a single computer or mainframe, but to create what he calls a "digital reserve" on the World Wide Web for these organisms. Second, he explicitly establishes a parallel between this digital exploration and a rain-forest conservation plan in northern Costa Rica that he himself is involved in (and where he owns land that is to be part of the reserve). He joins these two projects together in a paper titled "A Proposal to Create Two Biodiversity Reserves: One Digital and One Organic," which characterizes them as follows:

> The digital reserve will be distributed across the global net, and will create a space for the evolution of new virtual life forms. The organic reserve will be located in the rain forests of northern Costa Rica, and will secure the future of existing organic life forms.
>
> The proposed project will create a very large, complex and interconnected region of cyberspace that will be inoculated with digital organisms which will be allowed to evolve freely through natural selection. The objective is to set off a digital analog to the Cambrian explosion of diversity, in which multi-cellular digital organisms (parallel MIMD processes) will spontaneously increase in diversity and complexity. If successful, this evolutionary process will allow us to find the natural form of parallel processes, and will generate extremely complex digital information processes that fully utilize the capacities inherent in our parallel and networked hardware.[12]

This project of creating a reserve for digital organisms on the global computer network shares with the Jurassic Park of Michael Crichton's and Steven Spielberg's imagination the endeavor to recapture a part of nature's past that is usually inaccessible to humans. Both *Jurassic Park* and *Tierra* therefore have a historical dimension that is implicit in their biological project. Specifically, it is an ancient diversity of species that both projects are designed to re-create: unlike other AL researchers, Ray emphasizes, he aims at simulating not the moment of the emergence of life as such, but the "origin of biological diversity" in the "Cambrian explosion 600 million years ago" which "involved a riotous diversification of life-forms" ("An Approach to the Synthesis of Life," 112–13). But, of course, Ray does not conceive of his project as mere simulation: as Katherine Hayles has pointed out, he never hesitates to use the adjective *natural* in referring to digital processes, implying that the populations he designs would develop according to an evolutionary logic that is fully equivalent to that of the natural world.[13]

"A Proposal to Create Two Biodiversity Reserves," however, which establishes this equivalence clearly through the juxtaposition of the digital and biological projects, remains at the same time curiously elusive about what exactly the relationship between the computer experiment and a particular rain-forest conservation project really is assumed to consist of. Obviously, their appearance side by side is meant to make the proposal for a digital reserve appear as serious and important as attempts to safeguard the natural environment. But beyond that, both the natural and the digital projects seem to form part of one overarching purpose, to preserve and perpetuate life in both the forms that we currently know and the ones that might yet emerge. If a "Cambrian explosion" of digital life is in some respects a repetition of processes that have historically taken place in nature, it might in another sense also be understood as a continuation, an extension of the evolutionary narrative to as yet unheard-of life-forms. If this is so, then Ray's project participates at least implicitly in a relatively long history of envisioning computer networks as the next step in evolution, although this has usually been understood to refer to human evolution; from French theologian and paleontologist Pierre Teilhard de Chardin and media theorist Marshall McLuhan to some of the fringes of the contemporary computer culture, the emergence of digital networks has repeatedly been interpreted as the prelude to the birth of a new form of collective human consciousness that would be equivalent to the next major step in human evolution.[14] Ray's project operates less

anthropocentrically by focusing on life in general rather than on human life specifically, but it belongs to the same complex of ideas.[15]

Yet there remains a curious tension between the prospect of an explosive multiplication of life-forms in the digital sphere and the threats to habitats and species diversity in the natural world that make the creation of biological conservation areas necessary in the first place. Seen from this perspective, the motives for creating each of the two reserves come to seem radically different; whereas the Costa Rican reserve would be intended to protect the *reduced biodiversity* that can still be saved from the spread of human populations and their environmental impact, the digital one is designed to give rise to a *rapid increase of diversity* among cyberspecies. Biological conservation, in other words, is a last attempt to ward off further loss, whereas digital conservation is, on the contrary, meant to trigger huge gains in species diversity. This fundamental difference between the two projects, which in Ray's article appear to be seamlessly connected, raises the question to what extent setting off a "Cambrian explosion" of life-forms in cyberspace is a strategy of compensating at least imaginatively for the current rapid loss of biodiversity in the natural world. To ask this question is not in any way to cast doubt on Ray's environmental commitment and the seriousness of his ecological project, but rather to explore one of the reasons—*especially* for a computer programmer who is also a biologist and deeply concerned about environmental issues—that might lie behind the insistence that digital organisms be considered genuine life-forms of their own rather than simulations of natural ones.

Much has been written about the way in which electronic culture might come to reshape current social structures and the experience of space that goes along with them. Frequently, in such analyses, the World Wide Web is envisioned as an analogue to the metropolis and urban space.[16] The question that projects such as Ray's *Tierra* and Spielberg's cyberbiology raise is to what extent computer technologies will also remold our perception and experience of the natural world and other living species. Ray himself clearly sees his concerns with ecology and digitality as not only compatible, but indeed complementary, aspects of the same overriding exploration of life in different forms. The danger that this view brings with it from an environmentalist perspective is that it might reinforce the neglect of problems that beset natural wildlife in the late twentieth century in favor of the more appealing prospects of digital populations of "creatures"; if the latter really are equivalent to the former, they can offer a convenient means of escape from the unpleasant re-

alities of ecological deterioration and species extinction into a digital world that is not subject to the same sets of problems. The lack created by diminishing nature and disappearing species, in other words, may come to be filled in the cultural imagination of computer-literate societies by alternative life-forms on the global Web. This is no doubt far from the vision that Ray intends; but if studying populations of digital organisms and their evolution can become an incentive for rethinking similar phenomena in nature, it can also, and by the same logic, become a substitute for concerning oneself with the natural world itself and the dangers that it faces.

Dreams about Electric Toads

This possibility is realized in what is probably the best-known vision of a world in which the natural world and wild animal species have disappeared and been replaced by human-made animals: Philip K. Dick's classic science-fiction novel *Do Androids Dream of Electric Sheep?* (1968). Dick's novel does not yet envision the kind of species extinction owing to pollution and habitat destruction that biologists and environmentalists are currently most concerned about; rather, the world it describes has been devastated by "World War Terminus," a nuclear war that has laid the natural world to waste and covered it with a layer of radioactive dust. Most humans have left Earth for extraterrestrial colonies, and those that remain are threatened by infertility and degradation of their mental capacities. There are no wild animals left: the few live animals that still exist are carefully bred and sold as coveted private possessions. Unlike scores of other postnuclear sci-fi scenarios that seem by now hopelessly dated, Dick's novel has preserved an eerie relevance because it does not focus on nuclear warfare as such but on the daily lives of fairly ordinary people in a world in which few vestiges of the "natural" remain. Humans' changed relationship to animals in such a world emerges as one of the central topics of the novel.[17]

In this context, one scene toward the end of the text takes on particular significance. Rick Deckard, a bounty hunter and the novel's protagonist, flies from San Francisco to the radioactive northern Californian desert. After experiencing an almost mystical identification with the religious idol Wilbur Mercer in the middle of this bleak landscape, he gets back into his hovercar and is just about ready to fly back to the city when a slight movement among the rocks catches his eye. "An animal, he said to himself. And his heart lugged under the excessive load, the shock of recognition. I know what it is, he realized; I've never seen one before but I

know it from the old nature films they show on Government TV. They're extinct! he said to himself" (236). The animal moving among the rocks is a frog—a toad, to be exact, and Deckard, who has spent the last 48 hours killing six androids of the most advanced and intelligent type, cautiously lifts it up, puts it in a cardboard box, and flies home both shocked and elated. On top of his achievement with the androids, he expects, he will now be honored as the rediscoverer of an animal species believed extinct. Because such rediscoveries happen so rarely, he cannot quite remember what the reward for it is: "Something about a star of honor from the U.N. and a stipend. A reward running into the millions of dollars" (237). Because Deckard had used up his bounty money for the androids just a few hours earlier as a down payment for a live goat that it will take him years to pay off, this reward would relieve a considerable financial burden for him. But what most deeply thrills him about his discovery is not the potential financial benefit, but the encounter with a living, organic animal that is, in addition, one of the two that are sacred to Wilbur Mercer. This scene repeats, at a smaller scale, the imaginative gesture that also shapes *Jurassic Park* and the *Tierra* project—the recuperation by humans of lost animal species.

As in Spielberg's film and Ray's AL project, however, this recuperation is mediated and in the end contained by advanced human technology. When Deckard arrives home, he finds out not only that another android has avenged her friend's death by killing his newly purchased goat, but also that the frog is electric. Like the sheep Deckard has long owned, it is just another one of the countless artificial animals that populate Dick's futuristic San Francisco, robot specimens so sophisticated and lifelike in their appearance and behavior that only the discovery of their well-hidden electric control panels will give them away. When Deckard finds this out, he is disappointed, but not devastated; his wife orders a supply of electric flies to feed the toad, and Deckard admits that "it doesn't matter. The electric things have their lives, too. Paltry as those lives are" (241).

This discovery is so crucial to the novel that Dick originally intended to call it *The Electric Toad: How Androids Dream.*[18] But Deckard's statement may come as a surprise at the end of a novel that has persistently emphasized the difference between the real and the fake, and privileged the authentic over the false. Even though electric animals are common in Dick's world because many people cannot afford live animals, their artificiality is carefully concealed from the neighbors. Androids are mass-produced and used as a menial labor force in the extraterrestrial colonies, but mercilessly hunted down and exterminated when they escape from

their owners or travel to Earth. And yet Deckard's admission that electric life is also a kind of life may be understandable in the context of his society, where most humans can only experience other species through the intermediary of electric artifacts. Indeed, in his world, concern over and empathy with animals has become the principal defining characteristic of what it means to be human. After World War Terminus, the novel indicates, all citizens were obligated by law to take care of at least one animal; this law no longer exists but has mutated into social custom—a custom so strong that those who are unable to afford real animals acquire electric ones to remain socially reputable.

Even more important, concern for animal welfare is the central recurring topic in the question-and-answer test that bounty hunter Deckard routinely administers to ascertain whether an individual he has apprehended is human or android. The test equipment measures the emotional reaction of the subject to scenarios that include deer antlers mounted on walls, collections of butterflies, meals of oysters, bullfight posters, or a naked woman sprawling on a bearskin rug (the point of the scenario being the bearskin rug, not feminine nudity). Humans, theoretically at least, will display instinctive reactions of repulsion at such scenarios of animal death and exploitation, whereas androids typically will not. This criterion of distinction is interesting because the general claim in Deckard's society is that androids do not have empathy with other beings; presumably, to the extent that such an emotional capability is testable at all, it could be assessed through scenarios involving humans as well as animals. But of all the questions in Deckard's repertoire, only one involves humans; all the other ones hinge on references to humans' exploitation of animals.

The fact that most of these scenarios would appear entirely commonplace and hardly a reason for particular disgust to most late-twentieth-century Westerners has sometimes been interpreted to mean that Dick intends to ridicule the way in which the boundary between humans and androids is drawn in this culture, and to suggest that it is all mere ideology—an ideology that the protagonist in the end recognizes as such and transcends.[19] I do not believe that the novel actually sustains this post-Haraway perspective;[20] that the test scenarios seem commonplace to Dick's average reader could just as well be his indictment of Western culture's fundamental insensitivity to and relentless exploitation of animals. And although it is true that much of the first half of the text seems designed to make the reader side with the android characters and to blur the boundaries between them and their human antagonists, later plot developments radically shift

reader sympathies. In one of the novel's most excruciating scenes, a human who has befriended several androids, John Isidore, watches with horror as his android friends willfully and thoughtlessly cut the legs off a spider one by one to see how many it needs still to be able to walk. In this scene, the difference between humans and androids could not be more marked: not only do the androids think gradually mutilating the spider is excellent fun, they also fail completely, at first, to understand Isidore's reaction, interpreting his horror as a response to unsavory revelations on the TV program running in the background rather than to their own actions. Combined with the other android's revenge killing of Deckard's goat, this scene confirms precisely the perception of androids as incapable of understanding and feeling with other living beings that much of the preceding text had seemed to portray as mere prejudice.

What follows from this shifting representation of the androids is that the distinction between humans and androids is not exactly symmetrical in the novel to the one between real and electric animals, as one might at first assume. Deckard's final assertion that electric things have their own lives does not automatically extend to androids—among other things because androids are not really electric: unlike the artificial animals, they have no electronic circuits and no hidden switch plates, but are organically indistinguishable from humans (hence the necessity for psychological testing). They are not, like Deckard's electric sheep and toad, mechanical but organic artifacts. Dick seems willing to blur the line between real and electric animals because both types of animals help to define what is uniquely human; if he is in the end unwilling also to accept androids as humans' equals, it may be precisely because being an android, in the novel, is not so much equivalent to being a technological object as equivalent to having a certain attitude toward the natural world. The inability to empathize with other living beings that characterizes one dominant perspective on nature in the Western world is precisely the one Dick rejects as inhuman by contrasting the human-looking androids with advanced humans who are no longer capable of such insensitivity. Viewed on these terms, Dick's novel remains a complex critique of some of the social and cultural forces that have brought about ecological deterioration and species extinction, at the same time that it accepts technology to a certain extent as a replacement for irrecuperably lost nature.

Toward Cyborg Environmentalism

All three of the cultural products I have discussed can be understood as attempts to envision and redefine the role of nature in general and the

animal in particular in a world that is almost entirely shaped by human culture and technology. In all three, technology comes to serve as a means of recuperating a lost species diversity; but whereas *Jurassic Park* ultimately rejects this attempt as excessive and dangerous to human well-being, Ray's *Tierra* project views the diversification of electronic life-forms as not only a repetition of animal evolution, but an extension of it. And Dick's *Do Androids Dream of Electric Sheep?*, while it posits the animal other as crucial to the definition of what is human, accepts that the technological simulation of animal life may be able to fulfill the same function. From an environmentalist perspective, one might want to reject all three approaches: Spielberg's because it implies a trivialization of the dangers of species extinction, Ray's and Dick's because their acceptance of electronic or electric life-forms as equivalent to organic ones could well entail diminished concern over the fate of actual animal populations.[21] Although I am not unsympathetic to such criticism, it seems to me worthwhile to suspend it at least temporarily so as to explore the implications of the three works more fully.

The merit of Spielberg's, Ray's, and Dick's imaginative scenarios, even and particularly from an environmentalist viewpoint, lies in the fact that they capture something that is indeed essential about the human relationship to nature in the late twentieth century: the fact that for the majority of the population of industrialized nations (and of an increasing number of developing ones), the experience of nature is heavily mediated by technology. One need not even point to such events as the cloning of Dolly the sheep, the recently begun production by Mitsubishi of battery-run replicas of extinct marine species, or the release by Sony Corporation, in May 1999, of the first robotic pet dog, AIBO (retailing at $2,500), to illustrate the "realism" of Spielberg's and Dick's visions;[22] it is sufficient to note that especially for urban populations, biological diversity has already become a virtual reality of sorts, one that is conveyed centrally by a wide array of TV documentaries and entire channels devoted to nature and exotic wildlife, whereas everyday urban life exposes humans to an extremely limited number of animal species. Dick anticipates this situation most explicitly through his protagonist Rick Deckard, who reflects at one point that "[n]ever in his life had he personally seen a raccoon. He knew the animal only from 3–D films shown on television" (40), just as he only recognizes the toad for what it is by remembering televised images. In Western societies, even the disappearance of nature—including species extinction—has become a televised spectacle. Given that—ecotourism notwithstanding—the role of such mediations in shaping experiences

of nature is likely to increase rather than diminish in the future, and that it would be difficult or impossible for most of the population of industrialized countries to return to a more direct exposure to the natural world, the three works I have discussed raise the important question of how best to envision the relationship between the natural world and simulations of it in their role for late-twentieth-century human culture, science, and society.[23]

To say this, however, is to point not only to the merit of these works but also to their weakness, for it implies that all three envision the issue of species extinction and the relationship between real and artificial nature from a relentlessly speciesist perspective. Animals are envisioned and assessed in terms of the benefits or drawbacks they bring to human knowledge, experience, and comfort, not as beings with an independent right to existence. The dinosaurs of *Jurassic Park* are created for the entertainment of humans, Ray's electronic creatures for the sake of scientific study, and Dick's animals to enhance the experience of being human (as well as, not unimportantly, indicators of social status). Dick's novel in particular explicitly emphasizes the protagonist's "need for a real animal" (42) and his sense that he "couldn't go on with the electric sheep any longer; it sapped [his] morale" (170). Animals in particular and the natural world in general seem to have no intrinsic value in these works apart from their functionality for humans and their needs and desires. As a consequence, if simulations can be shown to fulfill the same functions adequately, the imperative to preserve or protect what is left of the natural world is considerably diminished in importance. If Ray's and Dick's works in particular are understood to make claims in favor of electronic and electric life-forms that at least implicitly reduce the significance of organic life—which one could sum up in Rick Deckard's discovery, at the end of Dick's novel, that "electric things have their lives, too"—these claims would have to be rejected from an environmentalist or animal rights perspective.

But Ray's and Dick's approach to "cyborg" animals cannot be summed up quite so neatly; upon closer inspection, a somewhat different conclusion imposes itself. Especially when one considers that Dick's protagonist is a hunter of androids, his insight actually amounts to an acknowledgment that the lives and needs of his species, organic humans, are not the only ones that count. In an oblique fashion, Deckard renounces the speciesist viewpoint that had guided him earlier when he accepts the electric toad as its own kind of living being. Such an acknowledgment is even more pronounced in Ray's *Tierra* project. In several essays on *Tierra*, Ray emphasizes that biology currently has to base all its conclusions

about life on one type only, the carbon-based life that dominates the planet Earth. Short of traveling to other planets with alternative life-forms, an option that is not currently available, humans must study artificial life processes on their own planet so as to gain a sense of alternative types of species evolution ("An Approach to the Synthesis of Life," 111; "An Evolutionary Approach," 179). Of course, this argument is not directed against a speciesist perspective that would insist on the primacy of humans so much as one that would much more broadly emphasize the primacy of organic life. Still, the thrust of Ray's essays is similar to that of Dick's novel insofar as its aim is, in the end, to broaden claims on behalf of one species or set of species to include a wider variety of life-forms. Clearly, one of Ray's objectives in bringing together plans for a digital and a biological reserve is precisely to give a sense of this greater diversity. What I am arguing, therefore, is that the endorsement of technologically generated life-forms in both Ray and Dick need not be understood as a threat to the claims an environmentalist might want to make on behalf of natural life-forms; rather, the advocacy of the cyborg animal can be viewed as at least in part a call to abandon speciesist prejudice and to accept alternative life-forms as beings with an existence and rights of their own.

It is my contention that if we accept this reading—or at least accept that it coexists with a more antienvironmentalist interpretation—it .could become a point of departure for rereading the figure of the cyborg from an ecological perspective. In a sense, this rereading would be complementary to Donna Haraway's well-known interpretation of the cyborg in her "Cyborg Manifesto." Haraway's objective in this seminal essay was to break the persistent associations of the feminine with the natural, and to turn the potential of technology (typically linked to masculinity) and fusions of the organic and the technological into imaginative tools for redefining femininity. More than a decade later, the crucial conceptual task for environmentalists in their encounter with a profusion of images and narratives that privilege recent technologies is, in some respects, the opposite one: how to reconnect this explosion of the technological imagination with a concern for the rapidly diminishing natural world. In this context, the figure of the cyborg, and in particular that of the animal rather than the human cyborg, takes on a somewhat different significance. Not merely the symbol of a nature finally vanquished by technology that it sometimes can be, the animal cyborg also points to the possibility of a different relationship between species: one that no longer privileges the rights of humans—feminine or masculine—over those of all other forms of life, but that recognizes the value and rights of nonhuman

species along with those of humans. Viewed in this way, the animal cyborg can take us, through the discovery of otherness in our own technological creations, to the recognition of and respect for the nonhuman others we did not make. If the recuperation of extinct animal species by technological means in the works discussed earlier points to this possibility, they open the way for reconsidering the imaginative functions of technology from an environmentalist perspective.

Notes

1. Some of the most important studies of the cyborg include the following: Donna Haraway's groundbreaking "A Cyborg Manifesto: Science, Technology, and Socialist-Feminism in the Late Twentieth Century," in her *Simians, Cyborgs, and Women: The Reinvention of Nature* (New York: Routledge, 1991), 149–81, and her later interview with Constance Penley and Andrew Ross, "The Actors Are Cyborg, Nature Is Coyote, and the Geography Is Elsewhere: Postscript to 'Cyborgs at Large,'" in *Technoculture,* ed. Constance Penley and Andrew Ross (Minneapolis: University of Minnesota Press, 1991), 21–26; Patricia Warrick, *The Cybernetic Imagination in Science Fiction* (Cambridge: MIT Press, 1980); Chris Hables Gray's comprehensive anthology of essays, *The Cyborg Handbook* (New York: Routledge, 1995); Mark Seltzer, *Bodies and Machines* (New York: Routledge, 1992); and Katherine Hayles, *How We Became Posthuman: Virtual Bodies in Cybernetics, Literature, and Informatics* (Chicago: University of Chicago Press, 1999). Subsequent references to Haraway and Hayles are given in the text.

2. William Gibson's "Johnny Mnemonic" appears in his collection *Burning Chrome* (New York: Ace, 1987), 1–22; Neal Stephenson, *Snow Crash* (New York: Bantam, 1993); *The Lawnmower Man,* dir. Brett Leonard, perf. Jeff Fahey, Pierce Brosnan, Jenny Wright, and Geoffrey Lewis, Allied Vision Lane Pringle/Fuji Eight Co., 1992. Subsequent references to these works are given in the text.

3. In somewhat different form, the Tamagotchi craze was echoed in 1999–2000 by the widespread enthusiasm of children in the United States and Western Europe for *Pokémon* creatures that formed the core of computer games, an animated television series, a movie, and an abundance of toy products. Their creator, Tajiri Satoshi, was an avid insect watcher and collector in his childhood and sees Pokémon as, among other things, an opportunity for a new generation of children to participate in this hobby. See Howard Chua-Eoan and Tim Larimer, "PokéMania," *Time* 154 (November 22, 1999): 84.

4. Some works also include remote echoes of Descartes's categorization of animals as clockwork-like mechanisms.

5. For Ray, see the following: Thomas S. Ray, "An Evolutionary Approach to

Synthetic Biology: Zen and the Art of Creating Life," in *Artificial Life: An Overview,* ed. Christopher G. Langton (Cambridge: MIT Press, 1995), 179–209; "An Approach to the Synthesis of Life," in *The Philosophy of Artificial Life,* ed. Margaret A. Boden (Oxford: Oxford University Press, 1996), 111–45; and "A Proposal to Create Two Biodiversity Reserves: One Digital and One Organic," http://www.hip.atr.co.jp/~ray/pubs/reserves/reserves.html. See also Philip K. Dick, *Do Androids Dream of Electric Sheep?* (New York: Ballantine, 1996); *Jurassic Park,* dir. Steven Spielberg, perf. Sam Neill, Laura Dern, Jeff Goldblum, and Richard Attenborough, Amblin Entertainment/Universal, 1993; *The Lost World: Jurassic Park,* dir. Steven Spielberg, perf. Jeff Goldblum, Richard Attenborough, Julianne Moore, Pete Postlethwaite, Arliss Howard, Vince Vaughn, and Vanessa Lee Chester, Universal, 1997. Subsequent references to Ray and to Dick are given in the text.

6. For a survey of issues related to contemporary species loss, see E. O. Wilson and Frances M. Peter's collection of essays *Biodiversity* (Washington, D.C.: National Academy Press, 1988); Les Kaufman and Kenneth Mallory, *The Last Extinction,* 2d ed. (Cambridge: MIT Press, 1993); and Paul Ehrlich, *Extinction: The Causes and Consequences of the Disappearance of Species* (New York: Random House, 1981). A controversial debate on the subject is recorded in Norman Myers and Julian Simon, *Scarcity or Abundance? A Debate on the Environment* (New York: Norton, 1994).

7. Mary Shelley, *Frankenstein* (Oxford: Oxford University Press, 1994); H. G. Wells, *The Island of Dr. Moreau* (New York: Dover, 1996).

8. W. J. T. Mitchell, *The Last Dinosaur Book* (Chicago: University of Chicago Press, 1998), 19. Subsequent references are given in the text.

9. For an introduction to Artificial Life as a discipline, see Claus Emmeche, *The Garden in the Machine: The Emerging Science of Artificial Life,* trans. Steven Sampson (Princeton, N.J.: Princeton University Press, 1994); Julio Fernández Ostolaza and Álvaro Moreno Bergareche, *Vida artificial* (Madrid: EUDEMA, 1992); and Stefan Helmreich, *Silicon Second Nature: Culturing Artificial Life in a Digital World* (Berkeley: University of California Press, 1998).

10. Helmreich, *Silicon Second Nature,* chapter 3; Hayles, *How We Became Posthuman,* chapter 9, and Katharine Hayles, "Simulated Nature and Natural Simulations: Rethinking the Relation between the Beholder and the World," in *Uncommon Ground: Toward Reinventing Nature,* ed. William Cronon (New York: Norton, 1995), 418–25.

11. The best source of information on *Tierra* is Thomas Ray's home page on the World Wide Web at http://www.hip.atr.co.jp/~ray/, which provides links to the program and many of Ray's publications about it; for descriptions of his project, see also his articles "An Approach to the Synthesis of Life" and "An Evolutionary Approach to Synthetic Biology."

12. See Ray's link, http://www.hip.atr.co.jp/~ray/pubs/reserves/reserves.html.

13. "In Ray's rhetoric, the computer codes composing these 'creatures' become natural forms of life; only the medium is artificial" (Hayles, *How We Became Posthuman*, 224).

14. See Pierre Teilhard de Chardin, "Une interprétation plausible de l'Histoire Humaine: La formation de la 'Noosphère,'" *Revue des questions scientifiques* 118 (1947): 7–37; Marshall McLuhan, "Interview," *Playboy* (March 1969): 53–74+; and Douglas Rushkoff's more recent restatement of this idea in *Cyberia: Life in the Trenches of Hyperspace* (San Francisco: HarperCollins, 1994). Mark Dery briefly comments on this evolutionary narrative in *Escape Velocity: Cyberculture at the End of the Century* (New York: Grove, 1996), 45–46.

15. See also Hayles's discussion of the fundamental role that evolutionary narrative plays in Ray's presentations of the *Tierra* project both in his writings and in a videotape released by the Santa Fe Institute (*How We Became Posthuman*, 225–31).

16. William J. Mitchell's *City of Bits: Space, Place and the Infobahn* (Cambridge: MIT Press, 1995) is a book-length exploration of this analogy.

17. Ridley Scott's film *Blade Runner,* which is loosely based on this novel and a classic in its own right, significantly reduces the importance of animals to the plot; whereas a "replicant" owl and an artificial snake do appear in the movie, their role is entirely marginal, as opposed to the central significance of electric animals in the novel. *Blade Runner,* dir. Ridley Scott, perf. Harrison Ford, Rutger Hauer, Sean Young, Daryl Hannah, and William Sanderson, Blade Runner Partnership/Ladd Co./Sir Run Run Shaw/Warner, 1982.

18. See Lawrence Sutin, *Divine Invasions: A Life of Philip K. Dick* (New York: Harmony, 1989), 306–7.

19. See Jill Galvan, "Entering the Posthuman Collective in Philip K. Dick's *Do Androids Dream of Electric Sheep?*," *Science-Fiction Studies* 24 (1997): 414, 427–28.

20. This is confirmed, among other things, by Dick's own reflections on humans and androids in his essays "Man, Android, and Machine," "The Android and the Human," and "Notes on *Do Androids Dream of Electric Sheep?*" For Dick, the blurring of boundaries between machine and human is tragic and not, as in Haraway, a phenomenon to be celebrated for its emancipatory potential. See Dick's "Man, Android, and Machine," "Notes on *Do Androids Dream of Electric Sheep?*," and "The Android and the Human," in *The Shifting Realities of Philip K. Dick: Selected Literary and Philosophical Writings,* ed. Lawrence Sutin (New York: Pantheon, 1995), 211–32, 155–61, 183–210, respectively.

21. As mentioned earlier, Ray's and Dick's approaches could also be criticized in terms of their underlying understanding of the concept of "life." Because such

a critique has already been elaborated in detail by Helmreich and Hayles, I will not pursue this aspect further here.

22. For Mitsubishi's robot sea bream and Sony's AIBO, see "The Call of Nature," *Economist* 351 (June 5, 1999): 78–79. Information and images of AIBO can also be accessed at Sony's Web site: http://world.sony.com/robot.

23. Akira Mizuta Lippit's *Electric Animal: Toward a Rhetoric of Wildlife* (Minneapolis: University of Minnesota Press, 2000), which appeared after the initial draft of this essay was completed, asks a related question about the disappearance of wildlife and the function of technology in the late nineteenth and early twentieth centuries. Lippit's central claim—which he discusses specifically with regard to photography and film, though he also seems to extend it to other fields ranging from electricity to quantum mechanics (see chapter 5, nn. 72–75)—is that "modern technology can be seen as a massive mourning apparatus, summoned to incorporate a disappearing animal presence that could not be properly mourned because, following the paradox to its logical conclusion, animals could not die. It was necessary to find a place in which animal being could be transferred, maintained in its distance from the world" (188–89). In its broad generality, Lippit's claim is not supported by the evidence and argument he presents. Although certain instances of animal representation in early photography and film he discusses are fascinating, this does not warrant the conclusion that these technologies in and of themselves are a response to the loss of animal life—a claim that Lippit supports by recurring to late-twentieth-century theories of these media whose applicability to the late nineteenth century remains unproblematized. It is, at any rate, not clear exactly what Lippit means by the "disappearing animal presence"; although he sometimes seems to refer primarily to the diminishing importance of animals in modern urban life (187), he seems to be thinking of actual species loss at other times (1–3, 184). But if species extinction is the reality he has in mind, then the assumption that animals are unable to die loses much of its meaning; as Lippit himself argues, the sense that animals cannot die is predicated both on their inability to speak (and therefore to "experience death as death" [170]) and on the perception that "animal being cannot be reduced to individual identities. It is dispersed thoughout the pack or horde, which preserves the individual organism's death within the framework of a group body or identity" (172–73). Consequently, it would seem, if the pack or entire species goes extinct, animals do acquire the ability to die, which would undercut the logic of the mourning process Lippit attributes to the technological apparatus. The generality of Lippit's claims and his lack of specificity in discussing both the status of animals and the conditions under which particular technologies emerge in the nineteenth century undermine the persuasiveness of an analysis that might otherwise have revealed potentially interesting parallels with the one I am proposing here.