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Playing Nature: The Virtual Ecology of Game Environments

by

Alenda Y. Chang

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in

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in

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in the

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University of California, Berkeley

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Professor David Bates, Chair
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Abstract

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Designated Emphasis in New Media

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Playing Nature proposes new methods and objects for environmental inquiry through ecologically minded engagement with the imaginative worlds of contemporary gaming. This work recognizes that though some of the most sophisticated scholarship on natural representation has evolved within literary environmental criticism, as a humanistic field steeped in Romanticism, ecocriticism has tended to exclude designed landscapes and modes of mediated interaction perceived as detracting from direct experience of the natural world. At the same time, new media theorists and practitioners have generally overlooked the ways in which emerging technologies are implicated in and by natural systems. Most mainstream games, for instance, offer game environments as simplistic vehicles for graphical spectacle or extractive resource management.

Rather than perpetuate the popular notion that the natural and the digital are realms inherently inimical to each other, *Playing Nature* contends that our experience of the natural world is not only increasingly mediated by digital technology, but also that our interactions with these technomediated natures inevitably shape our conceptions of individual and collective agency in relation to our environment. Despite the present historical moment, in which environmental movements are often stymied in their efforts to depict the scale and urgency of global environmental crisis (most notably in the case of climate change), games remain largely untapped in terms of their potential to allow players to explore manifold ecological futures. Because successful gameplay requires that players negotiate environments by discovering their operative logics, games are structurally predisposed toward creating meaningful interaction within artificially intelligent environments and modeling dynamics long at the core of ecological thinking, among them interdependence, feedback, scale, and human limitation. Games offer imagined worlds that can compress centuries of change into the matter of hours, range from microcosmic to macrocosmic extremes, and dramatize recuperation just as readily as catastrophe—virtual ecologies that are mirrors to our modernity.

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INTRODUCTION
ON SLOW VIOLENCE, AND A PROPOSAL FOR ECOLOGICAL GAME STUDIES

On Christmas Day, 2012, the front page of *The New York Times* featured an intentionally disquieting article about the growing ties between the video game industry and firearms manufacturers, no doubt meant to follow in the wake of public outcry after the tragic Newtown, Connecticut mass shooting on December 14. Given the accessibility and popularity of the assault-grade weapons used by the shooter (including a Bushmaster semi-automatic military-style rifle and Glock pistol), the article's authors draw attention to the licensed representation of purchasable guns in well-known, first-person shooter games like Electronic Arts' *Medal of Honor* and Activision's *Call of Duty* titles. However, the article is far less interesting in terms of its predictable media-effects finger pointing, than in its evidence for both the increasing commercialization and branding of game content and the persistent and problematically narrow ideal of realism in game design.

For decades, violence and video games has been a particularly fraught topic for anyone involved with games, from scholars and researchers to industry employees. Having regularly come under Congressional examination, most often after high-profile shooting sprees of the Columbine and Newtown variety, video game violence is no doubt the issue that most people, non-players especially, are most likely to have encountered in the mainstream media. Though in June 2011 the Supreme Court struck down a California law prohibiting the sale of violent video games to minors, ruling that games, like gruesome fairy tales, were Constitutionally protected as cultural forms of free speech, members of Congress continue to introduce legislation and convene hearings over video game violence and its potential effect on minors and pathological individuals. Video games (as well as other forms of screen violence) almost always bear the brunt of public and official reprisal, rather than lack of services for the mentally ill, our culture's general glorification of military strength, and the distinctively American rhetoric of survivalism and frontier individualism (notably, even spokesmen for the National Rifle Association have been known to blame video games when concerns are directed toward the gun lobby).

And yet, this is not a book about game violence. While I agree with those that think games are too convenient a scapegoat for heinous acts committed by armed killers, I am more concerned that the obsession with game violence has diverted our attention from other, equally important forms of game realism, other aesthetic and experiential avenues for gameplay and design, and other vital ways in which virtual game worlds inflect and cross over into our lived social and material worlds. Without exempting games from necessary scrutiny of their often extreme and tasteless violence, what might we gain by leaving behind the perpetual struggle between First and Second Amendment rights and instead identifying and addressing what I see as unfortunate but telling lacunae in the study and reception of games?

In the first place, not all games are violent, at least in the sense that they involve shooting, maiming and killing, or assassinating one's virtual enemies. As evidenced by the rise of so-called "art" games and "serious" games (sometimes called "games for change"), more and more games are being created outside of the channels of mainstream entertainment, with forms and goals enmeshed with art, education, and political and social activism. On another level, one might also productively argue that limiting the definition of violence to the kinds of spectacular brutality common in fighting, action-adventure, and shoot-'em-up games—that is, overt and often graphic physical harm generally committed by humans against other humans—ignores the reality that a different and more pervasive violence is constantly being perpetrated in today's world, what one author has called the "slow violence" of environmental destruction and cumulative toxic effects.[1] As I hope to show, games both duplicate and deny this less sensational but equally destructive sort of violence.

Moreover, while only some games may be labeled as violent, all games feature a game world or environment in which gameplay occurs, though that environment may range widely in terms of detail and visual fidelity, from the relatively impoverished worlds of text-based or single-screen games to the intricate and immersive three-dimensional worlds of massively multiplayer online games (MMOGs) and blockbuster console games. This suggests that a disproportionate amount of attention has been paid to a particular type (violence) and subtype (graphic violence) of game material, without considering a broader and in many respects more pertinent aspect of games, namely their environmental content.

Throughout this book, the term "game environments" is intended to designate more than a game's scenery, or the pictorial components of its in-game world, or diegesis. Though many remember the scrolling clouds and colorful obstacles of *Super Mario Bros.*, or the desert sands and garden palaces of *Prince of Persia*, as the defining elements of their respective game settings, game environments extend beyond surface appearances to the underlying mechanics with which programmers establish the "rules" of game universes. From motion physics to seasons and climatic zones, from resource availability and creature "spawn" rates to concept art and ambient sounds, players operate within a multitude of environmental parameters that determine not only what the game world looks like, but also how it responds to player input.

Game environments might also evoke other, more common senses of the word environment—as biological systems (what we mean when we refer, for instance, to the native habitat of an animal species), and as a human ethical orientation to one's surroundings (evident in the rhetorical and moral impulses behind efforts to save "the environment"). These valences of environment should not be seen simply as supervening layers added by critical interpretation, but as relationships and orientations embedded in the same visuals and mechanics that determine gameplay.

Granted, "game environments" suffers from a certain genericness characteristic of game design texts, and there is, perhaps, a danger that the term enfolds too much to be practically useful. However, a game environment is not synonymous with the game in its entirety; rather, it refers to the *ambient* game world as it is both designed and experienced. Though the player is part of the game

environment, our focus will not be on the player or player character but on his or her surroundings.[2] Game environments thus refer generally to the apparent virtual worlds presented by art and programming, and specifically to those worlds' ecological implications. This admittedly capacious definition has the distinct advantage of spanning concepts for both built and natural environments, and directs our attention away from already well-examined questions regarding game players, narrative, and image.

Disciplinary Entanglements

Though the nascent academic nexuses of the environmental humanities and ecomedia studies span an ever growing variety of disciplines, among them art, philosophy, history, film, and American studies, *Playing Nature* engages primarily with two areas of scholarship: literary and new media criticism. In many ways, this decision places some of the most established thinking alongside some of the least developed, but perhaps most novel ideas on natural representation. As I shall discuss in detail in Chapter 1, much of the apparent oddity of this theoretical pairing stems from our willingness to see the natural and the technological as mutually exclusive realms. The pairing is also deliberate in another sense, in that literary and new media criticism offer each other vital ideological correctives in a time of both widespread digital technologies and environmental crisis.

First, while some of the most sophisticated scholarship on natural representation has evolved within literary environmental criticism, sometimes called ecocriticism, as a humanistic field steeped in Romanticism and nature writing, ecocriticism has tended to exclude designed landscapes and modes of mediated interaction perceived as detracting from direct experience of the natural world. As a scholar who has been at the forefront of literary environmental criticism for nearly two decades, Lawrence Buell recognizes the conventions of so-called first-wave environmental criticism, while acknowledging a recent second wave characterized by increasing openness to "sociocentric" perspectives, "toxified" or urban landscapes, and the concerns of environmental justice movements.[3] Notably, Buell also suggests that we move away from the term "ecocriticism" toward the term "environmental criticism," because the latter encourages this growing heterogeneity of topics and concerns and distance from a naïve belief in pure nature, "all environments in practice involving fusions of "natural" and "constructed" elements."[4] By engaging the imaginative worlds of contemporary gaming, *Playing Nature* therefore proposes new methods and objects for literary environmental inquiry.

At the same time, new media theorists and practitioners have generally overlooked the ways in which emerging technologies are implicated in and by natural systems. Game researchers and designers, for instance, continue to treat game environments as simplistic vehicles for graphical spectacle or extractive resource management (a topic I will elaborate on in Chapter 1). On the whole, a wealth of game-related scholarship has arisen in the past decade, as researchers move beyond proving games to be worthy subjects of scholarly attention and the initial growing pains of the narratology versus ludology debate, to staking claims for a wider range of possible approaches. Games have variously been placed in a continuum with older forms of media, among them serial and interactive fiction, cinema, paper-and-pencil games, and cultural rituals, and just as often have been ordained as constituting a distinctive, if not radical break from previous forms, most often predicated on contemporary games' execution via code and high-speed, data-intensive computational processes. By now, a number of valuable methods have become familiar analytical frameworks for game studies: cultural studies inflected investigations of gender representation, particularly the lack of female role models and male chauvinism in game design; social scientific quantitative and ethnographic studies of player populations, often in relation to MMOGs like *Lineage*

and *World of Warcraft*; attention to game narratives and film-like "cutscenes" as evidence of games' continuity with earlier storytelling forms; readings of game code and procedural or algorithmic rhetoric as evidence of games' discontinuity with other media; and so on.

Absent from all of these fascinating and worthwhile forays, however, has been any sustained interest in connections to the life sciences and pressing modern environmental issues. Computer and video games' dual status as technology and recreation has arguably shielded them from questions about how they model natural environments, including factors such as the following:

- Relative emphases on built versus natural environments
- The dependence or independence of environments in relation to human actions
- Generic versus specific locations (e.g. regions, climates, terrain)
- Presence and activity of nonhuman actants (e.g. animals, plants, microbes)
- Sanctioned and prohibited interactions between players and the game environment

As the very title of the book demonstrates, this project is part provocation, part reorientation. The oxymoronic phrase "playing nature" should trigger both an initial confusion and a productive curiosity. Typically, we think of nature as something outside human jurisdiction, something that we may observe, enjoy, and even harness to an extent, but that ultimately obeys laws not of our own making. Game environments, however, are the antithesis of this ideal (one whose purity has been largely debunked by environmental historians and thinkers, prominent among them Carolyn Merchant, Bruno Latour, Donna Haraway, and William Cronon). Digital nature, like animal theme parks, wildlife documentaries, and landscape paintings, is patently a constructed entity, a realm designed by artists and engineers for a user's exploration and enjoyment. Thus the idea of playing nature may strike many as counterintuitive, if not nonsensical. One of the primary goals of this work is in that case to understand the origins of this conceptual discomfort, and to thereby expand our notions of nature to include digital games. It does not necessarily follow that games succeed where other forms fail, although I do think digital games are better suited to certain kinds of environmental representation than previous modes of expression.

A few final words on terminology are worth mentioning. While not nearly as culturally and historically overdetermined an idea as "nature," "play" possesses several meanings that may be usefully borne in mind while reading this book—its positive connotations as open-ended game activity and flexibility in relation to more fixed states, as well as its less flattering suggestions of performance, deceit, or manipulation. When we play nature in a contemporary game like *Red Dead Redemption* or *The Elder Scrolls V: Skyrim*, we generally do so by taking advantage of the game environment and profiting from an inegalitarian relationship with its elements, but in theory we could also play in a less goal-directed, less instrumental, and more inquisitive way. In addition, lacking the training of a professional ecologist, I take a known risk in appropriating the concept of ecology for this project. I am, however, far from the first to borrow the term for less scientific ends: Timothy Morton has published two well-known books of ecological philosophy; Katie Salen's MacArthur Foundation collection, called *The Ecology of Games*, uses the term in the media ecology tradition founded by Neil Postman; and the recent resurgence of writings on materiality, affect, and the nonhuman often deploys it, perhaps because a great deal of it can be traced to either Latour or Gilles Deleuze's and Felix Guattari's collected writings on ecology, the rhizome, and becoming animal.[5]

For me, ecology is a means to narrow the potentially diffuse emphasis on game mechanics to those feedback loops and variables that, in any game, body forth the "natural." While this application of ecology stands much more tightly in line with scientific understandings of the term,

this does not mean that *Playing Nature* will concern itself solely with educational games, or games designed to teach science, along the lines of the University of Washington Bothell's Wetlands Restoration game, or the MIT Education Arcade's recent MMOG for high-school STEM (science, technology, engineering, and math) learning, called *The Radix Endeavor*. Instead, let us remain cognizant that ecology is a fraught term, not only because science studies scholars have long sought to demonstrate the historical variability of normal science, but also because ecology, much like play, has lost much of its initial conceptual vitality to its growing popularity. On the one hand, ecology is less a monolithic or universally agreed upon entity than it is a constantly shifting set of actors, practices, technologies, discourses, and artifacts[6], while at the same time, its overuse by ordinary people, well-meaning environmentalists, and diverse academic disciplines has evacuated it of its original, largely scientific meaning (coined by late nineteenth and early twentieth century philosopher Jakob von Uexküll). Ecology textbooks today bear little imprint of previous and ongoing contests over its scope and meaning, while everyday use of the term has transformed it into a flaccid descriptor connoting everything from interdependence to the study of all things natural. Throughout this book, I will attempt to tread a middle ground between ecology's tempting generalities and its limiting technical specificity.

Chapter Overviews

In Chapter 1, "Games as Environmental Texts," I bring literary environmental criticism into conversation with new media discourse, using for my objects two games from very different time periods and genres. One is an early classic text game from the 1970s, *(Colossal Cave) Adventure*, while the other is a contemporary art game for the PlayStation Network, called *Flower* (2009). Though the first transpires solely through terse verbal description and the second offers a lush multimodal domain for immersive play, for me both games exemplify alternative, affective engagement with virtual environments, while conclusively demonstrating that graphical realism is neither sufficient nor necessary for games to achieve meaningful environmental similitude. *Adventure*, inspired by programmer Will Crowther's spelunking expeditions into the Mammoth Caves in Kentucky, and *Flower*, born of Chinese interaction designer Jenova Chen's first experiences with the rolling grass landscapes of California, also testify to the startling realization that digital games may have significant ties to real-world locations. Both games thus make evident the conclusion that games need not be explicitly environmental to have important environmental implications.

Chapter 2, "Scalar Environments," turns from an evaluation of the "ecomimetic" impulse to games' complex relationship to earlier media within the history of scientific visualization. Using industry luminary Will Wright's evolution-themed game, *Spore* (2008), in comparison to the 1970s science-education film *Powers of Ten*, I place contemporary games in convergence with modern scientific-imaging technologies in their shared movement away from static representation toward dynamic interaction and fabrication. Though *Spore* promulgates a flawed version of evolutionary theory, the game excels at modeling a fluid perspective on environmental systems through a literal journey outward in scale (players develop custom species from modest cellular origins into wide-ranging, galactic civilizations). This ludic perspective is notably both spatial and temporal, as the game invites replay and the pursuit of countless playable futures. In my mind, *Spore* presents a valuable means to navigate recognized tensions between local and global framings of environmental issues, and between visceral and virtual experience.

While Chapter 2 aligned games with a trend in scientific imaging beyond photorealism to data visualization, Chapter 3, "Back to the Virtual Farm," acknowledges that ecological matters are necessarily entangled with social and economic factors. As I demonstrate in my analysis of

agriculture-management games, or farm games, popularized in the last decade by hits like *FarmVille* and *Harvest Moon*, games that rest on ecologically absurd landscapes are likely to accompany those settings with gross misrepresentations of labor, gender, and race. Drawing on agricultural history, theories of the pastoral, ecological economics (thermodynamically based paradigms that stress entropy and energy flow through systems), and ecological Marxism (capitalism as the necessary interplay between human labor arrangements and natural systems), I identify numerous historical and environmental inaccuracies in the vast majority of farm games, which almost always proffer bucolic fantasies of rural escape and rugged self-sufficiency.

My final chapter briefly considers the increasingly high-profile genre of "serious" games and its intersections with so-called alternate-reality games (ARGs)—games that deliberately tackle social and political content and render permeable the usual barriers between game world and real world. Referencing the location-sensitive games of new media artist Greg Niemeyer, including *Black Cloud* (2008) and *AirQuest*, and alternate-reality games like *World Without Oil* (2007), I consider the impact of new forms of networked interaction on the ecological instruction that games can provide, including the leveraging of social networks and mobile or handheld devices. While proponents of unmediated natural experience might be tempted to automatically grant these kinds of games a key advantage in addressing environmental ills, because they follow a paradigm based on direct, physical interaction with the real world overlaid with a game-like scenario, I argue that, while useful, these games are not inherently superior to exclusively digital games. I suggest that the current industry trend toward "gamification" of everyday operations represents a desire to coopt the attractions and motivational efficacy of games in an indiscriminate manner that may ultimately prove detrimental to games' civic value.

Rather than accept that the natural and the digital are realms inherently inimical to each other, *Playing Nature* contends that our interactions with technologically mediated natures inevitably shape our conceptions of individual and collective agency in relation to our environment. Despite the present historical moment, in which environmental movements are often stymied in their efforts to depict the scale and urgency of global environmental crisis—most notably in the case of climate change—games remain largely untapped in terms of their potential to allow players to explore manifold ecological futures. Games are, by definition, restricted systems in which play occurs within the bounds of prescribed rules or sets of relations. Successful gameplay thus entails deciphering the hidden logics behind varieties of interaction, within imagined worlds that can just as easily accommodate apocalypse as the mundane, compress centuries of development into a matter of hours, and range from microcosmic to macrocosmic scales. In other words, games are structurally predisposed toward creating meaningful interaction within artificially intelligent environments, and should be well poised to model dynamics long at the core of ecological thinking—interdependence, limitation, nested organizational scales, flows of energy and biomass, feedback, and so on.

Though academics have only recently coined subfields like "ecomedia," "ecocinema," and the "environmental humanities," these are recognizable cousins to longstanding investigations in environmental history and science. Environmentalists, too, have been speaking out on behalf of the natural world for over half a century. Nevertheless, the current groundswell of scholarly interest that we are witnessing in this postmillennial moment, in the wake of Deepwater Horizon, Hurricane Sandy, and mounting evidence of extreme weather patterns, seems to me to be evidence of fresh wounds and deeply felt anxieties over the ways that our scholarship can stretch beyond classroom walls and printed pages to the world we inhabit.

While many rebel against the proposition that something as patently artificial and removed from the elements as a virtual game world might be thought of as environmental, how virtual is the virtual in an era when digital technology premises its eventual ubiquity on controlling a vast share of the world's resources and disguising discarded electronic waste? For many, hours spent in game

environments may greatly outnumber the hours spent outdoors or in wilderness areas, or hours engrossed in books, movies, and television. But most important for the following work, computer and video games present a rich limit case for the claims of environmental scholarship—a place where the natural and the digital collide and prompt careful reexamination of our assumptions about nature, realism, and the visual.

GAME, ENVIRONMENT, TEXT

Though the study of play in culture has been a subject of scholarly attention at least since the original Dutch publication of Johan Huizinga's *Homo ludens* in 1938, digital games—games reliant on electronic components and the computational processing of modern computers, more commonly called computer or video games—only became mainstream objects beginning in the 1970s (though the first prototypes were created as early as the 1950s and 1960s, with games like *Tennis for Two* and *Spacewar!*, they were often accessible only to a small group of programmers and engineers). Since then, digital games have proliferated in terms of both quantity and variety, and while scholarly writing on the subject remained minimal through the turn of the millennium, it is now increasingly common to find academic treatments of computer and console games. Game-design specialists and theorists like Katie Salen and Eric Zimmerman, Alexander Galloway, Jesper Juul, Noah Wardrip-Fruin, and Ian Bogost have all attempted to isolate the distinctive characteristics of this new medium, while social scientists and behavioral researchers like Constance Steinkuehler, Bonnie Nardi, and Edward Castronova have devoted their attention to player populations and the dynamics of virtual worlds.[1] Much of this work denies the usual criticisms leveled at games—that they are lowbrow popular indulgences, suitable only for frivolous-minded youth—in favor of extolling games and their ability to generate creative player behavior and to enact rhetorical arguments in a uniquely interactive medium.

But why meditate at such length on digital representations of nature, particularly game-based versions of the environment? The answer is multifaceted. Many games are tremendously popular, and like other forms of mass media, they have the ability to influence our perceptions and handling of certain situations. In an age when ecological questions have been consistently framed in terms of crisis and moral duty, games offer a potentially less off-putting, less overtly didactic way to encourage people to consider environmental problems and their solutions. Moreover, games and digital media more broadly offer unique affordances, ones that enable often abstract data and

otherwise distant threats of ecological calamity to take very real and even operable form, combating the twin hazards of apathy on the one hand ("I live in Texas. Why should I care about a hole in the ozone above the North Pole?") and paralysis on the other ("What difference can one person possibly make?"). As I hope to show, studying games through an environmental lens suggests several methodological transects for games, approaches that cut across the historical ludology versus narratology conflicts in game studies and widen the discussion around games to include environmental scientists, historians, educators, and activists.

Games may, of course, directly render pressing environmental issues like global climate change, deforestation, species loss, and energy crisis into fit material for play, or present more tacit lessons through their pursuit of qualitatively new player-environment relationships. Though some embrace environmentalism's core principles more faithfully than others, balancing education against entertainment (or preaching against profit), each game raises an interesting complex of questions: how do games model "nature" (the environment, scientific theories, etc.), and how do digital representations of nature differ from those in more traditional media? Do games potentially permit a better understanding of natural processes by moving past the mere visualization of data to procedural or algorithmic embodiment? I suggest that digital games and networked media offer promising avenues not only for rendering the realities of environmental crisis (nature as problem space), but, more importantly, for schematizing possible solutions in ways that leverage the unique affordances of the computer, the Internet, and the player collective.

Already, many theorists have worked to identify the properties specific to digital media. Rita Raley, comparing code languages to so-called "natural" languages, locates "the *difference* of the sign system of code" in

> its executability, its operative transformation of a message from one symbolic form to another. [. . .] code and language alike may amuse, astonish, inform, and delight; both may be written and read; both are performative and may initiate changes in the world; but one can be executed by the computer and one cannot.[2]

Paralleling Raley's emphasis on code and code-based projects, Ian Bogost, author of *Persuasive Games* and *How to Do Things with Videogames*, has coined the term "procedural rhetoric," arguing that video games need to be examined for more than just their graphics quality and narrative structure (itself often tied to film-like cut scenes). In their stead, Bogost emphasizes "processes" and the "computational" specificity of software (in particular games), and he draws attention to the way in which some, but not all, games craft and present arguments via their rules of operation—that is, the constraints imposed upon gameplay, or the interactions invited or disallowed on the part of the player—in short, game mechanics.

This notion of procedural rhetoric can be productively applied to any number of environmentally themed games, for instance, a simple web game found on the Discovery Channel site accompanying the BBC's celebrated *Planet Earth* (2006) television series. Though exigently dubbed *Mission: Planet Earth* and layered with inviting wilderness photography, the game at the procedural level does not involve saving endangered species, protecting fragile habitats, or educating the public about environmental concerns, but instead models media-related enterprise. The following introductory window establishes the player's true fiduciary role:

Figure 1.1. Instructions for the Discovery Channel game *Mission: Planet Earth*. Author screenshot.

After reading this introductory missive, players proceed to a "Command Center" window that contains four sub-frames: communication, weather, navsat, and overview (the last shows a two-dimensional map of the globe), which they must use to make decisions and resolve crises, from sending replacement supplies and arranging for medical assistance to consulting weather conditions in order to prepare film crews for developing storm systems. While the equipment and terminology employed (navigation and global positioning satellites, high-tech communications relays, and words like "mission," "on assignment," "command center," etc.) implicitly liken these expeditions to military operations, *Mission Planet* also unabashedly foregrounds commercial criteria, drawing attention to the diverse imperatives that frame nature-documentary production and inadvertently calling into question the character of scientific popularization. What ends up being emphasized is less an environmentally conscious mindset than the extraordinary difficulty of filming on location. Successful missions are those that come in under budget, and thrifty players are visually rewarded with clips from the television series (ostensibly caught by your well-managed crews). However, if any mission goes even a dollar over budget, it does not matter if you have already spent hundreds of thousands of dollars and captured some usable footage—the mission is deemed a failure, and you are duly chastened with a clip showing only empty habitat, devoid of eye-catching animals and even any attempt at a soundtrack. Thus the primary procedural argument of this game amounts to equating nature cinematography with hazard, expense, and operational challenge, indirectly valorizing the heroic efforts that must have gone into creating *Planet Earth* for its millions of television viewers. In this game universe, overspending is the cardinal sin, technology is the key to managing an unruly natural world, and footage is qualitatively graded in terms of unmediated access to target animal species (recapitulating the historic depreciation of inanimate or nonorganic actors). Put another way, vision supersedes knowledge—in fact, indulging your scientific curiosity, for

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instance choosing to investigate a "jade anomaly" on the horizon, leads to unacceptable, that is, costly, delays.

Like Bogost, Alexander Galloway also emphasizes the "algorithmic" nature of games as well as what he calls modes of "informatic control".[3] Galloway's work in *Gaming: Essays on Algorithmic Culture* foreshadows his later work with Eugene Thacker on the logic of protocols and networks; in both places he argues that we need to supplement ideological critique with "informatic critique," that is, a critique based on knowledge of the technologies and computational processes underlying technocultural objects like video games and the World Wide Web. As Galloway notes, taking as an example the *Civilization* games of Sid Meier, "Video games don't attempt to hide informatic control; they flaunt it."[4] Like Raley and Bogost, Galloway believes that code offers users and players qualitatively unique experiences constructed around programmed routines. While such routinization may be indicative of a more pernicious trend in our society at large, as Galloway suggests in his recent work, software, particularly in the form of computer and console games, may also offer particularly effective ways to model solutions to contemporary social problems, from urban blight to overconsumption.

Environmentally themed games are not a recent invention; in fact, though recent years have seen a marked increase in overtly environmentalist games, often linked to corporate public-relations campaigns or educational outreach (for example, the short-lived *Planet Green Game*, created by Starbucks Coffee Company and Global Green USA, and *CO₂Fx*, an industry-academic hybrid project funded by the National Science Foundation), such games have existed for decades, with 1990 perhaps representing a watershed year with the releases of Will Wright's *SimEarth* and Chris Crawford's *Balance of the Planet*. In the *Planet Green Game*, you played a resident of the fictitious town of Evergreen, exploring sites like your own house, the city park, and the local school, discovering mini-games that helped identify ways to improve the town's green quotient and your own "ecometer" score:

Figure 1.2. Start screen for the Starbucks-funded *Planet Green Game*. Author screenshot.

In the turn-based *CO₂Fx*, you were tasked with presiding over the hundred-year development of a country (Brazil was the only initial option), which involved balancing economic development with scientific research, conservation, and other initiatives. If you favored industry too much

environmental health and quality of life suffered; protecting natural resources too zealously likewise led to plummeting of the gross domestic product:

Figure 1.3. Juggling Brazilian national policy, economy, and science in the *CO₂Fx* game. Author screenshot.

One game rendered environmental decision-making from the bottom up, at the level of dozens of minute, daily actions, or the consumer's habitus; the other took a top-down, politician's-eye view, couching environmental concerns in terms of conflicting constituencies for national policymaking.[5]

The *Planet Green Game* and *CO₂Fx* are examples of *overt* environmental games—their concerns with global warming and energy usage were worn on their metaphorical sleeves and they likely attracted players already engaged with environmental issues. However, even games that appeal to players that may not have the least concern for environmental issues and that at first glance make no ecological claims can contain subtle reflections on the human-environment interchange. Take, for example, the very popular genre of real-time strategy (RTS) games, which are typically played on "maps" and require intensive resource-management skills. RTS games such as Blizzard Entertainment's immensely successful *Starcraft* and *Warcraft* titles fundamentally treat the game environment as a complex of natural resources to be extracted for player profit and civilization building. In *Warcraft III*, for instance, a player's most basic units mine gold and harvest lumber, which are then used to construct buildings, train armies, and research technological improvements like stronger defensive fortifications:

Figure 1.4. Human peasants extract gold from a mine in *Warcraft III*. Author screenshot.

Though it promulgates an essentially utilitarian view of the environment, *Warcraft III* also realistically represents the limitations of such resources. Gold mines will eventually be exhausted, so once a certain area has been plundered for its minerals, players must establish "expansions" (new mining operations that support additional towns) in order to ensure victory. Similarly, with one exception, trees, once felled, do not grow back—they leave stumps and cleared land behind.[6] Players must therefore choose between harvesting timber, necessary for population growth and physical expansion, against the attractive option of leaving natural defensive barriers intact around their towns, since enemy players may not pass through dense forest. In these games, environmental matters are not explicit aspects of the game content, but implicit in the games' rules of play.

In summary, while only a small minority of games may seek to tap the growing desire for environmental ethics and sustainable production (as opposed to monopoly capitalism), almost all games can be productively analyzed with an ecological lens. While explicitly environmental games remain on the fringe of mainstream game production, often relegated to the hybrid "edutainment" category, on rare occasions a "triple-A" or "AAA" game (the unofficial classification game developers and marketing executives attach to games with the largest development budgets and teams, high-quality graphics, and/or the likelihood of selling over a million copies) will engage with environmental issues in a very direct manner, as in the case of *Spore* (discussed in Chapter 2).[7]

It is worth noting at the outset that the environmental mechanics of games are necessarily complicated by the size and organization of player populations. Games targeted at single players (the *Planet Green Game*) or small groups of players (*Warcraft III*) may differ dramatically from those meant to support thousands or even millions of players, as in the case of massively multiplayer online games, or MMOGs. Most MMOGs tend to include elaborate player profession systems supported by natural resource collection mechanics. In perhaps the most successful MMOG to date, *World of Warcraft* (*WoW*), for example, each character can learn up to two tradeskills, such as blacksmithing, leatherworking, jewelcrafting, and alchemy, and once properly trained can forage for herbs, collect natural gases, mine mineral nodes, and even skin animals, in a process akin to resource collection in the RTS genre:

Figure 1.5. A *WoW* player mines copper ore from a rocky hillside. Screenshot by Jose Leiva.[8]

Unlike RTS games, however, MMOGs only simulate a state of limited natural resources—in *WoW*, should your blue-skinned troll pick a lakeside tiger lily or use his pickaxe to pry gold ore out of a hillside, the resource (flower or mineral node) will vanish temporarily, only to reappear at a later time, perhaps in a slightly different location, for the convenience of other players. Resources in *WoW* are not plentiful, engendering a fair bit of competition among players, but neither are they exhaustible. The challenges of maintaining a persistent virtual world for the thousands of players on each "shard," or world server, necessitate tinkering with the otherwise realistic properties of natural objects.

In Chapter 3, I will consider the postmillennial outpouring of "social" and "casual" games that often piggyback on existing social networks, where the potential for collaborative gameplay remains largely untapped. For now, suffice it to say that games are complex entities usefully approached, but not exhausted by procedural or algorithmic analysis. Bogost's concept of "procedural rhetoric" at its best retains its links to both computation and interpretation, so let us turn next to textual study and its relevance, if any, to game criticism.

Electronic Textuality

Debate over the nature and value of environmental mediation is hardly new, though video games present a new and particularly unwelcome challenge to proponents of direct contact with the natural world. Having briefly delved into the procedural rubric well rehearsed in game studies, we can now extend this foray into the ecological implications of digital games in an unlikely direction— that of literary analysis, using the text-based dungeon of one of the earliest computer games as an example. As a medium that has lost its formal salience after hundreds of years of relative ubiquity, the printed word provides a convenient bridge between the well-traveled terrain of literary criticism and its associated gravitas and the still volatile and undertheorized realms of digital entertainment. And for decades, literature scholars have already puzzled over the pleasures and pitfalls of environmental representation in poetry and nature writing; their conversations will help me to establish some early and important limit cases for my argument about game environments,

particularly regarding the role of graphics, and to a lesser extent the historical contexts for game development and reception.

As intimated in the introduction, nature and technology are for most people mutually exclusive realms. Many sympathize with author Richard Louv's judgment in *Last Child in the Woods* (2005) that generations born since the 1970s are increasingly victims to what he calls "nature-deficit disorder." Moreover, they likely support his apportioning of the blame, for his primary culprits are television and the electronic devices that have come to occupy a disproportionate amount of our time—computers and game consoles in particular. Yet while we may grant that Louv's work has sparked valuable efforts to reclaim wild land for the education and spiritual growth of children, a crucial problem remains in that Louv, like the nature-technology dichotomy itself, leaves little room for forms of media to be productive agents for social and environmental change.[9]

Many of the benefits of the natural experiences Louv describes could be found in computer and video games—free, unstructured play without adult supervision; a chance to learn about natural processes and life cycles, or how people, animals, plants, and inorganic matter are connected; educated mentorship, as in a guiding presence knowledgeable enough to provide more information about what one is experiencing; and hands-on activity with actual consequences. While game environments, no matter how lovingly realized, are not substitutes for direct experience of the natural world, more and more people are turning to virtual worlds not only for entertainment but also for challenge, companionship, and even civic participation—why not embrace and encourage game design in forms that recall our favorite modes of natural play?

Games can offer a compelling way to reconcile a deep connection to nature and the nonhuman world with an equally important connection to technology and the virtual. Even Louv might agree that this is a defining dilemma of our times, or at least of the generations raised with a walking stick in one hand and a joystick in the other.

"SORRY, BUT I AM NOT ALLOWED TO GIVE MORE DETAIL":
Will Crowther's *Adventure* and Mortonian Ecomimesis

> It is utterly different in a cave. Within seconds you lose sight of your starting point. The sinuous passages twist and turn. Always you are confined by walls, floor, and ceiling. The farthest vistas are seldom more than one hundred feet—along a passage, down a pit, up at a ceiling. You are always in a place; you never look out from a point. The route is never in view except as you can imagine it in your mind. Nothing unrolls. There is no progress; there is only a progression of places that change as you go along. And when you reach the end, it is only another place, often a small place, barely large enough to contain your body. It is conceivable that you have missed a tiny hole that goes on. You may not have reached the end at all. The only sign that you have reached the end is that you cannot go on. And there is no view.
>
> <div align="right">Roger Brucker and Richard Watson,
The Longest Cave</div>

Almost by definition, all computer and console games are environments, but surely not all games are environmental.[10] What, then, constitutes an environmental game? Or should we prefer to steer clear of environmentalist rhetoric, how can a game environment model ecological principles? Most games commit at least one if not all of the following missteps in their realization of in-game environments: relegating environment to background scenery, relying on stereotyped landscapes,

and predicating player success on extraction and use of natural resources. In the first and most common scenario, a game flaunts its environment to the extent that it provides gratifying visuals, while the environment itself remains inert, the functional equivalent of theater flats or bluescreen or greenscreen (chroma key) technology. Action takes place within or in front of such digital set pieces, and it is in this vein that volumes devoted to the artificial intelligence (AI) of games carefully outline the behavior of non-player characters (NPCs) and monsters (mobiles), but leave the articulation of the game environment to artists.[11] Such a spatial hierarchy is readily apparent in games like Nintendo's old Mario platform games, which featured the iconic plumber running, bouncing, and sometimes falling through a series of obstacles set against a simple, side-scrolling backdrop.[12] Though some might argue that the newer virtual worlds offered by massively multiplayer online games appear to exchange background and foreground distinctions for a more immersive experience of space, the range of possible interaction with the game environment remains disappointingly slight.

Game environments also tend to lean heavily on clichéd landscapes, abandoning any attempts at regional specificity for pre-patterned and ultimately generic scenes. Such environments give players the disorienting and somewhat anaesthetizing sense that *this could be anywhere or nowhere at all*, conveniently overlooking ecological concerns with the finite character of the natural world, entropic limitations on energy and throughput, carrying capacity, etc.[13] In an era of widespread anxiety over climate change, increasingly scarce fuel reserves, and population control, it should come as no surprise that an especially popular recourse is the abstract, ever-receding pastoral ideal that Raymond Williams once derisively called "a babble of green fields," which lurks in all the medieval and pre- or alter-industrial lands of games like Blizzard Entertainment's *World of Warcraft* or the *Legend of Zelda* series, and rather explicitly in the multitudes of crop-management games like *Harvest Moon* and *FarmVille*.[14] Ecological specificity and accuracy are neither necessary nor sufficient criteria for successful commercial games, but when we measure games as instruments of public knowledge, it suddenly becomes worthwhile to make games that are more meaningfully local, which take seriously the goal of environmental realism—not solely in terms of visual rendering, but also in sound design, weather, species density and distribution, and the arrangement of organic and inorganic actors in complex interrelation.[15]

Both of these criticisms—treating game environments as mere scenery, falling back on caricatures of landscapes rather than attempting to plumb their complexity—already suggest within them the third major issue: game designers have yet to develop more sophisticated rules for interaction between players and game environments.[16] While most game environments are predominantly visual, with the majority of the environments remaining functionally inert, actionable parts of those environments are most often things a player can use immediately (a power-up, like a health or speed boost), acquire for later use (an item such as a key for a locked door further in the storyline), or destroy (panes of glass between you and your target, a creature you didn't like the looks of).[17] Many celebrate games for this player-centered paradigm, what Bonnie Nardi calls "performative mastery," a tribute to player agency and skill that tries to dissociate itself from critiques that games are virtual Skinner boxes producing addiction in return for randomized reward.[18] While I cannot discount the value of player agency, too often this kind of skill mastery equates to mastery of the external environment, and I find games naively reproducing a whole range of instrumental relations that would be better reimagined. Games are opportunities to create entirely new sets of relations, outside of those based on dominance or manipulation. More environmentally realistic games could impact our understanding of real-world environmental issues (not just crises), either by implicitly or explicitly modeling different forms of our individual and collective environmental agency.

Pragmatists might argue that building natural life cycles and both abiotic and biotic factors into game environments would be cumbersome from a development standpoint, as well as frustrating to players accustomed to endless supplies of raw materials. But attention to ecological details can make for not only a more responsible game experience but also a more compelling one. As many have observed, games are so enticing largely because they challenge us to puzzle out the systems of logic underlying gameplay (What works? What doesn't? What happens when I do *this*?). Games that invite our attention to environmental states and shifts, to our implication in those processes, promise a new kind of gameplay challenge, one which can deliver the deathblow to the pernicious myth of a free and ever abundant Nature at the same time as it elevates player experience to a new level of consciousness. Why replicate in games the same kind of costly obliviousness we see every day in the non-virtual world, that refusal to acknowledge or even attempt to understand our role in climate change, environmental degradation, and species loss, when taking these factors into account could prove so very interesting?

Some games elegantly avoid many of these common pitfalls, and perhaps surprisingly, we can begin with an example not far from the origin of modern computer games, one which took the longest known cave system in the world as its inspiration and used only text to communicate ambient detail. The game, *Adventure* (sometimes called *Colossal Cave Adventure*, or simply ADVENT, due to an archaic FORTRAN six-character identifier limit), was designed by William Crowther in 1975-1976 while he was an employee at Bolt, Beranek and Newman (BBN), best known for developing the ARPANET. Crowther developed Adventure using BBN's PDP-10 computer in his off hours, and the game quickly became something of a craze among early computer enthusiasts; it was significantly extended by Don Woods at Stanford in 1977, and throughout the next decade other player-fans would revamp the game for newer platforms like the TRS-80 and the Atari 2600, eventually adding graphics.

While the original, text-only *Adventure* seems simplistic by contemporary game standards, it successfully foregrounds environment and environmental knowledge because of and not despite its textual limitations. *Adventure*'s site-specific subterranean world exemplifies Timothy Morton's concept of ecomimesis, from *Ecology Without Nature*, which he defines as the project whereby nature writers and ecocritics alike attempt to bring the natural world into their writing through evocative, present-tense descriptions.[19] Though Morton's ruminations on environmental aesthetics, written in the context of literary ecocriticism, may at first appear to have little to do with game criticism, my overwhelming sense is that ecocriticism and game studies have much to gain from breaking disciplinary isolation. Having been dominated for some time by amorphous notions of play, narrative, and computation, games are sorely in need of more diverse forms of critical articulation at the same time as they offer particularly fertile terrain upon which to raise questions of environmental representation, knowledge, and ethics—questions that have dogged ecocritical attempts to reconcile the natural and the ecological with the literary and the artistic.[20]

For Morton, ecomimesis is perhaps counter-intuitively non-natural, sharing more with the self-reflexive, self-conscious aspects of postmodern art than documentary realism. While poets, nature writers, and ecocritics like Lawrence Buell find that ecologically inflected, thick descriptions of natural setting permit an escape from the confines of writing, from representation to reality, Morton concludes that "ecomimesis is not necessarily on the side of nature".[21] A similar but more polemical critique can be found in Dana Phillips's *The Truth of Ecology*, in which Phillips describes Buell as evincing "an inchoate and perhaps not fully conscious desire for a literature of presence,"[22] and accuses ecocriticism of going "well beyond the realm of the plausible in its declarations about what literature can and ought to do."[23] Phillips expresses deep skepticism over the claims of literary mimesis, dismissing them as badly veiled attempts "to do an end run around contemporary literary theory."[24] However, unlike Phillips, Morton is careful not to throw the proverbial baby out with the

bathwater—while "the idea of nature is getting in the way of properly ecological forms of culture, philosophy, politics, and art" and ecomimetic projects are clearly artificial constructions, ecomimesis remains a valid and important form of poiesis. Moreover, though Morton looks to "art above all else" and Romantic literature in particular for "properly ecological forms,"[25] his theory of ambient poetics allows for the analysis of works in a range of media.[26] While ecomimesis in Morton's view presents the greatest complications in the context of the written word and its attempts to incorporate or capture ecological truth in writing itself, we can easily see how the concept of ecomimesis could extend to photography, film, music, and games—both game texts and games *as* texts. In this age of aggressive graphical display—3D, high definition (HD), and computer-generated imagery (CGI)—we tend to forget that many of the earliest computer games were purely textual constructs, and thus neglected progenitors of both the modern, visually saturated computer or video game and continuing experiments in interactive fiction. We could ask ourselves, to what degree could such text-based games be said to model the kind of "writing degree zero" Phillips so readily dismisses, or the less naive Mortonian craft of ecomimesis? As a game like *Adventure* demonstrates, game designers are recognizable cousins to ecocritics and nature writers, in that all "want the world to be in the text."[27] But game texts, unlike conventional texts, demand action—games are "richly designed problem spaces" or "possibility spaces" where we come face to face with our environmental knowledge and impact.[28]

Adventure's ecomimetic qualities stem from both the game's signature descriptive brevity and the artful correlation between textual output and player language and movement. When you begin the game, for instance, should you ask for instructions, you receive the following cryptic remarks:

> SOMEWHERE NEARBY IS COLOSSAL CAVE, WHERE OTHERS HAVE FOUND
> FORTUNES IN TREASURE AND GOLD, THOUGH IT IS RUMORED
> THAT SOME WHO ENTER ARE NEVER SEEN AGAIN. MAGIC IS SAID
> TO WORK IN THE CAVE. I WILL BE YOUR EYES AND HANDS. DIRECT
> ME WITH COMMANDS OF 1 OR 2 WORDS.

Otherwise, you begin with the following description of your location:

> YOU ARE STANDING AT THE END OF A ROAD BEFORE A SMALL BRICK
> BUILDING. AROUND YOU IS A FOREST. A SMALL
> STREAM FLOWS OUT OF THE BUILDING AND DOWN A GULLY.

Exploring the surrounding forest yields little, but when you investigate the building you discover a range of objects that might help you in your search: keys, a shiny brass lamp, some food, and a bottle of water. Following the streambed south leads to an area of "bare rock," and "a 20 foot depression" at the bottom of which is "a strong steel grate." Unlocking and opening the grate allows you to lower yourself into the chamber below, and there begins your journey into the expansive underground cave system that forms the majority of the game world.

No progress can be made without issuing recognizable one- or two-word directives to the program's mysterious narrator-actor, thus at first the game can unfold as a humorous, ELIZA-like conversation between you (the player) and it (the unknown interlocutor who presents the game), through the input mechanism of the command-line prompt.[29] Though this interlocutor supposedly serves as your "eyes and hands" and can be ordered about with simple phrases like "north" or "get keys," attempts at complex or creative workarounds are liable to earn only nonplussed responses such as

11

I DON'T KNOW HOW TO APPLY THAT WORD HERE.

or this gem,

YOU CAN'T BE SERIOUS!

At times, as you wander about lost in chamber after chamber, the computer seems as disoriented as you are, though the disorientation is verbal as much as spatial:

I AM UNSURE HOW YOU ARE FACING. USE COMPASS POINTS OR NEARBY OBJECTS.

I DON'T KNOW IN FROM OUT HERE. USE COMPASS POINTS OR NAME SOMETHING IN THE GENERAL DIRECTION YOU WANT TO GO.

Compared to current games, in which player identity is most often grafted onto a three-dimensional avatar in a curious blend of first-person belief ("I am the military operative on this mission") and third-person witnessing ("That is my character moving around on the screen"), *Adventure* is unusual in its interposing of an artificial intelligence (AI) between player and environment. In a mode reminiscent of the orthodox Cartesian dualism between mind and body or philosophy's brain in a vat, the player issues commands to her physical extremities and waits patiently to see if the commands are understood and acted upon; garbled commands lead to extensive linguistic negotiations, as the player searches for objects and actions that the program can recognize. Thus, "inch forward" becomes "go down" and "hit snake with black rod" resolves simply to "strike snake" (if you err on this account, the program helpfully reminds you that "MY WORD FOR HITTING SOMETHING WITH THE ROD IS 'STRIKE'"). Meanwhile, movement into new caverns and crawl spaces are often leaps of faith—until the program outputs the textual description of these new areas, the player is effectively blind.

Figure 1.6. A map of the convoluted cave system popularized by the early text game *Adventure*, drawn by Bruce Beaumont. Reprinted by permission of David Platt.

Crowther's *Adventure* was, in fact, based on a real system of caves—the Bedquilt and Colossal Cave sections of the Mammoth Caves in Kentucky. Crowther, it turns out, was both an avid caver and a player of the early Dungeons and Dragons, and *Adventure* thus effortlessly melds aspects of fantasy (axe-throwing dwarves and "magic words," like the nonsensical teleportation incantation "XXZZY") with the mundane details of spelunking (Crowther and his soon-to-be ex-wife Patricia had both spent time mapping Bedquilt). That Crowther imaginatively retooled his own physical experiences within a material milieu, transforming them into the stuff of computing lore, supports the game's ecomimetic classification; the text delivers an unexpected intimacy with an alien environment that stems directly from a caver's ecological awareness and expertise. In a process familiar to cavers, the game therefore proceeds as the compass-guided navigation of a series of interlocking chambers or "rooms," whose descriptions sometimes forego aesthetic detail for matters of practical judgment:[30]

> YOU ARE ON THE BRINK OF A THIRTY FOOT PIT WITH A MASSIVE ORANGE COLUMN DOWN ONE WALL. YOU COULD CLIMB DOWN HERE BUT YOU COULD NOT GET BACK UP.

Where an untrained eye would see only undifferentiated stone and darkness, the *Adventure* player, with the aid of knowledge Crowther has embedded in the game's descriptive texture, spies evidence of previous expeditions, networks of linked passages, climbs of varying difficulty, and even the familiar results of geologic processes:

YOU ARE IN A ROOM WHOSE WALLS RESEMBLE SWISS CHEESE.
OBVIOUS PASSAGES GO WEST, EAST, NE, AND
NW. PART OF THE ROOM IS OCCUPIED BY A LARGE BEDROCK BLOCK.

"Obvious" passages notwithstanding, *Adventure* also militates against player hubris, confounding would-be cartographers with the sheer scale and complexity of its natural environment. As one of the game's fan sites notes, *Adventure*'s cavernous expanses eschew the orderly, planar preferences of Euclidean geometry, instead reproducing the curved, choked, and irregular topologies of real cave systems.[31] Some routes are passable only in one direction, and leaving a room by its northern opening does not necessarily mean that you can return to that room by heading south from the next chamber. As veteran spelunkers Roger Brucker and Richard Watson observe in *The Longest Cave*, their account of the Cave Research Foundation's involvement in Mammoth Cave National Park, caving expeditions rarely have a discernible end. The challenge is instead to discover connections between cave systems, or to find your way back to where you began (using *Adventure*'s magic word XXZZY whisks you back to the starting point), and unlike most enshrined outdoor activities, caving is less about ascent, panoramic views, and wide open spaces than close confines, restricted vision, and plunging deep below ordinary terrestrial life:

> Caving is tactile in a way that no other contact with the inanimate can be. There is no other sport where one crawls through mud and slides through sand. One is *in* a cave, but not as a swimmer is in the water. In the cave one is clasped in solid, ever changing walls of stone that provide variegated patterns of visual and tactual delight. Caving can be almost totally sensual.[32]

Adventure grants its player the caver's quasi-mystical relationship to the nonhuman environment, bringing her into meaningful proximity with often overlooked inorganic actors and the humbling scale of geologic time.

This is not to deny *Adventure* its share of literary excellence. According to Dennis G. Jerz, a recent chronicler of Crowther's work, "'Adventure' succeeds in large part due to the depth and realism of the scenery, which is rendered in concise prose that calls interesting details to the reader's attention, yet leaves much to the imagination."[33] The economy of *Adventure*'s language allows for both the game's ecomimetic properties and its captivating ambiguity. As if to underscore this point, the most cited areas of the game seem to be its two labyrinths, which owe much of their lasting impression to their rendering in words. Nick Montfort, for instance, borrowed the title of his 2005 book on interactive fiction, *Twisty Little Passages*, from this delightfully cryptic line:[34]

YOU ARE IN A MAZE OF TWISTY LITTLE PASSAGES, ALL ALIKE.

In one of the two mazes, this phrase appears but rearranges itself slightly at every turn, enabling attentive readers to determine the way out; in the other, the phrase never changes. Here the game casts the player into a featureless labyrinth of stone and language, in a brilliant play on the double sense of "passages" as both literary and geologic constructs, and it is not at all clear which aspect is the more maddening.

Adventure not only returns us to a time when games were unabashedly textual (sophisticated computer graphics do not necessarily immersive games make), but also offers us a new model for Morton's concept of ecomimesis. Demonstrating at times both the spare elegance of poetry and the resolute matter-of-factness of prose, the text of *Adventure* generates the kind of "poetics of

ambience" that Morton describes as "a sense of a circumambient, or surrounding, *world* [...] something material and physical, though somewhat intangible, as if space itself had a material aspect."[35] *Adventure* is also an example of what Henry Jenkins calls "environmental storytelling", but as a text game, it is not simply an inferior precursor to the kinds of lush, visual environments offered by modern games.[36] Text games remind us that game worlds are not just substitutive or compensatory simulations, but also evocative spaces in their own right.

Greening the Game Walkthrough

Though game design and game studies anthologies have often acknowledged *Adventure*'s importance in the genealogy of both computer games and interactive fiction, most have downplayed the game's unusual relationship to the Mammoth Caves in Kentucky. However, in an unconventional 2005 article in *Digital Humanities Quarterly*, Jerz not only recovers and analyzes the game's original source code, comparing Crowther's version with the one Woods amended, but also embarks on an expedition to Kentucky to assess the accuracy of the game's environmental descriptions. Aided by members of the Cave Research Foundation, Jerz takes pictures as he and his guides descend into the Bedquilt region of Mammoth Cave National Park. As Jerz was aware, the extensive lore around *Adventure* includes numerous testimonials from avid *Adventure* players who, upon visiting the real cave system, were purportedly able to use their detailed knowledge of the game to navigate underground. While Jerz seems to rely less on his familiarity with the game than on his human companions, he does seek out and document a lengthy series of game referents. The result is an annotated "photographic walkthrough," images from the real cave system captioned with the corresponding lines of textual description from *Adventure*. Less interesting is the matter of *Adventure*'s physical accuracy; rather, Jerz's journey playfully suggests that established notions of game scholarship can be expanded to include more ecocritical concerns, while offering a new, more flexible methodology for approaching game environments—the walkthrough.

Walkthroughs, in common parlance, conjure pedestrian images of real estate tours, theater rehearsals, or airy passageways between buildings. In the world of video games, however, the term "walkthrough" has come to mean a kind of "how-to" guide authored by experienced players for the purpose of guiding novice players through difficult game material. Most often textual, sometimes these walkthroughs also include player-generated maps, screenshots, or lines excerpted from the games themselves. In addition, game walkthroughs typically adopt the second person, addressing the reader with the familiar "you" and thus echoing the present-tense affectation of ecomimetic writing.[37] Jerz's deliberate conflation of multiple *Adventures*—game, text, and environment—implies that sometimes turning a literal face to the worlds of game fantasy can produce significant exchanges. Walkthroughs need not remain confined to any single realm of experience, and game environments cannot consider themselves impervious to correspondence with real-world environments, whether they are based on known places or not.

Again, Morton's *Ecology Without Nature* proves a productive starting point for considering game environments as more than artificially isolated, ludic spaces. Though Morton focuses on the need to do away with the idea of nature and to recognize ecomimesis as only natural-seeming, drawing from the realm of art in its attempt to convey environments unadulterated by linguistic mediation, he also reserves some skepticism for what he calls the "supposedly antinatural bliss of sheer textuality".[38] While some might argue that a text game like *Adventure* lies at an even greater remove from the natural world than text penned or printed on paper, that its environments are doubly mediated by language and code, Morton's hesitations suggest that *Adventure* is not the less ecomimetic for all its computational permutations. Tellingly, many of the terms that Morton turns to

in his desire to outline the ecomimetic project are redolent of the discourses surrounding digital media—ecomimesis brings us "into a shared, virtual present time of reading and narrating",[39] and Morton acknowledges "the significance of multimedia in general, and synesthesia in particular, in inspiring the notion of an ambient poetics," two aspects of which are "rendering" and "the medial".[40]

Morton seems to recognize a natural affinity between the virtual and the ecological, though in an oddly limited way. His concept of the virtual is tied to the outdated notion of virtual reality, a set of technologies and a concept that has long been set aside as the product of an overzealous technological utopianism and the same historical conditions that gave rise to the furor over hypertext literature and talking robots. So, when Morton points to the "surprising connections between the imminent ecological catastrophe and the emergence of virtual reality,"[41] what he really means is that both experiences are "immersive," threatening to do away with distance or reference, mixing the inside and outside. However, he is at pains to remind us that the disorientation caused by the ecological is of far more import, because it entails real-world consequences. Should life continue on solely in virtual reality, the result would be "psychotic." Thus, virtual reality for Morton seems to be a convenient if stereotyped point for comparison, which does little to recognize not only the kinds of technologies present in today's games and digital worlds but also ignores many years of increasingly subtle thinking about these worlds and the kinds of "realities" they present. For Morton, virtual reality cannot help but produce the experience of anxiety—How do we know if this is real? Where does the real end and the virtual begin?—questions that reveal surprising naïveté about the actual experience of virtual worlds.

A growing cadre of academics interested in games has called the very term "virtual reality" into question, by positing the lack of a hard dividing line between its two aspects. One of these scholars, economist and emerging virtual world guru Edward Castronova, relegates the entire "virtual reality" paradigm to an appendix in his first book, *Synthetic Worlds*, seeing it as a relatively inconsequential phase of technical development tangential to the kinds of player experiences found in massively multiplayer online games. Castronova uses the metaphor of the permeable membrane to describe the easy passage between the real and the virtual, and his paramount examples are economic—for instance, the sale of virtual items and currency for real-world money. A wide range of research in the social sciences and humanities supports the observation that players do not experience virtual worlds as separate realities: Constance Steinkuehler, Nick Yee, James Paul Gee, and Mia Consalvo, among others, point to games as extensive environments for learning and social bonding; anthropologist Bonnie Nardi describes play in a game like *World of Warcraft* as active aesthetic experience, in terms originally set forth by philosopher John Dewey and activity theorist Alexei Leontiev; and in the essay "'Complete Freedom of Movement': Video Games as Gendered Play Spaces," Henry Jenkins has argued that "video games constitute virtual play spaces which allow home-bound children [...] to extend their reach, to explore, manipulate, and interact with a more diverse range of imaginary places than constitute the often drab, predictable, and overly familiar spaces of their everyday lives."[42] In a conclusion particularly relevant to ecocritical concerns, Jenkins credits video games as compensating for the loss of what was already in his generation not so much "wild" land as marginal land—areas of overgrowth or undeveloped property within or between suburban enclaves that allowed unsupervised young boys to exercise their bodies as well as their imaginations. Notably, Jenkins takes a position completely counter to that of Richard Louv, whose qualms concerning electronic exclusion of the natural began this meditation.

Game environments necessarily exist somewhere between Jenkins's attractive idealization and Morton's worried skepticism. Though games might serve as a palliative for "latchkey" kids whose parents work long hours, or anyone without the means to adopt the "weekend warrior" mentality of the privileged, game environments are ultimately not the environments that players live

in. Environmental justice activists remind us of the danger of deflecting our hopes for environmental quality onto the places other than where we live—whether those are national parks, wildlife sanctuaries, or compelling virtual realities. At the same time, games have always been subject to accusations of escapism, and with Lisa Nakamura's description of online identity tourism in mind, we might advise ourselves of the dangers of virtual environmental tourism: pleasant abstraction from actual environmental realities in need of our conscious attention and intervention.[43] Nevertheless, given that game and related equipment sales generated almost 25 billion dollars of revenue in 2011, we cannot turn a blind eye to the kinds of game environments that are being produced and played.[44]

Games as Environmental Texts: thatgamecompany's *Flower*

> Things don't have purposes, as if the universe were a machine, where every part has a useful function. What's the function of a galaxy? I don't know if our life has a purpose and I don't see that it matters. What does matter is that we're a part. Like a thread in a cloth or a grass-blade in a field. It is and we are. What we do is like wind blowing on the grass.
>
> George Orr, from Ursula K. Le Guin's
> *The Lathe of Heaven*[45]

Most games oblige players to enter into a player-environment relationship based almost wholly on extraction and utilization of natural resources, often effectively infinite.[46] The few that dare to contemplate alternate schemas merit closer inspection, among them thatgamecompany's *Flower* (2009), available as a download on the PlayStation Network.[47] This lyrical, largely meditative game begins with images suggestive of urban ennui—a forlorn, potted flower drooping on an apartment windowsill, a brief cutscene portraying a breathless summer day in the city—but quickly expands into the imaginative realms of vegetal plenitude. Selecting the wilting flower carries you into *Flower*'s first level, a landscape of verdant hills and distant cliffs in which every blade of grass is lovingly rendered and curving lines of unopened flowers beckon you onward. You soon notice, however, that each level of *Flower* begins in an environment that is somehow marred or drained of its full vibrancy, marked, say, by swaths of withered grass, defunct machinery, or collapsed structures. Alighting on or brushing past unopened flowers causes them to bloom and effectively rejuvenates the surrounding landscape, infusing its moribund aspects with a mysterious natural energy.

Figure 1.7. A windswept hillside in thatgamecompany's *Flower*.[48]

Already, *Flower* seems well poised to fulfill Lawrence Buell's criteria for an "environmental text", presented in *The Environmental Imagination*.[49] For Buell, an "environmentally oriented work" is one in which:

1. The nonhuman environment is present not merely as a framing device but as a presence that begins to suggest that human history is implicated in natural history.
2. The human interest is not understood to be the only legitimate interest.
3. Human accountability to the environment is part of the text's ethical orientation.
4. Some sense of the environment as a process rather than as a constant or given is at least implicit in the text.[50]

Above all, the ideal environmental text produces involvement. It brings the nonhuman world into equal prominence with the human, exposes humanity's moral responsibility to and participation in the natural world, and portrays the environment as fluid process, not static representation. While not all games can satisfy all of these criteria, games seem especially well suited to the last—they are, after all, inherently processual, requiring rule-based, procedural interaction between a player or players and multiple environments. In theory, games could use their ability to model environmental change to bring the first three criteria into play in instructive ways, for instance by tying environmental change to player action or inaction.

At first glance, *Flower* appears inclined to discard the human entirely in favor of the nonhuman. While human presence and activity are often suggested, they are never directly seen, unfolding instead through abstract and disconnected images of city life. Accordingly, each level begins with a telling inversion of typical game "cutscenes," moments in which games usually showcase their most refined animation via photorealistic glimpses into key characters' lives and dramatic episodes. In contrast, *Flower*'s cutscenes are conspicuous with the absence of the human, shifting priority to the environment and establishing an elegiac tone that reads as a grim warning about urban anomie. Moreover, many of the game's reviewers have suggested that *Flower*'s levels represent the daydreams (and later nightmares) of house plants—a quirky idea corroborated by the designers' decision to have the player essentially "play" wind, using the controller's SIXAXIS™

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motion-sensing technology to navigate through the given landscapes, visiting unopened flowers like some kind of spiritual pollinator and causing them to bloom. While most games offer players human or at least humanoid avatars, *Flower* destabilizes not only player corporeality but also player agency and perspective. Each level is an invitation to inhabit a nonhuman consciousness, and as a gust of wind you are essentially invisible except *through* your effects on the environment (the wake left by coursing through tall grasses) or as the intangible suspension of multicolored flower petals gathered throughout each level. The result is not lack of embodiment so much as amorphous embodiment, as the game offers several forms of interaction feedback: the controller responds to the rotation of your hands and wrists and gently shakes at appropriate times (haptic feedback via DualShock technology), and the game's elegant sound design features only music, the sound of wind, and the tonal notes triggered by coursing over and through flower nodes. A successful run of a line or group of flowers achieves a satisfying burst of sound, and while the sunnier levels employ bright, melodic tones, the darker, more disturbing levels turn to atonality in a subtly unsettling way.

This geographic transition from city studio to country meadow is at the same time a liberating spatial transition from flat, pictorial representation to ambient immersion. Movement formerly restricted to two axes transforms into navigable space that extends out in all directions, as the game encourages you to shed your sense of terrestrial bounding in favor of birdlike swoops and skims. *Flower* melds almost photorealistic environmental detail with patently imagined elements—minimalist flowers in neon blue, pink, and yellow hues, panoramic expanses expressive of both painting and cinematic animation. *Flower* celebrates broad, open landscapes, sensations of weightlessness and speed.

However, while *Flower* might seem at first glance an easy read as a condemnation of urban blight and human encroachment on a pristine natural world, many of the levels explicitly address the player's powers to ameliorate human damage or even return life to human inventions in an encouraging way. In several levels, your actions set defunct windmills to turning, or restore power to electrical lines (evidenced by lights strung along them), or create bioluminescent haystacks; in others, you weave your way through twisted electrified metal, gently opening ghostly white flowers that render the wreckage harmless. Far from condemning human intervention, *Flower* attempts to bridge the country and the city through the player's experiential journey. Both daydream and nightmare, *Flower* brings to life both faces of environmental thinking as described by Morton in *The Ecological Thought*: the sunny optimism characteristic of "green" marketing as well as the dark underbelly of waste, despair, and the emptiness of space—the abject realities of our existence on planet earth.[51] Like *Adventure*, *Flower* embodies a fascination with the unlit spaces beneath the surface of everyday life.

Unlike *Adventure*, *Flower* is visually quite stunning, but like *Adventure*, *Flower* foregrounds natural environments as constitutive of, rather than supplementary to, gameplay. *Flower* directs our attention to a nonhuman world on the margins of human society; progress is tied to visitation and restoration rather than exploitation and strife in a self-paced, lyrical set of stages that has led some traditional gamers to decry the lack of firearms and buxom women while others, including Sony executives, see the vanguard of "Zen" gaming (for most Americans, this seems to be shorthand for a kind of hippie meditative experience, but it would be interesting to pursue the similarities in Zen Buddhist art and aesthetics, with its experiential focus and emphasis on natural subjects, and *Flower*'s aesthetics).

Though *Flower*'s landscapes are somewhat generic, despite Chen having taken his inspiration from the windmill-blanketed hills of California, and the game is far from being biologically or ecologically accurate (the flowers are all of one kind, and leafless), the game should be celebrated for its careful decentering of human agency and its unusual lyricism, which invite both aesthetic joy and conscious reflection on the environment. Chen's games demonstrate that games are not just

technical but also emotional experiences; games generate anticipation, pleasure, anger, the thrills of fear and engagement, and even sadness. Neuroscientist Antonio Damasio usefully reminds us that emotions are not mere decoration over the base functionality of an organism, but rather part of our congenital toolkit to navigate and respond to our environment: "Emotions provide a natural means for the brain and mind to evaluate the environment within and around the organism, and respond accordingly and adaptively."[52] Moreover, that environment need not be the "real" one that surrounds us in physical, natural space.[53] An "emotionally competent stimulus" can be "a certain object or situation actually present or recalled from memory".[54] To support this conclusion, Damasio unearths Spinoza's statement that "A man is as much affected pleasurably or painfully by the image of a thing past or future, as by the image of a thing present," from *The Ethics*, Part III, Proposition 28. Spinoza's proposition adds a new temporal dimension to our consideration of game environments—the future—as well as the language of the "image." This is key to the power of games as affective environments, particularly those concerned with environmental futures ranging from Edenic, peaceable kingdoms to ecological disaster.

Spinoza's writing and Damasio's research suggest that games are not hermetically sealed objects or environments, divorced from "real life" and the range of emotions and experiences we experience there. In addition, emotion becomes part of the player or user's learned and genetically predisposed tools for navigating virtual environments. Just as coming upon a wild bear or precipice might trigger the emotion of fear and the corresponding complex of mental and physiological responses—elevated heart rate, a surge of adrenaline, a nervous sweat, heightened senses—so might rounding a corner in *Half-Life* and encountering a legion of undead zombie scientists provoke the same fright. The emotions experienced by gamers also need not be limited to these more dramatic examples. Games like *Flower* deliberately set out to expand the emotional spectrum of games, and furthermore, to create complexes of emotions, sometimes contradictory, often subtle, that realistically reflect the conundrums of everyday life—awe and terror, bittersweet joy, poignancy and levity. One of Damasio's statements could very well be a description of Chen's games: "If anything in our existence can be revelatory of our simultaneous smallness and greatness, feelings are."[55]

Games are no doubt assemblages of computational processes, an approach emphasized by Ian Bogost and Noah Wardrip-Fruin, but games are also emotional constructs with historical underpinnings, something akin to what Raymond Williams calls "structures of feeling" throughout his work. While both *Adventure* and *Flower* literally depict natural scenes, that is not sufficient to qualify them as environmental texts. What is also needed is a design attitude that somehow decenters or displaces the human agent, calls attention to the environment as more than mere staging, and introduces gameplay mechanics beyond gross assault and exploitation.

Why Moore's Law Doesn't Matter[56]

While most of the game industry for the past thirty or more years has been tied to the notion that better games demand higher quality graphics, lifelike settings and characters that approach the real, a few have begun to question this paradigm, among them designers aware of Japanese roboticist Masahiro Mori's notion of the uncanny valley,[57] and *New York Times* writer Edward Rothstein, who in 2002 penned the column "Realism May Be Taking the Fun Out of Games." While Rothstein acknowledges that "One of the major goals of video game systems has been to simulate the real, to create images so lifelike, and movements so natural that there is no sense of artifice," he also notes a curiously anti-technological streak in many of the games developed for recent generations of home gaming consoles. He gives as an example Nintendo's game *Pikmin*, which begins with the crash-landing on a distant planet of the player's spaceship, which can only be reassembled with the help of

the planet's ambiguously vegetal-animal creatures known as Pikmin. For Rothstein, *Pikmin* and other titles demonstrate "a tension in the video game universe: technological powers are courted for their possibilities and resisted for their fetishistic demands." Ultimately, he posits a spectrum between games that leverage the increased realism offered by more powerful processors and graphics engines—fighting games, racing games, and shoot 'em ups—and more "abstract" games like puzzle and mystery games that rely less on visuals than the satisfactions of exploring an at first unknown and complex set of rules. While *Adventure* would presumably fall on the latter end of this spectrum and *Flower* on the former, I think ceding so much representational ground to the pyrotechnics of visual display may be a mistake.

Castronova seems to agree with Rothstein on at least one point, concluding that "Great graphics are neither necessary nor sufficient for a successful synthetic world."[58] Noting that the majority of massively multiplayer online role-playing games are medieval in theme, Castronova jokes that there can be such a thing as too much realism—after all, what player would want the disease and filth and stench of real medieval cities in their game? Rather (and this is the way we prefer it, according to Castronova):

> All in all, the synthetic environment looks rather like a very nice painting. Even a dull painting would have been sufficient, but nevertheless, the painting is getting better and better every year.[59]

Some might read this as evidence of the malaise of urban modernity and nostalgia for a sanitized, pre-industrial past, however Castronova suggests that immersion does not spring from verisimilitude, but rather from "selective fidelity" to real details ("selective fidelity" is a term apparently coined in the 1980s by a colonel in the U.S. Department of Defense, who was tasked with building a tank-simulation game). Thus, Castronova's belief about game worlds is reminiscent of Roland Barthes's description of the "reality effect" in literary discourse as the product less of exhaustive detail than telling detail.[60]

This productive decoupling of "immersion" from graphics reminds us that realism is never purely the domain of the visual, and that immersion requires little more than the "magic circle"[61] provided by games or game-like scenarios. Early role-playing games, now quaintly referred to as "paper-and-pencil" or "tabletop" games, were conducted entirely face-to-face, using paper, writing implements, dice, and little else. Galloway has also usefully approached game realism from the standpoint of "social realism," whereby one evaluates a game's realism in terms of the conformity between the game world and the player's social, political, and other lived contexts. His primary example involves comparing the experience of a young Palestinian boy playing a Hizbullah-sponsored first-person shooter versus the American military's recruiting game *America's Army*.[62] In the former case, the game succeeds at being realistic; in the latter case, realism cannot be achieved due to the enforced American surrogacy. What matters here for a game like *Adventure* is the unhitching of realism from crisp visual detail and other forms of postmillennial game design—polygon count (higher numbers mean less jagged edges), texture mapping (the lieutenant's suit looks like real wool), and haptic feedback (the controller shakes when you fire a gun) matter little on this account. As Microsoft, Sony, and Nintendo all move to game consoles featuring body mapping, voice recognition, and motion-sensitive control, in the ever-present quest to break down the walls between artifice and reality, one wonders whether all that research and development is really necessary. Both *Adventure* and *Flower* are examples of environmental realism (though *Flower* is more accurately called a form of environmental idealism), the first for its descriptive texture and navigational structure, the second for its emphasis on the nonhuman and environmental interaction. They are realistic without being real.

Should it matter whether or not a text-based game like *Adventure* was based on a real system of caves? Crowther did not intend his textual descriptions to serve what Morton calls one of the primary roles of ecomimesis—that of "authentication"—seeing as the vast majority of *Adventure* players were not cavers but gamers, and had never visited or planned to visit the Mammoth Caves. Similarly, would *Flower* be any less compelling should we know that its environment was based on an imaginary topography, something created from whole cloth and unverifiable by direct experience? Designers might understandably loath subjecting game design to the strictures of physical laws and environments known to our universe, seeing them as fetters to truly imaginative world-building. Nonetheless, it is tempting to see the environmental realism present in *Adventure* and *Flower* as the basis for a defense of video games. So much of anti-game rhetoric that takes the form of concern over children's time spent sequestered indoors ("Why are you playing games in here when you could be playing *outside*?") seems to follow the pattern of attacks on the ecocritical project ("Why write about the environment when you could just go outside?"). The same flaws characterize both avenues of questioning: not only the positing of a falsely limiting either/or but also the not altogether ridiculous supposition that the only way to experience nature is to be exposed to the elements. Though in radically different ways, Buell and Morton both remind us why we should bother to create literature and art (and games) that portray people's relationship to their environments. Rather than seeing this as introducing a barrier to understanding, we can see the particular realization of an environment—whether textual, visual, or procedural—as a filter that helpfully selects certain aspects for consideration while excluding others, not unlike Max Black's description of the function of metaphor in language. As Andy Clark argues in *Natural Born Cyborgs*, what distinguishes humans is not so much some sort of innate genius but rather their capacity to use tools and their environment to complement and extend their otherwise limited powers of reasoning:

> For what is special about human brains, and what best explains the distinctive features of human intelligence, is precisely their ability to enter into deep and complex relationships with nonbiological constructs, props, and aids.[63]

Replacing the Cartesian mind-body problem with what he calls the "mind-body-*scaffolding* problem",[64] Clark uses the by now culturally current figure of the cyborg to argue that humans have always been cyborgs in some way, or at least since the development of tools and language.

Acknowledging the ecomimetic properties of games, and games as environmental texts, might begin to erode the oft-posited but little-experienced divisions between the real and the virtual, the ecological and the literary, the visual and the textual. Like literary texts or artworks, games allow for a range of interpretation, but importantly, through active, exploratory play. Games offer environments that are not stable, but shifting, that react to player input, and both *Flower* and *Adventure* demonstrate that those reactions need not be of a purely instrumental kind. Having begun with game environments that invite affective and ethical engagement, we move now to another set of relations that games are predisposed to make accessible—perception and behavior adjustment across levels of magnitude.

Chapter 2
SCALAR ENVIRONMENTS

Given the recent scholarly and industry excitement over "big data"—a new name for established practices once less euphemistically called data mining and database supercomputing—a handful of social scientists and Internet gurus like danah boyd, Kate Crawford, and Mary Gray have questioned the drive toward ever more effective and comprehensive forms of consumer tracking and marketing. boyd and Crawford observe that "Big Data tempts some researchers to believe that they can see everything at a 30,000-foot view. It is the kind of data that encourages the practice of apophenia: seeing patterns where none actually exist,"[1] while Gray argues that even terabytes of data are not, in and of themselves, enough to understand human preferences and behavior within lived contexts; the anthropologist must continue to perform ethnographic research, which takes its subjects at the everyday level and tries to understand them as part of their social and environmental milieux.[2]

At first glance, digital games might seem squarely on the side of big data, susceptible as they are to description and promotion using the language of industry standards. But games possess an innately playful mandate, one that allows for what Galloway has called "countergaming," Mary Flanagan has marked as "radical play," and Rita Raley, Geert Lovink, David Garcia, and others have designated as a "tactical" use of media. (Unfortunately, this also opens games up to less benign "gamification" purposes, as I will discuss in Chapter 4). Unlike the majority of "big data" projects, games place the responsibility for data gathering and interpretation in players' hands, and games that foreground the distortions and constraints that result from aggregating or atomizing information can yield important environmental insight. While I use the term "data" here loosely, every game in essence turns its player into a field scientist, motivated to determine what information is significant and where patterns do exist, combining automation with interaction in a less rigid and contextually evacuated manner.

More than any other game designer, Will Wright's work exemplifies these claims regarding games' ability to dramatize (and perhaps ultimately humanize) the exploitation of scale. What follows is therefore a highly selective consideration of Wright's oeuvre, particularly the game *Spore*, which augments the previous chapter's comparison of games to literary texts by placing games alongside parallel developments in the still and moving image and the history of scientific visualization.

"Your Personal Universe in a Box"

Tired of your planet? Build a new one as you embark on the most amazing journey ever.
Spore packaging

Figure 2.1. Life as an ocean microorganism, during *Spore*'s first game stage (the cell). Author screenshot.

Developed by game luminary Will Wright and the studio Maxis, and published by Electronic Arts (EA), *Spore* (2008) was eagerly anticipated by both critics and players alike over the course of its three-year long development.[3] Long before its full release, *Spore* was widely touted as one of the most ambitious undertakings in the history of video games (by reviewers at *Time*, *Forbes*, the game site IGN.com, and so on), and the game owed much of its anticipatory buzz to its purported melding of innovative gameplay and scientific know-how. Though it tacitly tackles a wide range of scientific topics ranging from ecological succession to astrobiology, *Spore* is most prominently associated with evolution. *Forbes* contributor Mary Jane Irwin, for instance, has described the game as "a guided tour of evolution that allows players to witness how their decisions might impact the entire development of a species on a physical and societal scale."[4] Given the marketing claims that accompanied it, then, as well as its actual design, as will be seen, *Spore* invites both overt environmental analysis as well as a more subtle consideration of its own internal ecological logics.

Historically speaking, *Spore* represents the culmination of nearly two decades of Wright's work in the game industry, most of it on the *Sim* series, of which *SimCity* and *The Sims* and their various expansions are probably the best known. Taken altogether, the *Sim* games already suggest something of Wright's broad-ranging fascination with environmental modeling, in their unresolved tension between an emphasis on environmental or biocentric concerns—how to manage a planet, an

ant colony, an urban landscape—and an equal anthropocentric fascination with how the agents within those landscapes, who over time became less drones and workers in favor of idiosyncratic individualism, carry out their lives within their environments. Visually speaking, the various *Sim* games also represent different points on a scale of magnification, from the global perspective of *SimEarth* (1990) and the metropolitan perspective of *SimCity* (1989) to the neighborhoods and single-family dwellings of *The Sims* (2000-present) and the backyard dirt colonies of *SimAnt* (1991).

  Spore's clearest predecessor in the *Sim* franchise is *SimEarth: The Living Planet*. While *SimEarth* is a much more explicitly scientific exercise, resembling less a game than environmental forecasting software, many of *SimEarth*'s elements are retained in the noticeably more lighthearted and graphically sophisticated *Spore*. In *SimEarth*, players are invited to run multiple scenarios, from open-ended evolutionary experiments to the theoretically pre-scripted "Daisyworld" paradigm proposed by Andrew Watson and James Lovelock, the originator of the Gaia hypothesis. Lovelock's Gaia hypothesis posited that the world and its inorganic and organic actors form a holistic, self-regulating entity greater than the sum of its parts, while the subsequent daisyworld theoretical models attempted to provide support for the Gaia hypothesis by demonstrating that the population behavior of living species (in this case, black or white daisies with different albedos, or reflective properties) could explain the planet's apparent ability to regulate its own atmospheric and surface temperatures in response to varying solar luminosity.[5]
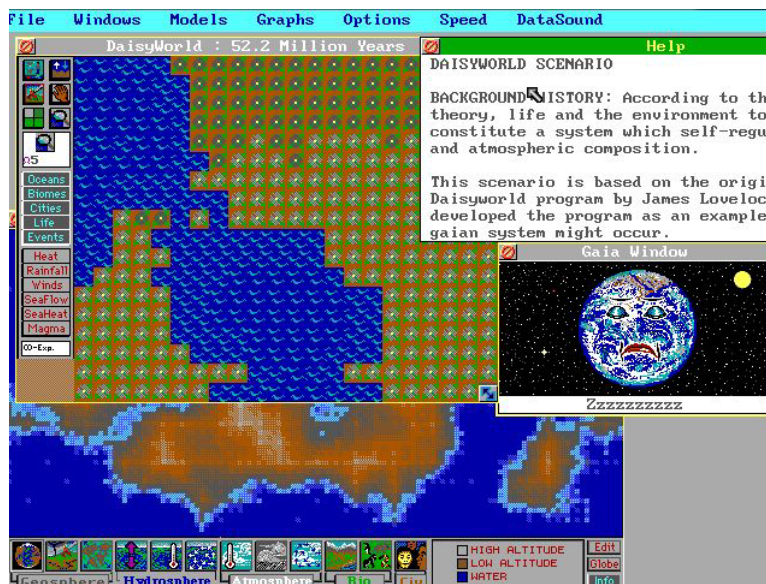
Figure 2.2. The Daisyworld scenario made playable in *SimEarth*. Author screenshot.

In all of its potential playable iterations, however, *SimEarth* includes the ability to manipulate geospheric, atmospheric, and biospheric processes, as well as energy investments and allocations in the player's civilization, should he/she develop one. The game also charts, via innumerable bar graphs, any given world's changing distribution of biomes, life classes (species of life-forms), atmospheric components, and technologies. Each aspect displays in its own window, so the *SimEarth* desktop can quickly grow cluttered with images that would be equally comfortable in an environmental science textbook. Depending on the player's preference, game scenarios may begin as far back as Earth's Cambrian era, approximately 550 million years ago, or as recent as "modern Earth" (circa 1990), but players may also choose other planets. In its freeform willingness to allow players to experiment with the evolution of life and culture on Earth and elsewhere, *SimEarth*

prefigures *Spore*, particularly in its cheeky reminder to players that the civilizations that evolve need not even be composed of humans.

Graced with all the computational and graphical advantages of the intervening nearly twenty years, *Spore* revels in an unprecedented level of virtual ecological detail and offers five stages, each of increasing complexity. Players develop from unicellular organisms adrift in the primordial soup of an alien ocean to land-based creatures that eventually pursue social organization, progressing from primitive tribal communities to acquisitive city-states to sophisticated spacefaring civilizations. Despite this teleology, however, players and scientists quickly realized after the game's much heralded release that *Spore* had fallen short of advertised marks in both its gameplay and its science. GameSpot associate editor Kevin VanOrd spoke for many when he delivered the following lukewarm review:

> Spore isn't as much a deep game as it is a broad one, culling elements from multiple genres and stripping them down to their simplest forms. By themselves, these elements aren't very remarkable; but within the context of a single, sprawling journey, they complement each other nicely and deliver a myriad of delights.[6]

Meanwhile, *Science* magazine's John Bohannon called the game a massive disappointment in terms of its potential for science education, even after granting that its primary aim was to please rather than inform. After playing *Spore* with a team of scientists to evaluate its scientific merits, Bohannon ultimately flunked the game, lamenting that it got "most of biology badly, needlessly, and often bizarrely wrong," particularly in its treatment of evolution. Two of the scientists who helped to assess the game, evolutionary biologists Ryan Gregory and Niles Eldredge, similarly concluded that "Spore is essentially a very impressive, entertaining, and elaborate Mr. Potato Head that uses the language of evolution but none of the major principles."[7]

For science-minded critics, perhaps first and foremost among *Spore*'s many evolutionary inaccuracies is the complete lack of consequence for player death. Should you get chomped to bits by a hungry carnivore or blown up by a hostile alien spacecraft—fairly likely scenarios as you learn to maneuver whatever fantastic creature you've produced and hatched—you magically re-emerge from your nest or your home planet without penalties of any kind. This kindhearted policy may gratify EA's legions of casual players, but it is a questionable application of the theory of natural selection. What's more, during the cell and creature levels of the game, evolutionary adaptations are not the products of gradual change over generations of descent, but rather may be found while searching terrain or defeating other creatures, then applied at one's convenience. To alter your creature's appearance and/or physical capabilities, for instance by adding a faster set of legs or poison-emitting defensive glands, all you need to do is click the interface's "Call a Mate" button to initiate reproduction. Having partnered off with an identical mate of your species, you enter *Spore*'s Creature Creator, which allows you to select the characteristics you would like your offspring (and future playable self) to possess. As if the product of alien (or player) abduction, the newborn enters the world without noticeable delay, oftentimes completely transfigured, and at the same time all members of your species have "evolved" to mimic the new template. Evidently, *Spore*'s much touted version of evolution is, in fact, closer to the long discredited theory of Lamarckian evolution (in which an individual organism can develop and pass on adaptations during its lifetime) or evolution's creationist-tending nemesis, intelligent design (where players are the universe's unseen architects), than it is to Darwinian evolution or the more recent theory of punctuated equilibrium, as proposed by Stephen Jay Gould and Niles Eldredge (the latter notably one of *Spore*'s aforementioned reviewers at *Science*).

In the eyes of scientists, *Spore* deploys evolution primarily as a marketing gimmick; the theories of genetic succession are less the guiding force for actual game mechanics than rhetorical trimming around the digital dollhouse play for which Wright has become famous. The logic of immediate customization inherent to *Spore*'s Creature Creator is noticeably at odds with the protracted, random nature of real evolution. However, in comparing *Spore* to a glorified Mr. Potato Head, Gregory and Eldredge nevertheless acknowledge the creativity and technical genius behind the Creature Creator, arguably the game's best feature. The software for the Creature Creator was actually released free of charge several months before the game itself so players could explore its functionality and begin lovingly crafting their future animal avatars.[8] In *Spore*, the Creature Creator lets you design the species whose destiny you steer, offering a cartoonish assortment of basic body parts—eyes, snouts, limbs, "hands" (talons, claws, pincers, etc.), and "feet" (paws, hooves, etc.)—as well as colorful skin textures and later a decorative medley of tribal feathers, masks, hats, and bags. Though some are purely cosmetic, most of these appendages and accessories affect your creature's defensive and offensive skills, its speed, and its charisma, allowing you to specialize as a bellicose carnivore, a peace-loving herbivore, or an opportunistic omnivore. One could easily spend hours within the Creature Creator, shaping one's image of the ideal species—it is a feature, or a sub-game, that threatens to render the rest of the game a mere showcase for the well-crafted avatar.

On the one hand, *Spore* and its quirky Creature Creator represent the logical culmination of Wright's many years as a game designer, building open-ended sandbox games like *SimEarth* and immensely popular virtual dollhouses like *The Sims*. On the other hand, *Spore* still exerts conspicuous limitations on both player creativity and biological mutation—in particular, in its bias towards terrestrial vertebrates and bilateral symmetry. Players evolving their species from stage one to stage two, that is, from cell to creature, cannot benefit from certain adaptations unless they attach legs to their former microbial selves. Players also cannot create and play flying or aquatic animals, invertebrates, and non-animal species like plants; instead, Maxis generates *Spore*'s entire flora. In this way, *Spore* could be said to recapitulate some of the sorrier assumptions of our current ecological frame of mind, in which humans reign supreme, followed by charismatic megafauna, with the rest of the animal, plant, and inorganic matter of the world forming a picturesque backdrop without recognizable agency.

Beyond the Creature Creator and its unspoken rationale, *Spore*'s environmental mechanics (by which I mean game actions involving the game environment) are also fairly limited, simplifying the complexity of actual species interaction to the point of potential caricature. Beginning the game as a lowly cell, you are immediately confronted with a far-reaching choice of dietary regimes—become an herbivore and you will ingest phytoplankton through a tentacle-ringed orifice, or opt for carnivorousness and your cell will be equipped with a jagged beak for tearing into other animalcules. This initial decision regarding food preference translates into a basic fight-or-socialize dichotomy later in the game. Thus, as a creature you can choose to battle other species into submission by charging, biting, and sneaking, or instead woo them to your side by posing, dancing, and singing. During the tribal phase, again you can either conquer other tribes by military might or social prowess, which in this stage means presenting food as gifts and performing with primitive musical instruments. The civilization phase, which, as many have noted, is a pared-down version of a real-time strategy (RTS) game, allows for a slight expansion of winning methods: your species can take over the planet using trade (economy), alliances (diplomacy), or faith-based conversion (religion).

Figure 2.3. Flying a spaceship around a planet during *Spore*'s final game stage (space). Author screenshot.

For some, the final space stage is the most scientifically accurate of the five, though scientists themselves disagree over the likelihood of encountering intelligent life elsewhere in the universe. One standard comes from astronomer Frank Drake, who formulated the Drake Equation in 1961 as part of scientific efforts in the search for extraterrestrial intelligence (SETI).[9] The equation estimates the number of intelligent, communicative civilizations we could expect to encounter in our galaxy, based on seven variables, including the rate of star formation and the expected number of habitable planets per star. Drake's current approximation of the number of communicating civilizations in our galaxy is 10,000, though we have yet to find concrete evidence of extraterrestrial intelligent life. For skeptics, then, *Spore* goes well beyond conservative estimates, with alien life to be found at almost every turn; for others, *Spore* rightly suggests the rich diversity of life awaiting us beyond the boundaries of our tiny solar system.

Beyond its take on astrobiology, *Spore*'s space stage includes curious approaches to a number of other sciences—ecology, taxonomy, meteorology and climatology, and agriculture among them. Gameplay in this phase also touches on long cherished environmental principles like ecosystem stability, sustainability, and habitat renewal. For example, one of the primary tasks of the space stage is to render environmentally challenged planetoids hospitable enough for colonization by your species, thereby enabling the expansion of your galactic empire. To raise the terraforming score of any given planet you must balance its temperature and atmospheric levels between equally hostile extremes. Not enough atmosphere? Not a problem—toss an atmosphere generator at the planet surface and watch clouds of reassuring-looking gases drift into the troposphere. Climate too chilly? Rain a toasty meteor shower down on the world or use a more sophisticated heat ray to begin a warming trend. Once these variables are satisfactorily settled, populating the planet requires only the abduction of species from other inhabited planets and a large cargo hold—using your handy tractor beam to snatch and deposit specimens, you fill any empty ecological niches with appropriate species of small, medium, and large plants, and two species of herbivore for every species of carnivore or omnivore, while settling your own colonies. In *Spore*, an ecologically complete planet requires nine distinct species of plants, six unique species of herbivore, and three unique species of carnivore/omnivore, as well as three of your people's cities. Just as players are encouraged to spend large swaths of time tweaking their species, buildings, and vehicles within the various creation

modules, they are also motivated to shuttle plant and animal species from planet to planet in order to create just the right mix of inhabitants. Yet the fact that species may be carted across the universe and are largely interchangeable so long as dietary preference or phylogenetic kingdom is observed means that *Spore* radically oversimplifies habitat considerations and interspecies dynamics, downplaying connections between organisms and between life and place in favor of blunt categorization. The interface for planetary ecology reflects this: in a style reminiscent of infant's toys, vacant plant and animal slots on each planet are represented by the empty outlines of basic shapes (circles, stars, and squares). When a player finds and delivers an appropriate species, the shapes are gratifyingly filled in—life's biological and inorganic diversity in the form of baby shape-sorting toys.

Meanwhile, *Spore*'s in-game currency has shifted from the evolution-enabling DNA points of stages one and two to the Sporebucks of stages three through five (from stage three on your creature's appearance is fixed—in other words, evolution is no longer biological but cultural). Sporebucks can be amassed via successful harvesting from your planets' "spice" vents (a seeming nod to Frank Herbert's bestselling *Dune* series), as well as through interstellar conquest, exploration, and trade. Players can also complete missions to earn money, some of which deal overtly with environmental crisis, for example, the directive "Save planet Walkne from ecological disaster!" Once alerted to such a crisis, the player must hurry to the afflicted planet and exterminate infected individuals within a given species using her spaceship's onboard laser. At another time, the player might be asked to restore balance to an ecosystem by filling in a vacant animal or plant niche in a planet's partially constructed food chain. On the one hand, these missions entreat the player to take on the mantle of environmental steward for colonized worlds as well as the more familiar roles of intrepid space explorer, military leader, and crafty diplomat; on the other hand, the espoused version of ecological care drastically oversimplifies life's complexity and threatens to perpetuate the myth that humans can exercise surgical precision in diagnosing and addressing environmental ills.

In fact, most of the space stage's command interface is devoted to matters of aesthetic preference—for instance, should you find yourself displeased by the lumpy contours of your planet or its dull sandy color, you can use special tools to level terrain, form "cute" canyons, grow crystalline mountains, or turn the sea purple, the atmosphere red, and the land cyan. Incredibly, none of these changes seems to affect life on the planet, implying at some fundamental level that cosmetic alteration and environmental health need not be mutually exclusive aims. Like the Creature Creator, which essentially equates evolution with deliberate customization in a digitally enhanced production mentality at odds with the vagaries of actual evolution, the building- and vehicle-design menus and the spaceship's planet-sculpting ability palette emphasize the malleability of matter, less its ontological essentialism than its receptivity to the expression of individual preference.

In its defense, other critics have praised *Spore* as a trendsetter, both within the game industry and in related realms of networked collaboration. In contrast to the massively multiplayer online role-playing games prevalent in recent game theory, among them Sony's *EverQuest* and Blizzard's *World of Warcraft*, Wright has touted *Spore* as the first "massively single-user" game. In other words, though the game itself follows a single-player trajectory, the creatures, plants, and structures that populate the universe one explores are drawn from the so-called Sporepedia, which amasses and makes available not only the creations of Maxis employees but also other *Spore* players. Creatively challenged or time-strapped players can peruse the Sporepedia to find and use the inventions of others, and in return, it is quite possible that their own creations will find their way into other players' games. While this content-sharing scheme promotes its share of impish pranks, from expletive-labeled species to phallus-shaped monsters, it also leads to a delightful cross-pollination of imaginative worlds. You can, of course, choose to play the game entirely offline, protecting your universe from the intrusions of other designers, but *Spore* players are encouraged upon login to play the game "online," in a mode of free exchange.

Steven Jones, who devoted the final chapter of his book, *The Meaning of Video Games*, to *Spore*'s anticipated release, has more recently suggested that the game's player-interaction and content-creation interfaces should be imitated by the digital humanities—"today's digital environments," he writes, are "potential models for digital scholarship".[10] *Spore* in particular presents a highly developed example of "[d]istributed and time-shifted content creation and content sharing":[11]

> What we can learn from a game such as *Spore* is how to imagine a research infrastructure that encourages asynchronous content-creation and -sharing by many users on different schedules, with different agendas — one that allows for the continual reediting of content objects, which can be experienced as if they existed in parallel universes but at the same time remained entangled and linked together for collaborative activity.[12]

For Jones, an improved approach to new textual scholarship lies in an emphasis on improvisation and performance within the productive restrictions offered by digital environments like the *Spore* universe. The ideal infrastructure for such activity would provide "interpretive consequences, as a set of constraints and affordances within which to perform textual meanings":[13]

> I would compare texts and video games not in terms of their supposedly shared narrative content (not in terms of their content at all, really) but formally — in terms of how they model complex systems, how they construct networked environments for the (re)production, transmission, reception, and continual reediting of their respective content-objects. In this sense, both texts and video games are best understood as systems of prompts for various possible performances.[14]

Like Jones, I believe that games can be usefully related to "texts" both in the capacious manner of poststructuralist analysis and in terms of their formal elements; this kind of unexpected melding of literary interpretation and game studies was already pursued in Chapter 1. However, while Jones's argument that "textual and digital humanities cyberinfrastructure needs to be more like games" is an important one,[15] *Spore*'s massively single-user paradigm also suggests that world creation and maintenance can be the work of both the one and the many. As I will discuss in relation to Ursula Heise's work on the frictions between local and global framings of environmental issues, *Spore*'s hybrid realization as a local (stored on the player's hard drive), single-player game with global (networked), multiplayer content models one method of bringing together the oft cited boundaries of ecological thinking.

In the end, *Spore* exerts a quirky and endearing charm, though it may set some science sticklers to muttering.[16] While game critics may have pronounced *Spore*'s overall gameplay lackluster, most found at least a few points to admire. GameSpot's VanOrd, already mentioned, echoes Jones in praising the game's creature-creation tools and the "community integration" aspect of its Sporepedia, and he also commends the game's art and audio design. Others have generously allowed that *Spore* is less a game than a "software toy," in the vein of the *Sim* games. Wright himself has called *Spore* a "philosophy toy," or a type of "Montessori toy" (influenced by his own elementary education), designed to lead younger generations to insights via self-directed investigation. What generally distinguishes a toy from a game is the lack of prescribed goals, a tolerance for idiosyncratic exploration rather than unrelenting movement toward a single, often predictable end-state. The worlds that Wright creates therefore tend to be sandboxes more than slides, open-ended systems inviting experimentation more than goal-oriented spaces centered on measurable achievement. At the same time, *Spore*, like most of Wright's games, is recognizably a "God game," meaning that

players essentially act as omnipotent beings whose every action influences the universe in which they operate. Tellingly, Wright has said that he wanted players of *Spore* to feel like George Lucas, not Luke Skywalker—that is, the architect of fantastic worlds rather than an individual within them. *Spore* reflects Wright's valorization of human agency and intentionality, giving the player an astonishing amount of leeway in shaping the game environment while reserving the position of ultimate mastermind for Wright himself. From an environmental standpoint, *Spore* models the tension between envisioning nature as either a design space or a problem space, or a place of invention and expression versus an arena fitted with recognizable troubles and solutions.

Though we may question whether or not players can usefully extrapolate real-world strategies from in-game relationships to the environment, *Spore* has the potential to stage environment and environmental crisis in productive ways, both by defamiliarizing the everyday and encouraging structured, rule-based interaction tailored toward particular realizations. In fact, *Spore* is procedural on many levels—Maxis has dubbed *Spore*'s sophisticated algorithms for animating a fantastic array of creatures "procedural animation" (the code produces the movements of an amazing variety of species using general rules concerning the shape of the creature's backbone, its amalgam of body parts, and so forth), but more importantly Wright sees *Spore* as a procedurally based simulation with powerful environmental implications. During a demo of *Spore* to TED Conference participants in March 2007, Wright used his game spaceship to pump huge amounts of carbon dioxide (CO_2) gases into one planet's atmosphere, thereby raising its ocean levels, swamping his own cities, and eventually increasing the temperature of the planet to a point where the oceans evaporated altogether and the surface burst into flame (clearly not a "winning" strategy so much as a curiosity-driven experiment). Having done this, Wright casually remarked:

> What's interesting to me about games in some sense is that I think we can take a lot of long-term dynamics and compress them into very short-term kind of experiences, because it's so hard for people to think fifty or a hundred years out, but when you can give them a toy and they can experience these long-term dynamics in just a few minutes, I think it's an entirely different kind of point of view, where we're actually mapping, using the game to remap our intuition. It's almost like in the same way that a telescope or microscope recalibrates your eyesight. I think computer simulations can recalibrate your instinct across vast scales of both space and time.[17]

In a manner reminiscent of Marshall McLuhan's contention that media act as extensions to humankind, or even anthropologists' or evolutionary biologists' emphasis on humans as tool-making animals, Wright implies that a game can act as a kind of intellectual and spatiotemporal prosthesis. A software toy like *Spore* has the power to reveal to us the dramatic consequences of our current follies—here, the overproduction of greenhouse gases that trap the heat of the sun's rays and lead to global warming.

While it might be tempting to read *Spore* as an exercise in frivolous and ultimately noncommittal play, Wright also revealed in his TED talk that he is driven by more than mere whimsy:

> [. .] basically the reason why I make toys like this is because I think if there's one difference I could possibly make in the world, that I would choose to make, it's that I would like to somehow give people just a little bit better calibration on long-term thinking, because I think most of the problems that our world is faced [sic] right now is the result of short-term thinking and the fact that it's so hard for us to think fifty, a hundred years, or a thousand years out, and I think by giving kids toys like this and letting them replay dynamics, you

know, very long-term dynamics, over the short-term, and getting some sense of what we're doing now, what it's going to be like in a hundred years, I think probably is the most effective thing I can be doing, probably, to help the world.

Though terms like "calibration" and "dynamics" smack of classic engineering discourse on equipment precision and scenario modeling, Wright is notably not just concerned with "dynamics" but "replay dynamics, you know, very long-term dynamics." In one sense, replay has been a characteristic distinctive of games for thousands of years, in that most games rely on some element of chance to stimulate repeated play—why play a game if the outcome is always the same? Modern computer and video games enshrine replay with several of their conventions, including the allotment of multiple "lives" to players, the provision of "save" points to allow players to retain their progress and make multiple attempts at difficult encounters, and optional difficulty levels (many games offer easy, medium, or hard settings, and in some, harder modes may only be accessed upon game completion).

Wright's equation of replay dynamics with long-term dynamics, however, underscores another aspect of replay—the exploration of diverse outcomes. Motivated less by chance or failure than curiosity, replay in this sense affirms the benefits of alternative thinking. A game like *Spore*, which by design has been freed from the constraint of a single "win state," opens up an ethically unencumbered space in which players can spool out countless environmental futures, from pastoral empires to admittedly morbid fantasies of ecological disaster. While there seems to be little necessary connection between the concept of replay and experiences of extended duration (one could in theory replay the same, short sequence over and over again, like a challenging level of a *Super Mario Bros.* title), Wright may have confounded the two in his eagerness to imbue *Spore* with predictive potential.

The name *Spore* is itself indicative of this expected diffusion of paths and terminuses.[18] In its biological contexts, a spore may refer to mechanism and thing, animal and plant. Spores describe reproductive and dispersive methods across multiple kingdoms in the Linnaean taxonomic system (animals, plants, fungi, protozoa, etc.), and while in zoology, a spore refers to "a very minute germ or organism," in botany the spore becomes "[o]ne of the minute reproductive bodies characteristic of flowerless plants."[19] Unlike seeds, spores carry very little in the way of nourishing resource, yet they are designed to survive for long periods of time under unfavorable conditions. The word itself derives from the Greek word σπορά, meaning "sowing, seed," a rather fitting description of the *Spore* player's ultimate role as a kind of cosmic disseminator, spreading species across a distant galaxy.

Though *Spore* clearly celebrates a certain level of indeterminacy and Wright has publicly demonstrated the game's potential to underscore environmental objectives, at times *Spore*'s approach to the difficulties of planetary stewardship lacks logical substance, verging instead on formulaic parody.[20] Here the formulas derive less from science and policy than the established genre of "god" games, within which players typically act as powerful deities and issues are often resolved via divine intervention, or *deus ex machina*. At the same time, *Spore* elides critical associations, divorcing many effects from their more likely causes. In the game, global warming, for example, is tied to the player's use of godlike technologies, not the individual and industrial consumption of oil and coal. Once begun, any warming trend can be reversed by again using your spacecraft's superior machinery, but cannot, for instance, be naturally mitigated by the growth of more CO_2 loving plants on the planet's surface. Ultimately, procedural lessons do exist in this universe, but they are schematic at best. Using weapons-grade lasers, high-tech rays, and elaborate mechanical gizmos to bludgeon a planet's climate into shape makes a mockery of the delicate "butterfly effects" espoused by chaos theoreticians, a term which describes the extremely sensitive dependence of final states on even seemingly unrelated or minor initial conditions.

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We might usefully compare *Spore*'s vision of global environmental change to that portrayed in science-fiction writer Kim Stanley Robinson's "Science in the Capital" series (*Forty Signs of Rain*, *Fifty Degrees Below*, and *Sixty Days and Counting*), which takes as its cast members of the elite scientific bureaucracy in and around Washington D.C. and at research universities around the country. Following the work of National Science Foundation employees and environmental political lobbyists, the series explores the "what if?" scenario presented by irreversible global warming, including rising sea levels, greater temperature fluctuations, and increased storm activity. The nation's capital is flooded, then alternately baked and frozen, and as civil society braces for the worst nature has to offer, the scientist heroes do their best to increase funding for science and to develop realistic alternatives for addressing climate change, for example through massive carbon sequestration enabled by the introduction of a fast-growing forest lichen. Unlike *Spore*, or for that matter, Robinson's *Mars* trilogy, solutions do not come at the other end of stupendously sophisticated technological apparatuses like orbiting solar mirrors or heat rays.[21] Instead, the scientists in the *40/50/60* trilogy consider genetically modifying a fast-growing tree lichen, marshaling the world's ocean liners to pour tons of salt into the north Atlantic ocean in an attempt to restart the stalled current, and, when all else fails, airlifting people away from drowning land masses. Much of the series is also devoted less to damage prevention than damage control, implying that *some* fallout is inevitable. In *40/50/60*, environmental crisis is not simply an ominous future, but an inescapable present—the solutions will no longer arrive via tepid political and social initiatives for hybrid cars and tankless water heaters. Robinson dares to imagine catastrophic call and response, and for him resolution is an odd admixture of technocracy, spirituality, and primitivistic, anarchic impulses.

What *Spore* perhaps does best is allow us to interact with the environment at a variety of scales. As discussed at length in the next section, Wright's design of the game was to some degree inspired by the old, educational film *Powers of Ten* and its systematic presentation of the universe. However, unlike the iterations of a purely scientific model or the preset narratives of film or science fiction, a game like *Spore* offers both repetition and difference—what gamers would call replay value—directed by the personal choices of the player. Rather than just allowing them to bear witness, Wright wanted to offer players the ability to experience and affect procedural change at scales ranging from the microscopic to the galactic.

Exponential Vision

In 1977, husband-and-wife team Charles and Ray Eames released the short film, *Powers of Ten* (a shorter sketch of the film was also released in 1968), a nine-and-a-half-minute educational journey through space and the human body that I recall watching alongside Disney's *Donald in Mathmagic Land* (1959) as a school-age child. The film uses the framing device of an expanding and contracting white square, each side determined by a power of ten, to demonstrate the differences in scale between astronomic and atomic levels of inquiry. In what is perhaps its most iconic scene, the film begins from a vantage point just a few feet above a man and woman picnicking on a blanket by Lake Michigan in Chicago.[22] Looking down at the couple, as if pinned to the airy nothingness above them, the film gradually expands out to the known boundaries of the universe (10^{24} meters), then returns at accelerated speed to the blanket, only to plunge deep into the cells of the man's resting hand. Eventually, the film reaches the inverse magnitude of 10^{-16} meters, or the scale of an individual proton.

Figure 2.4. An expanding bird's-eye view in the film *Powers of Ten*. Author screenshot.[23]

While it would be easy enough to dismiss the film as mere propaganda for the triumphal march of science, with its authoritative male narrator (the voice of physicist Philip Morrison) and obsessively tidy vision, the bulk of the film notably takes place beyond the limits of unassisted sight, venturing deep into the realms of both conceptual and pictorial speculation. As such, the film testifies not only to a centuries-old scientific desire for all-encompassing observation but also the fundamentally imaginative character of scientific epistemology. Alex Funke, an Eames Office employee and a key contributor to the 1977 film, described the production staff's creative protocol for dealing with the twin limits to knowledge and imaging as follows:

> In preparing for the film, we first sought out at every power the very best pictures available, then asked workers in that particular realm what we might see if the imaging were a hundred, a thousand times better. We had the raw material [. . .]. Then in each case *we made the imaging more than real* through adding, by hand, the details of what might (or should) be there.[24]

Like the atomic landscapes, or topographical maps, now produced by nonoptical technologies like the scanning tunneling microscope, many of the images used in *Powers of Ten* are less direct imprints of actuality than mediated constructions, or enhanced renderings of the real.[25] Thus at the macrocosmic scales, the film dissolves between artful composites of satellite and observatory photos and visualizations of data garnered outside the visible spectrum via radio, ultraviolet, and infrared astronomy; at the microcosmic scales, the film relies heavily on scanning electron and transmission electron microscopy, but also takes representational liberties—for example, the out-of-focus, frenetically vibrating clumps of pixels said to be electrons and later a proton at the interior of a nucleus were generated from colorized television static.

Historians of science Lorraine Daston and Peter Galison have described the history of scientific endeavor in visual terms, yet by emphasizing "practices of seeing, rather than theories of vision," they remind us that individual, or even instrumental objectivity, is always the product of subjective preferences—different tools and methodologies will inevitably yield different results.[26] The authors trace visual technologies across three major epochs of record-making, from hand-drawn botanical prints through increasingly powerful scopic technologies like the microscope and

telescope, all the while contending that "Making a scientific image is part of making a scientific self":[27]

> As we have seen (literally seen, in the images from scientific atlases over three centuries), to learn to observe and depict in a science is to acquire at once an ethos and a way of seeing. The same cultivated patterns of attention that single out objects in a certain way [. . .] also pattern a self.[28]

Daston and Galison are noticeably less concerned with articulating a broad critique of vision as a dissecting or dominating sense (in the vein of Martin Jay or Laura Mulvey) than with establishing the cultural and historical specificity of scientific sight. While all modes of scientific visualization may have "a common goal: [. . .] a faithful representation of nature,"[29] visualization implies selection, and selection implies the practiced judgment of scientists, technicians, and artists.

In many respects, the short history of *Powers of Ten* recapitulates the longer history outlined by Daston and Galison. Within the relatively brief span of fifty years, the film, its immediate precursor, and its various successors make evident the effects of medium and time period on scientific visualization. Any such film, made today, would not only have to cope with the increased scale of astronomical and biological observation, but would also have to contend with images of city, planet, and cell that have since proliferated and grown more fraught. While the original *Powers of Ten* is an unapologetic paean to the scientific imagination, depicting a world where couples lounge contentedly near "bustling" freeways, seemingly sandwiched between two wondrous worlds of undiscovered matter, the intervening decades have borne witness to a growing concern over environmental quality, one that would render such a film considerably more difficult to present today without serious caveats or qualifications. A modern audience presented with aerial views of Lake Michigan, Chicago highways, and the troposphere might be more likely to associate them with the invasive zebra mussel, automotive congestion, and greenhouse gases than with idyllic summer relaxation. Similarly, peering into the recesses of the cell and the atom today is likely to conjure debates over genetic modification, cloning, and nuclear energy—the common litany of post-World War anxieties over the nature and extent of scientific progress.

Furthermore, given the pace of scientific and technological innovation since the film's original release, *Powers of Ten* belongs to a now bygone era of exceptional visualization. In 1972, when astronauts on the Apollo 17 mission took some of the first pictures of our planet from outer space, one of the resulting images, "Blue Planet," became an icon of the nascent environmental movement (images of this kind were regularly used as cover art for Stewart Brand's *Whole Earth Catalog*). In that historical period, one noticeably less saturated by satellite imagery, the sight of Earth suspended in the void of space highlighted the planet's singular fragility. Since 2005, however, satellite imagery of the Google Earth™ variety has become a staple of daily media use, moving beyond government, particularly military usage, to become the quotidian basis for everything from maps and driving routes to weather and traffic monitoring. In the contemporary moment, *Powers of Ten* loses much of its initial novelty, for now anyone with a smartphone or broadband-enabled computer can replicate the film's visual maneuvering from the terrestrial to the atmospheric.

Yet *Powers of Ten* captures a pivotal moment in the history of scientific visualization, in its bypassing of traditional print media in favor of cinematic animation. While the film was itself based on a young-adult book by Kees Boeke, called *Cosmic View: The Universe in Forty Jumps*, and later served as the basis for its own volume, in the latter Eames supporters Philip and Phylis Morrison emphasize the superiority of the moving over the still image:

No visual model can convey unaided the full content of our scientific understanding, the less if it is restricted to the static. Pictures in a book mostly present a static account of the world, a limitation not imposed upon swift-flying film or videotape because of their vivid fidelity to the world of change. [. . .]. The limitation of the static image is not simply that it lacks the flow that marks our visual perception of motion: Real change in the universe is often too slow or too fast for any responses of the visual system. The deeper lack is one of content. A single take belies the manifold event.[30]

For the Morrisons, the advantages of film and its fledgling companion video derive from their capacity to present not only movement, but also change over time, leading them to conclude in this same passage that "Film and the video processes together constitute the most characteristic form of art in this changeful period of human history."

What might the Morrisons have made of *Spore*? Though the game was created some thirty years after *Powers of Ten*, it is recognizably similar in form and intent and perhaps offers yet another qualitative leap in the manner of scientific visualization. Even while trumpeting the advantages of the moving over the static image in the book version of *Powers of Ten*, the Morrisons conceded that cinematic motion is illusory, the happy byproduct of the mechanics of human perception—we conveniently perceive projected sequences of 24 still film frames per second and 30 still video frames per second as continuous. The Morrisons also acknowledged the difficulties of simultaneously representing both time and scale, even in their favored medium. In order to accentuate "the relative size of things in the universe and the effect of adding another zero" ($10^0 = 1$ meter, $10^1 = 10$ meters, $10^2 = 100$ meters, $10^3 = 1{,}000$ meters, and so on), *Powers of Ten* strung together images from a single moment in time along a linear path. *Spore*, on the other hand, permits both temporal and geographic exploration or synchronic and diachronic analysis—like the personnel at the Smithsonian American Art Museum and the National Endowment for the Humanities, whose embrace of video games began this chapter, we might begin to wonder whether the video game has become the most characteristic art form in *this* "changeful period of human history"!

To take this unorthodox thought one step further, let us propose that video games are even better suited to scientific visualization than the conventional moving, but noninteractive, image. Surprisingly, support for such a proposition may be found well outside the bailiwicks of game scholars and educational software developers. Science and technology scholars Daston and Galison, and more recently Colin Milburn, for example, have independently identified the same trend in scientific imaging—away from depiction toward fabrication, at a point where the formerly distinct boundaries between recording and producing have been breached. Thus Daston and Galison's final chapter extends their focus on traditional scientific atlases to those constructed via computer simulation and nanomanipulation: "Representation of nature here gives way to presentation: of built objects, of marketable products, even of works of art."[31] Though they are related modes of visualization, "Representation is always an exercise in portraiture, albeit not necessarily one in mimesis. The prefix *re-* is essential: images that strive for representation present again what already is."[32] In contrast, presentation involves a bringing into being; making and imaging become one and the same process and the formerly discrete roles of engineer and scientist begin to blur or fuse.

Daston and Galison sort these new kinds of images into two categories: the "virtual" ones used in recent digital archives and the "haptic" ones generated through "nanofacture" (manufacturing at the nanoscale). Both types are "manipulable" and "interactive," though the former is best characterized by "navigation through given data sets" and the latter by "navigation through the image to modify physical objects in real time."[33] As with many other database-driven, digital media, so-called virtual images invite selection and modification:

With clicks and keystrokes, these digital images are meant to be *used*, cut, correlated, rotated, colored. Their subjects are as diverse as ever: there are e-atlases of flora, fauna, and fluid-flow, but also of microbiological, chemical, physical, and astrophysical structures.[34]

Haptic images take this apparent convergence of seeing and doing even further. To exemplify, Daston and Galison describe the use of an atomic force microscope, which both "rolls a nanotube and projects its image."[35] Both virtual and haptic images, like the digital games discussed at length in these chapters, shift their beholder's function from passive to active, from a contemplative relationship to one of intervention.[36] While photography's early forerunner William Henry Fox Talbot conceived of light's action on photosensitive paper as the "pencil of nature," Daston and Galison argue that "The shift from image-as-representation to image-as-process wrenched the image out of a long historical track. [. . .]. Images began to function at least as much as a tweezer, hammer, or anvil of nature: a tool to make and change things."[37]

Colin Milburn's treatise on nanotechnology, *Nanovision*, echoes but also extends Daston and Galison's brief foray into new trends in scientific visualization. Milburn also deals with the radical miniaturization of fields of study to the subatomic, or quantum levels, where the images produced by instruments like the scanning tunneling microscope (STM) are as much pictorial as products of operational manipulation. Rather than presentation, however, Milburn singles out the term "fabrication" as doubly integral to "nanodiscourse," or scientific and science-fictional writing about nanotechnology; the word "must be understood in both its senses as making and making up, building and representing, *techne* and *poiesis*, for in the case of probe microscopy, representing and building are the same."[38] Milburn makes the case for the distancing, dominating effect of such technology, for instance the STM as "a key apparatus of technoscientific exposure and the scopic regime of the picture," but at the same time allows for a surprising countervailing tendency based on the recognition of the limits of human vision:

> The shrinkage of the small world into the human subject enables at a deeply embodied, affective level an alternative trajectory of nanovision away from mastery and toward something else like responsibility and eroticism, or an ethical pleasure in and for the other— the very small other of the nanoworld.[39]

In other words, the nanoscale engineer is often moved in the act of moving, or touched in the act of touching—he or she experiences what Milburn calls nanovision, akin to but not coterminous with Deleuze's notion of haptic vision, as the collapse of distance and the forging of physical contact with what is technically beyond traditional optical visualization. Rather than light waves, tunneling electrons reveal atomic surfaces; nonoptical molecular visualization relies on the interface between probe and sample, generating images not through illumination or magnification, but through the application of voltage.

For my purposes, the value of what Milburn, Daston, and Galison believe to be a paradigm shift from ocular to tactile science, or perhaps the unexpected convergence of visual and haptic epistemologies, lies in its evident recapitulation in less rarefied media contexts. Well outside the elite research laboratory, in millions of ordinary living rooms and home offices, computer and video games have popularized the same qualitative shift beyond vision toward interactivity, in roughly the same period (nanotechnology flourished from the 1980s onward). The player of a game like *Spore* is thus close kin to the archetypal scientist of the latest representational epoch described by Daston and Galison—one who melds creativity and intuition with the straightforward labors of instrumental science. Skilled in "pattern recognition" and characterized by "ludic and intuitive contributions to data visualization, or extracting the essential,"[40] "practitioners of trained judgment professed

themselves unable to distinguish between work and play—or, for that matter, between art and science. [. . .] surrendering themselves to the quasi-ludic promptings of well-honed intuitions."[41] Milburn's nanotechnology professionals are no exception; he notes that some of the most iconic images to emerge from nanoscience have had less to do with function and "serious" research than an artistic sense of play, for example Donald Eigler and Erhard Schweizer's now-famous creation of the IBM logo using xenon on nickel or John Mamin et al.'s "Gold-Dot Map of Western Hemisphere". The history of nanotechnology is itself a motley conglomeration of science and science fiction. As Milburn discusses at length, imaginative and hyperbolic rhetoric have often papered over the discrepancy between claims for nanoscience's future ubiquity and all-encompassing utility and its present feasibility.

In this vein, we can argue that the game *Spore* transcends the film *Powers of Ten* by transforming a purely visual demonstration of scale into an activity that offers multiple levels of environmental interaction. But most likely it is too reductive to portray the shift from (book to) film to game as simple teleology. *Powers of Ten*, it turns out, still has much to offer us, along with the realm of scientific epistemology through imaging.

Think Galactically, Act Microscopically?

One of the primary challenges faced by contemporary environmentalism is that of representing largely intangible problems—ozone holes, global warming, carcinogens in air and water, and so on—in a way that drives home both their existence and their exigency. Many environmental ills are poorly grasped at the scale of everyday life, either because of their temporal or physical vastness (climate change), or because of their insidious subtlety (lead and mercury poisoning, pesticide contamination). The effective visualization of ecological states at a range of scales is therefore crucial as people are not likely to seek solutions to problems that they doubt are even real.

Spore's modest successes in this area owe much to the influence of *Powers of Ten*—in particular, the film's determination to present what is typically inaccessible to visual inspection, and its general obsession with scale. In parallel formal and narrative ways, *Spore* embeds its player in neatly nested experimental domains, first by treating developing life at successive orders of magnitude, from the microscopic to the macrocosmic. In the game's culminating space stage, Wright also pays unmistakable homage to the film by allowing players to control in-game perspective through the use of their mouse wheels. Scroll the wheel forward and your spaceship descends from orbit through layers of atmosphere to the chosen planet's surface, where you can skim the ground to search for native flora and fauna or engage city populations. Scroll the wheel backward and your spaceship lifts off and returns to the microgravity of outer space. Keep scrolling, and the game perspective widens from planet to solar system and finally to the entire galaxy, where in much accelerated time, you can watch spinning celestial arms crammed with the twinkling lights of dying stars. Unlike viewers of *Powers of Ten*, however, *Spore* players may navigate between these different scales at will, depending on their motivations: goal-oriented achievement, aesthetic preference, perhaps even plain whimsy or curiosity. The game's deliberate open-endedness forces players to ponder the benefits and drawbacks of interaction at each level. Like ecologists who study and model real-world environments, players in virtual worlds may find themselves struggling with a similar set of questions: what is the value of remaining at one scale, and when is it necessary to move beyond that scale to examine the relations or transgressions that occur across the artificially imposed boundaries of hierarchical thinking?

Fortuitously enough, *Powers of Ten* has been recently reinterpreted in a way that draws attention to these very questions of appropriate scalar engagement, thanks to the artists that

collectively make up the group Futurefarmers (led by Amy Franceschini and Michael Swaine). Known for dozens of previous projects ranging from the revival of urban victory gardens and the launching of community soil and seed banks to street-level planting interventions, it is perhaps no surprise that the Futurefarmers' novel take on the film limits the audience's perspective to the terrestrial scale—visually, at least, their project refrains from swooping off into outer space or delving down to quantum particles. Instead, Franceschini and Swaine retain only the one square meter of picnic blanket as a familiar framing, treating it not only as visual device but also as event, restoring to the occasion the sense of lived duration and opportunity for relation lost or barely present in the original image. In the Futurefarmers' *A Variation on the Powers of Ten*, the picnic is less a convenient narrative premise or mathematical anchoring point for interstellar and intracellular journeys than it is the very model for human dialogue and connection to place. While the Eames' film could not help but downplay the human scale in comparison to the wide expanses of scientific inquiry, the Futurefarmers' version forces us to reconsider at close quarters what we think we know, through intimate conversation and shared presence.

Rather than literally depicting the growing boundaries of scientific investigation, the Futurefarmers invited ten scholars involved in a diverse range of sciences to join them for a series of personalized picnics. Each researcher demonstrates a special affinity for a particular power of ten: Ignacio Chapela, known in many circles for his near dismissal after publishing evidence of rogue transgenic elements in Mexican corn, represents the world of microbial ecology; Ananya Roy, a professor in city and regional planning, ponders urban systems and international development; premier lepidopterist Arthur Shapiro ruminates on insects, weather, evolution, and ecology; and so on.[42] The Futurefarmers allowed each interviewee to choose the site for his or her own picnic, as well as the array of accompanying foods, publications, and special objects.[43] So far, the outcome has been a dispersed network of documentation, not a single cinematic product—the picnics are not only filmed but photographed, audio recordings are made, conversations transcribed, and diverse materials displayed on the Futurefarmers' web site and selected for exhibition (the work was briefly previewed at the Berkeley Art Museum in 2010 and shown again in Sweden in 2012).
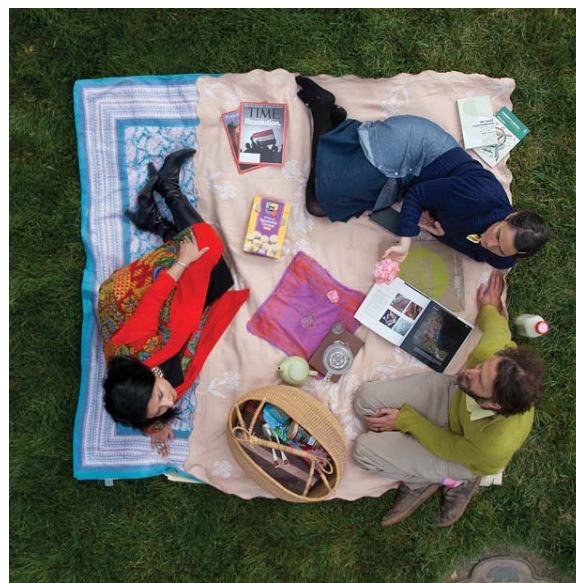

Figure 2.5. Futurefarmers Amy Franceschini and Michael Swaine picnic with Ananya Roy, professor of city and regional planning (10^5) at the University of California, Berkeley. Photograph by Jeff Warrin.[44]

In the outwardly simple decision to restrict *A Variation on the Powers of Ten* to the modest area between 10^0 to 10^1 meters, the Futurefarmers demonstrate a preference for local knowledge that places them squarely within the ongoing debate over the merits of local, as opposed to global, modes of thinking and living. Twin nemesis to modern environmentalism's difficulty in representing elusive phenomena has been the movement's internal frictions between devoted adherents to place and proponents of international, or worldwide, resolutions—what we could call the micro- and macroenvironmental approaches to pressing ecological problems. To my mind, new media, in particular games of the sort discussed in these chapters, have the potential to obviate the perceived choice by mingling the best of both worlds. Two recent texts, Mitchell Thomashow's *Bringing the Biosphere Home* and Ursula Heise's *Sense of Place and Sense of Planet*, may help us to consider the appropriate role for new media in establishing environmental consciousness, for instance by imagining the proper relation between the local and the global, but games are notably omitted from both authors' consideration.

As an environmental scientist, Thomashow advocates place-based environmental learning and a return to natural history curricula. Thomashow stresses that the nature of the challenge is largely perceptual—learning to perceive the effects of global environmental change in our local places, by recovering the "naturalist's gaze," a patient, meditative, observant demeanor to be joined with the analytic knowledge provided by science and the spiritual guidance provided by religious or other moral and ethical reflection. For Thomashow, new media are always double-edged technologies. The Internet, like television, presents "seductions" and "traps": "Every hour spent in front of the computer screen comes at the expense of your time observing natural history directly."[45] While far from condemning technology wholesale, Thomashow remains wary of its tendency to hasten conclusions, manipulate our attentions, and collapse space and time in ways that encourage us to overlook the world around us. "At high speeds, your observations become more cognitive and symbolic,"[46] he cautions, and "the inexorable pace of Internet participation dramatically changes how nature is observed, accelerating the pace of information, creating expectations for speed, and perhaps, placing a greater conceptual distance between the object of study (the ecosystem) and your visceral understanding of it."[47] For Thomashow, the Internet and related technologies crowd out sensuous experience of the natural world in favor of virtual intellectual engagement. Moreover, their routine daily use blinds us to their simultaneously broadening and limiting perceptual effects.

Yet Thomashow also acknowledges that "the permeability of the visceral and virtual is the hallmark of our age"[48]—where "visceral" should be taken in the sense of "bodily".[49] "Despite the best efforts of environmental educators," he admits, "millions of people mainly observe nature through windows and screens."[50] At other times, Thomashow less abashedly celebrates the sampling power of contemporary technologies, its ability to connect people and locations from all over the world and to translate otherwise abstract situations into readily graspable simulations and data visualizations: "What's remarkable about technologies of information, speed, and distance is that they accelerate this process, enabling you to scan and manipulate broad realms of data."[51] The Internet, in particular, enables almost anyone to "scan and synthesize" the kinds of information that would enable us to better perceive the scale of changes in our environment[52]—"We now have a sophisticated, international network for the gathering and dissemination of global environmental change data."[53]

Both excited and dubious about the possible meetings of the biological and virtual worlds, Thomashow at first hesitates—"Maybe the prospect of cultivating biospheric perception via the Internet is an illusion"[54]—but then ultimately grants that "crawling on your knees through a wetland on a humid summer morning, watching warblers on their spring migration, or observing biogeographic patterns on a series of computer overlays" are "all so many means of learning how to affiliate with life."[55] Inadvertently recalling both Dana Philips's critique of literary ecomimesis and

Daston and Galison's appreciation for relative dimensions of vision, Thomashow allows that "Each pace reveals some patterns and conceals others. Taken together as perceptual tools, various paces allow for the juxtaposition of scale."[56] As an example, he cites the "emergence of a coherent, ecosystem monitoring function—the blending of the Internet, GIS systems, satellite images, and field-based natural history research" as "an indispensable tool for interpreting global environmental change."[57] In sum, our approach to environmental realities need not militate wholly for or against new media; they are one part of a larger arsenal for combating ecological damage and scientific ignorance.

Thomashow's writing on biospheric perception was one of many intellectual precursors to Ursula Heise's *Sense of Place and Sense of Planet*, which takes up the question of technology's right relation to environmental thought in even more direct ways. The first part of Heise's book tackles the thorny paradox of such mantras as "think globally, act locally." Arguing that recent years have been characterized by "an excessive investment in the local," Heise makes the case for "an ideal of 'eco-cosmopolitanism,' or environmental world citizenship,"[58] one that acknowledges but offers a clear alternative to liberal skepticism toward globalization. Though it has become second nature among environmental devotees to minimize carbon footprint through eating, traveling, and purchasing within as minimal a radius as possible, and globalization has become something of a watchword for transnational corporate ambitions, Heise suggests that environmentalists have lost sight of the large-scale nature of environmental challenges in their well-intentioned espousal of the local. In response, Heise turns to a range of works across fiction, poetry, and installation art that are collectively "meant to point to ways of imagining the global that frame localism from a globalist environmental perspective."[59] Though she does not explicitly invoke games, Heise wonders "what aesthetic forms might be most appropriate for articulating [a deterritorialized environmental vision],"[60] or "what new possibilities for ecological awareness inhere in cultural forms that are increasingly detached from their anchoring in particular geographies."[61] Her recognition that Google Earth™ presents conceptual opportunities unavailable to the Apollo 17 image of the "Blue Planet" implies the promise of other recent media—including games.

So far, then, I have suggested that affect, ethics, and scale are some of the primary areas in which games are poised to make an important intervention in environmental representation. Despite common perception to the contrary, games need not remain on the sidelines when other cultural forms regularly wrestle with both the foolish and the profound. Key questions remain, however. What kinds of games are best suited to generating ecological insight? Is there an ideal player configuration (single player or multiplayer, online or offline)? In the case of social game worlds, environments that reflect the actions not of just one person but many, the game environment may become a document of collective and potentially cooperative processes. In that vein, the next two chapters explore games that deliberately leverage contemporary online sociality and with varying degrees of success permit traffic across the "magic circles" of their imagined game worlds, once erroneously thought to be impermeable barriers to the realities of social and environmental context.

First, a failure of the environmental imagination—a genre of games that, like text games and their interactive fiction forebears, can be tied to a rich literary history, but typically falls well short of the kinds of social, economic, and ecological understandings necessary in this post-industrial age.

BACK TO THE VIRTUAL FARM
POSTMILLENNIAL HOMESTEADING IN THE AGRICULTURE-MANAGEMENT GAME

It's a cold and dreary winter morning, and raindrops are pattering away at the windows. But I drag myself out of a warm bed because I know I have wheat and onions to harvest, crops that will wither and die if I yield to the temptation to sleep a few more hours. Pausing only to slide my feet into slippers, I shuffle to my office, plop down at my desk, and press the button to start my computer. Just another day on the farm.

Really, it's not so bad when your crops are online.

Stifling yawns, I open a web browser and log in to Facebook, the undisputed social networking giant of the new century, but I go right past the news feed and its status updates to Zynga's game *FarmVille*. Long moments pass as my quaint, two-dimensional farm loads, crammed as it is with row upon row of neatly aligned brown squares, each square representing an arable plot of earth. Around the fields I have placed orchards, barns, and pastures filled with livestock, all rendered in a pleasantly cartoonish style marked by bright colors and gently rounded contours. My avatar, a wide-eyed young woman with wiry pigtails and *FarmVille*'s signature oversized bobblehead, translates my targeted mouse clicks into on-screen actions: collecting wool from the sheep, milk from the dairy cows, eggs from the chicken coop, honey from the beehive, and fruit from the orchards; at my behest, she also feeds slop to the pigs and sends them truffle hunting, makes bread, cakes, and pies at the estate's bakery, and of course, plants and harvests crops. Surprisingly, this compact little farm, though virtual, is a veritable hive of industry. And while I realize that this land does not truly belong to me, that the animals and plants cannot feel genuine suffering or neglect, I experience a certain sense of satisfaction, both aesthetic and proprietary, in this vision of a well-tended farm.

As expected, the wheat and onions that I planted the day before are mature, but the red poinsettias I was hoping to gather up in decorative bunches aren't fully grown. When I move the mouse cursor over the poinsettias, the game helpfully informs me that they are only 74% ready.

Though it may seem counterintuitive at best, *FarmVille* and many games like it subject crops to precise time management. If you plant a carrot, you may be confident that it will be 100% ready (that is, ready for harvesting) exactly twelve hours later, and should you forget how far along the carrot is, you can either rely on rough visual cues (seeds turning into sprouts followed by flowers and full plants) or simply mouse over the plot in question to obtain an exact percentage. While we might decry this as evidence of our human tendency to impose analytical frameworks and capitalist deliverables on a qualitatively rich natural world, as a player these minutely measured levels of readiness are reassuring, because they render nature predictable and therefore manageable.

Indeed, although the farm may be virtual, virtual farming is not without undesirable consequences. If I had hit the snooze button on my alarm one too many times, I would have risked returning later to a sea of withered plants. Like real crops, *FarmVille* crops must be sown as seeds on prepared soil and can be harvested only after an appropriate maturational period; like real crops, they will shrivel up and die if neglected but conversely can also be fertilized to grow to greater heights and produce higher yields; and like real crops, they can be sold or traded.

However, the differences between real agricultural work and virtual agricultural play can quickly rise to outnumber the similarities. Growing crops in *FarmVille* takes not seasons but hours, sometimes even minutes, in a vastly temporally condensed version of farming. *FarmVille* farms are notably never subject to the vagaries of changing weather systems, pests, diseases, market competition, and consumer preference. Crops fail only when you fail to attend to them, and even then Zynga makes it easy for you or your in-game neighbors to magically "unwither" dead crops, the full absurdity of which I grasped only after keeping a retired neighbor's abandoned crops in a state of perpetual readiness for several months. Financially speaking, it is nearly impossible to fail at virtual farming, not the least because no one, the player included, is dependent on the crops for food or income. Arguably the only individuals whose livelihoods might be at stake are those responsible for creating and maintaining the game as a source of revenue, and thus games like *FarmVille* are forgiving by design, since only active players are likely to purchase and spend "Farm Cash" or submit to partner-advertising schemes for in-game rewards: faster task completion, designer items, and more land. In other words, failure by any means—meteorological, biological, or economic— goes against all that so-called social games like *FarmVille* represent: low-key fun with minimal time commitment.

Because of their basic graphics and limited gameplay mechanics, casual games have often been dismissed as so much collateral fluff to the real innovations in online social networking and big-budget game development. But hardcore gamers and industry pundits alike were stunned by the unparalleled successes of social and casual games in the first decade of the new millennium. As Wired.com games editor Chris Kohler conceded in a 2009 reflection, "The '00s will be remembered as the decade when the videogame industry got flipped on its head," as "publishers came to the belated realization that all those simple, accessible games from days gone by weren't obsolete; in fact, there were untold millions of people playing *Solitaire* on their computers, just waiting for something better to come out."[1] The mass-market appeal of browser-based and downloadable puzzle games like *Bejeweled Blitz* and time-management games like *Diner Dash* has given the lie to once conventional industry wisdom: namely, that game consumers demand blockbuster titles with intricate storylines and progressively better graphics.

Within this growing constellation of popular casual games, farm games significantly hold pride of place. Kohler lists *Happy Farm*, a Chinese farm game, as one of the top fifteen most influential games of the past decade, despite the fact that most Americans have never even heard of it. As he explains, *Happy Farm*'s trendsetting role as a model for *FarmVille* and games like it justifies its inclusion alongside more well-known properties like *Grand Theft Auto III*, *The Sims*, and *Wii Sports*: "Whether or not social games are the next big thing, *Happy Farm*'s blend of planting, growing and

harvesting crops turned out to be the simple game-design formula that had gigantic repercussions." Surveys of the current rosters of casual games support Kohler's observation that farming has emerged as both a preeminent theme and game mechanic. (By mechanic, I mean a discrete rule-governed process. Games include many different kinds of mechanics, some more vital than others, from loading, aiming, and firing a gun in a first-person shooter to wooing a potential spouse with home-cooked meals in a game like *Harvest Moon*.) Tellingly, even games that are not ostensibly about farming, such as Zynga's most recent releases *FrontierVille* and *CityVille*, include farming as a core component of gameplay.

To gain some sense of the dramatic impact farm games have had on the overall online social landscape, consider the webcomic *xkcd*'s famously tongue-in-cheek "Map of Online Communities," first published in 2007:
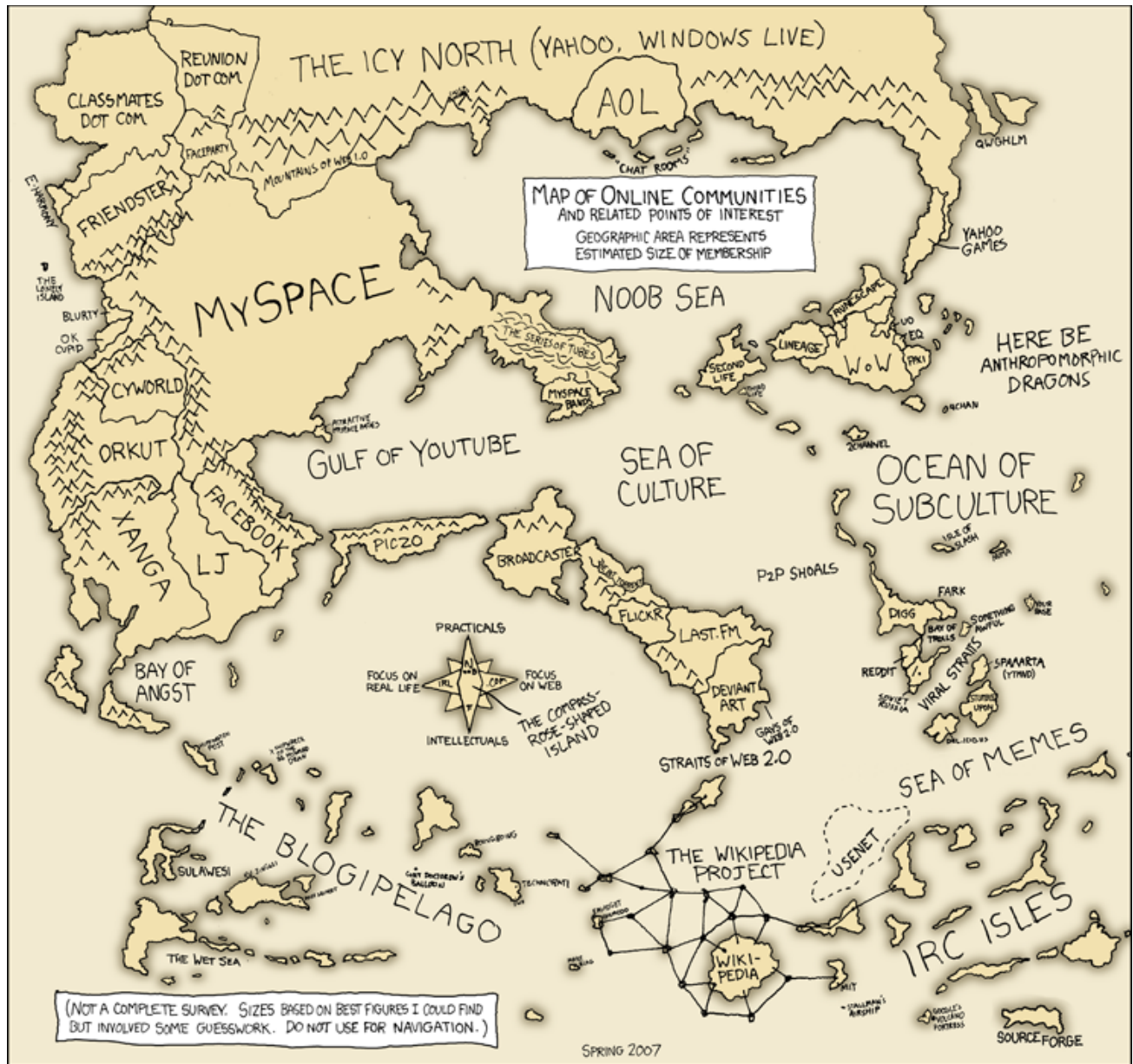
Figure 3.1. The webcomic *xkcd*'s humorous representation of the online world, circa 2007.[2]

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Only a handful of years ago, there were few dominant players. The clearest frontrunner, MySpace, finds itself thronged by eager social media competitors, MMOGs form a modest island nation, and Web 2.0 blogs and start-up companies with niche followings litter the seas of cultural transmission. Taken altogether, the world of online communities circa 2007 appears largely user-generated and highly fragmentary, a seismically active geological palette of submerged volcanoes, fragile atolls, and exposed peninsulas, many mere migratory stopovers for viral propagation.

By late 2010, *xkcd*'s map depicts a postwar world of monolithic corporate continents. MMOGs, about which an arguably disproportionate amount of game criticism has already been written, continue to occupy a sizable, but relatively isolated isle; YouTube, Twitter, and Skype have become established territories; and Facebook and the Chinese QQ service through Tencent have arisen as global superpowers. Perhaps most striking of all, both Facebook and QQ feature a farm game as their most prominent province—for Facebook, *FarmVille*, and for QQ, *Happy Farm*:
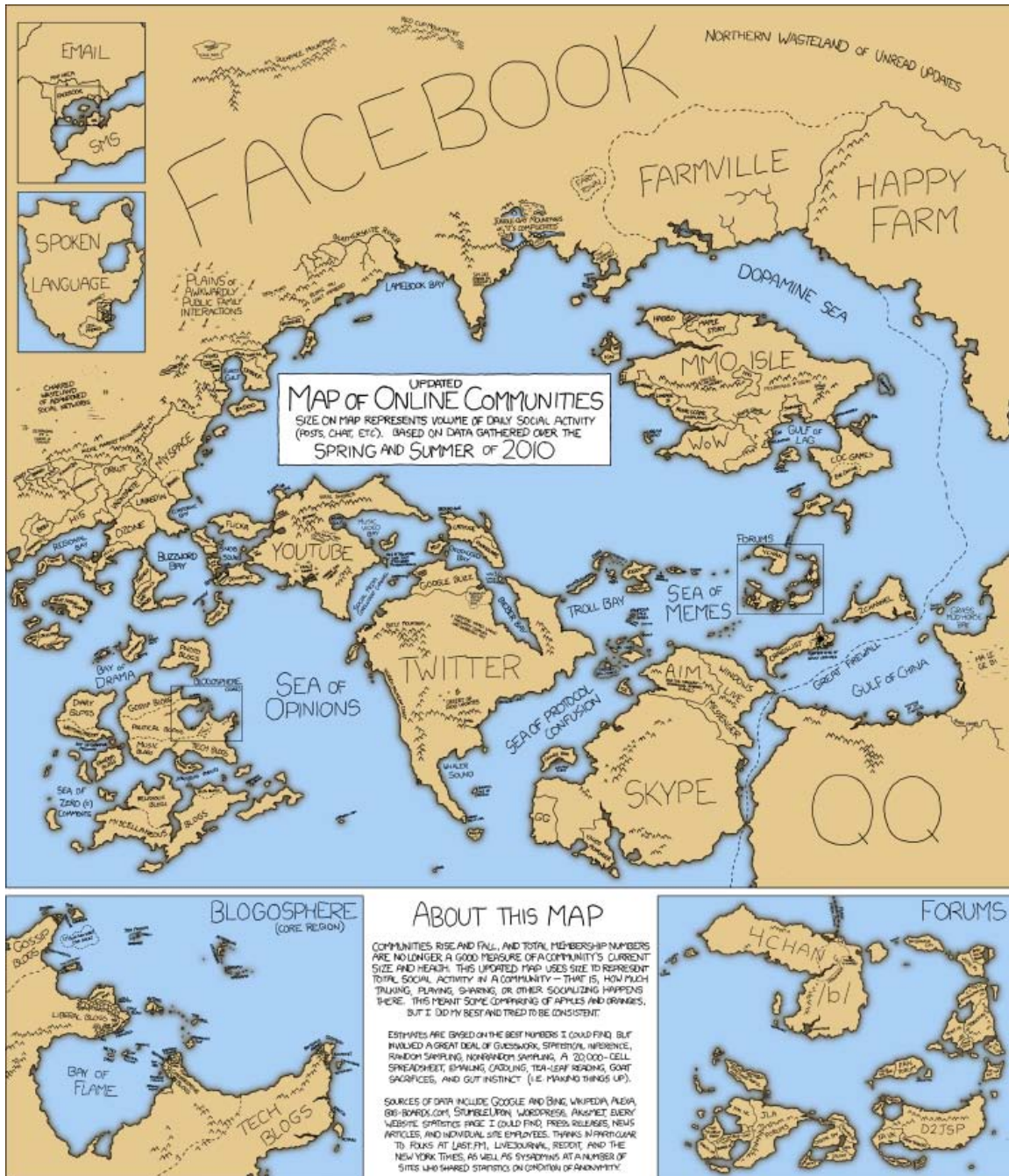
Figure 3.2. The webcomic *xkcd*'s updated representation of the online world, circa 2010.[3]

Paradoxically, the 2010 map suggests that somewhere within its enormous socially networked and short-message-service (SMS)-enabled land masses lies a pastoral utopia, a seemingly off-the-grid haven for even the most jaded of tech geeks. According to available Facebook user data, the number of active *FarmVille* accounts peaked in March of 2010 at around 85 million, and *FarmVille* players at the time constituted anywhere from fifteen to twenty percent of Facebook's overall user base.[4] (*Happy Farm*'s mostly Chinese and Taiwanese players are said to number well over 200 million.) Meanwhile, the Environmental Protection Agency has reported that less than one percent of the over 300 million people living in the United States claim farming as an occupation, and less than half

of those list farming as their principal occupation.[5] These radically discrepant numbers suggest that Americans no longer concerned with the day-to-day production of food are nevertheless heading back to the farm in droves, albeit a virtual one.

By 2011, Zynga, *FarmVille*'s creator, went so far as to tout *FarmVille* as "the most popular game in the world," and exhorted the unconverted to join its ranks using a combination of peer pressure and comforting solicitousness. "Play FarmVille - the biggest game on Facebook. Your friends are!" or "It's not just a Farm - It's a home away from home!" were just a few of the many taglines likely to appear in Facebook advertisements. Although *FarmVille* remains the best-known game in its category, along with its successor *FarmVille 2*, they are far from the only examples of virtual agricultural play. Beyond the dozens of "social" Facebook farm games like *Farm Town*, *myFarm*, *Happy Farm*, *Happy Farm 2*, and *Sunshine Ranch*, there are also hosts of single-player downloadable personal-computer (PC) games like *Farm Mania*, *Farm Craft*, *Farm Simulator*, and *Farmer Jane*, console-based farm games like Namco's extremely popular *Harvest Moon* series for the PlayStation, and mobile/handheld titles like *Hay Day*. A popular game portal like Big Fish Games hosts over 40 games just with the word "farm" in their titles, and that is not even counting the less obvious but still clearly related productions like *Country Harvest* and *Plant Tycoon*.

Clearly, something is afoot here that goes well beyond a convenient premise for lightweight game design. To better understand the marked success of the agriculture-game genre, as well as the genre's current limitations, we will need to visit by turns the literary, historical, economic, and ecological implications of the games and their implementation, and where better to begin than with the much-bandied notion of the pastoral.

The Garden in the Machine

In December 2010, in one of the short, daily musings curated on the online technoculture forum *In Media Res*, contributor Ted Friedman offered a generally positive reading of *FarmVille* not only as a model gift economy but also as evidence of a "new techno-pastoralism."[6] Friedman's term is suggestive, as is his titular inversion of Leo Marx's famous notion of "the machine in the garden," but the rosy-hued invocation of both formulations lacks any sense of their copious internal contradictions. After all, pastoral is usually invoked as a foil for the kinds of machinic rhythms and complications assumed to be technology's pernicious and inevitable byproduct.

According to *The Concise Oxford Companion to English Literature*, pastoral is "a form of escape literature concerned with country pleasures" that experienced its various heydays in eras prior to modern times[7]—during the golden ages of ancient Greece and Rome, particularly in the writings of Theocritus and Virgil, and again during the Renaissance and the seventeenth century, before being ousted by the qualitatively unique rise of Romantic poetry. This temporally narrow definition of pastoral has its formal counterpart, which grounds the genre in traditional verse and drama, with an emphasis on bucolic scenes and the simple lives of shepherds. Yet despite the relative scarcity of shepherds in contemporary life, pastoral remains an apt label for many modern phenomena, less as a concretely known range of experiences than as a form of cultural wish fulfillment. Found now wherever positive portrayals of country living surface, pastoral has become a flabby descriptor connoting any kind of idyllic, temporally removed way of life, rural in nature and ostensibly full of simpler pleasures. Thus in their reductive idealization of country work, *FarmVille* and games like it partake of modern pastoral, but as we shall see, they also contain elements that seem to run counter to the pastoral tradition, namely an embrace of high technology and the flows of industrial capitalism.

Increasingly throughout its venerable history, pastoral has represented a direct contrast not only to the urban but also the mechanical and technical innovations represented therein. For Leo Marx, in *The Machine in the Garden*, this tension defines pastoral as it has evolved in the American context. Unlike the Oxford companion editors, who pronounced pastoral proper as having declined with the ascent of a more acute and visionary Romantic poetry, Marx argues that the "pastoral ideal" migrated with European settlers to become a "distinctively American theory of society"[8]—from Thomas Jefferson's well-known agrarian ideals to the kind of freewheeling frontier mentality of "New World" settlers. America's wide open spaces, the perception of immensities of land and relatively few people, promised a moral, social, and geographic utopia denied to effete, urbanized Europeans. Marx studies the figuration of American industrialization within nineteenth-century American writing and its notable precursors, including Transcendentalist writer Henry David Thoreau, Nathaniel Hawthorne, Herman Melville, and Mark Twain. His analysis centers on the spiritual and cultural transformations encapsulated in the metaphorical and sometimes literal intrusion of the "machine"—the new technologies of the late 1800s, such as the railroad, the factory, and telegraph, that were abruptly collapsing space and time—into the proverbial "garden," here the untrammeled expanses of the American continent, with reference to both Scriptural and literary pastoral utopias.

Importantly, for Marx, this entry of the technological into the pastoral is not altogether negative, certainly nowhere near the common reading of technology as unfailingly pernicious that might be said to predominate in this age of anxious environmental awareness. Rather, Marx suggests that the shock of this encounter can yield extraordinary insights—as in Thoreau's description of a locomotive's passage through his beloved Concord woods—and that the complex, superficially paradoxical blend of agrarian ideals and machinic enthusiasm has come to characterize the American way of life. Of course, Marx developed his thesis at a time when environmental concerns had not yet come to the forefront of the American sociopolitical agenda. His chosen texts recall an even earlier, though pivotal, time, when both the shock of mechanical invention was more apparent but it also may have been easier to see the machine less as an interloper than as a vital catalyst.

Notably, Marx distinguishes between two varieties of pastoral: a "popular and sentimental" version at large in mass culture, and a more rarefied, "imaginative and complex" form, characteristic of the writers he extols.[9] One is mere unlettered escapism, the other the stuff of genuinely insightful literary experience:

> An initial receptivity to the pastoral impulse is one way in which our best writers have grounded their work in the common life. But how, then, are we to explain the fact that the same impulse generates such wholly different states of mind? While in the culture at large it is the starting point for infantile wish-fulfillment dreams, a diffuse nostalgia, and a naive anarchic primitivism, yet it also is the source of writing that is invaluable for its power to enrich and clarify our experience.[10]

We might turn to Marx to denigrate farm games or to explain the apparent paradox of a virtual farm, where the machine is present not only within the game (as tractors, combines, and even the genetic manipulation of seeds) but also as the game's framework: the infrastructure (computer, network, code) without which the game could not be played. Hence Friedman's reversal: the garden in the machine. But Marx's formulation only seems revelatory if one begins with the assumption that technology is necessarily disruptive to or damaging of the qualities enshrined by pastoral thinking, such as peace, lassitude, simplicity, and independence from court and city. Only when technology and the pastoral are seen as mutually exclusive, as complements, can Marx envision a partial

reconciliation of the technological and the pastoral through the inspiration that the shock of their encounter generates in the artistic mind.

However, to see *FarmVille* as a direct descendant of the pastoral tradition, or even as an extension of Marx's nineteenth-century productive encounters between the mechanical and the natural, is to miss the way *FarmVille* and games like it naturalize technology so that it becomes an undifferentiated part of the agricultural landscape. Pastoral in this modern form has lost any need to self-consciously examine its relation to technology, because it has already incorporated technology wholesale into its fold. Reminiscent of the sub-literary genre of wholesome marketing claims made in high-end grocery stores dubbed "supermarket pastoral" by journalist Michael Pollan, pastoral in its contemporary manifestation in farm games could not exist without technology and its time- and labor-saving devices, from machinery to chemicals and genetically modified organisms.

In other words, as I putter away on my virtual farm, the garden may be in the machine, but the machine has already taken up residence in the garden.

Landscape's Labors Lost: Technology and the Counter-Pastoral

At the beginning of the twentieth century, American agriculture was still largely driven by horsepower and human manual labor. Nearly half of Americans either lived or worked on farms, with a significant portion of their daily exertions applied toward raising livestock and crops for subsistence purposes. By mid-century, dramatic gains in the efficiency of agricultural production (measured both by yield per acre and labor required for cultivation) had made it both easier and cheaper for farmers to buy their food at the store than to raise it themselves. In the years that followed, as farm technology grew more sophisticated and markedly more expensive, reducing the need for human and animal labor, millions of farm owners and workers had little choice but to leave the profession and seek employment in urban centers. Consolidation followed, as multitudes of small, community farms gave way to fewer and fewer yet larger and larger commercial farming operations.

Historian Paul Conkin details American agriculture's comprehensive shift toward pervasive technological infrastructure in his part-autobiographical volume, *A Revolution Down on the Farm: The Transformation of American Agriculture since 1929*. To do this, he weaves an exhaustive but otherwise impersonal attention to incremental improvements in farm technology and the labyrinthine changes in federal farm policy (from the Depression-era and New Deal years of Herbert Hoover and Franklin Delano Roosevelt through more recent administrations) with anecdotal recollections of his formative years on an eastern Tennessee farm. Observing the considerable alterations the decades have wrought in his semi-rural hometown and the country at large, Conkin reveals a fundamental ambivalence: while by and large he celebrates many of the massive gains in production efficiency enabled by tractors, combines, rural electrification, "chemical inputs" like synthetic fertilizers and herbicides, and selective breeding, he also recognizes the dwindling number of farmers and the often damaging effects that intensive farming has had on the nation's land and waterways.

Thus in what is primarily a tale of technological revolution, Conkin acknowledges that following the Second World War American farms "became so capital intensive that the cost of entry into farming discouraged most aspirants" and that the new range of tools and machines "exponentially increased the amount of land needed for efficient farms."[11] At the same time, he little regrets the "enormous reduction in human labor" and the "huge shift from labor to capital inputs" caused by developments in mechanical harvesting, most notably by the invention of the combine and the automated cotton picker, because they enabled a staggering increase in American agricultural productivity and the country's consequent ability to support a burgeoning internal population and

hungry masses abroad.[12] What may strike many as a lasting irony, however, is that American agriculture has been so effective at driving up yield, replacing workers, and eliminating pests, pathogens, and the necessity of time-consuming crop rotation, that in many respects it has fallen victim to its own manifold successes. For much of the century following the short period of balanced supply and demand before the First World War, American farmers have consistently faced massive production surpluses and market saturation, which has driven prices down and invited near-constant government intervention in the form of production regulations and hefty subsidies. In the meantime, pests and diseases affecting both plants and animals have returned in novel, strengthened forms to plague the vast monocultural landscapes of single-crop farms and concentrated animal feeding operations (CAFOs), while any number of alarming public-health trends, most notably a rise in childhood obesity and adult-onset diabetes, have indicted an American food culture based on excessive processing and caloric overabundance.

Few of these problems arise in the farm game, where technology, much as in the real world, permits the displacement or erasure of labor, waste, and natural contingency. In *FarmVille*, work that typically takes entire seasons to come to fruition, that in the physical world is vulnerable to all sorts of natural reductions, is condensed into the easy work of a few minutes and hours. A modest parcel of land is given to you free of charge just by beginning to play the game, and though at first you must laboriously plow your land, plant seeds, and harvest crops plot-by-plot with carpal-tunnel-syndrome-inducing, repetitive clicks, your profits quickly roll in and enable you to purchase top-of-the-line farm machinery—tractors to plow, seeders to plant, and harvesters to collect—vastly simplifying the earlier processes. Eventually, players can even build combines, which merge all three tasks for one-click harvesting, plowing, and seeding.

Farm games' technological effacement of human, animal, and environmental labor in many ways simply extends conventional pastoral notions of country life, which tended to obscure labor by imagining rural living as paradoxically both productive and idle. Raymond Williams, in *The Country and the City*, offers a particularly perceptive genealogical tracing of the pastoral genre, and its predication on a studied inattention to the discomforts and dislocations of the laboring class. Drawing on his own rural childhood on the Welsh border, Williams is less concerned with pastoral as a literary conceit than as an artifact of and testament to changing social and economic relations in England: "As in so many other areas of English literary thought, there has been an effective and voluntary congealment at the point of significant historical transition, from a feudal to a bourgeois world."[13] Earlier forms of pastoral are of less interest than "the internal transformation of just this artificial mode in the direction and in the interest of a new kind of society: that of a developing agrarian capitalism.[14]

Having carefully demonstrated that every generation casts back to an earlier era for a supposed agricultural purity, on and on almost without end (the "escalator" theory of pastoral recursion), Williams sets about carefully restoring socioeconomic truth to the pastoral ideal in English literature. First, he excavates the often injurious and less glamorous systems of land tenancy and enclosure that underlie the romantic tales of courtship, marriage, and gentlemanly intrigue that permeate the novels of Jane Austen and Thomas Hardy. Then he pairs pastoral with an equally important "counter-pastoral" impulse exemplified, for him, by authors like George Eliot in *The Mill on the Floss*, who struggled not to let domestics and laborers fade into insignificance or local color: "she sees work here as it is, without any sentimental contrast between the town and the village labourer."[15] Williams is also intent on deconstructing any lasting division between country and city, while acknowledging the polemical attraction of such a dichotomy. For him, country and city are inextricably linked, whether as the necessary means of production and economic centers of exchange, or as convenient conceptual foils for each other. One can only imagine what Williams, with his cultural materialist and socialist emphases, would have made of this recent spate of farm

games. No doubt he would have taken issue with the giant disparity between these games' happy-go-lucky representations of farm work and the actualities of agricultural labor, just as he chided the country-house romances of Austen for their strategic excision of the poor tenant farmers whose labor sustained the life of the landed gentry.

In the United States, the official narrative of agricultural distress over the past century has largely centered on the diminishing ranks of white, middle-class, Midwestern farmers. The plight of the archetypal American farmer, by now an established trope in the national psyche, conjures tales of small, family farms driven to bankruptcy or neglect by youthful flight to urban centers; consolidated agribusiness; the high price of the latest technological innovations in machinery, pesticide control, and irrigation; drought and aquifer depletion; legal battles over patented seed stock; and even the unrefined palates of at-home consumers. But when the EPA, citing Purdue Research, reports on the continuing decline in the number of American farmers, it summarizes data limited to self-reporting farm owners and legal workers, a "graying" population that is rapidly aging out of existence like the equally romanticized frontier cowboy. As sobering as this trend is on its own, it leaves aside critical subtexts from the agricultural South and West, the stories of thousands of undocumented, border-crossing workers and the nearly complete exodus of African-Americans from farming despite their long yet fraught relationship to the land as slave laborers and tenant farmers.

Farm games, with their default cast of pale, cheerful faces, seem doubly removed from these realities. As a study in the *American Journal of Public Health* reveals, ethnically diverse migrant workers constitute a critical but underserved segment of the nation's agricultural workforce:

> Migrant farmworkers constitute almost half (42%) of the population employed in seasonal agricultural work in the United States. The majority of farmworkers (70%) are foreign born, and of those, 90% are Mexican. In California, about half of the estimated 1 million farmworkers are migrants, and as many as 98% are Mexican. [. . .]. According to the National Agricultural Workers Survey, the farmworker population in the United States is predominantly (80%) male and young (two thirds are younger than 35 years). However, most farmworkers are married and have children. They are also poor, with a median personal income between US $2500 and US $5000, but despite these meager earnings few use publicly assisted social services.[16]

Many of these workers are exposed to a wide range of abuses because of their illegal status, ranging from unacceptable occupational hazard and lack of medical insurance to scant wages and cultural isolation. Yet aside from this controversial reliance on undocumented and migrant workers, American agriculture has little to boast of in terms of economic, racial, or sexual diversity:

> Agriculture is, by far, our least diverse economic sector in terms of race, ethnicity, and gender. More than 97 percent of principal farm operators are white, and just over 90 percent are male, although women make up a much larger share of nonprincipal or secondary operators. African Americans, once so critical to southern agriculture, have almost completely deserted farming. Only 29,090 are principal operators, meaning either owners or tenants.[17]

The general lack of racial diversity in the contemporary farm game therefore represents either truth or sham, depending on which rung of the economic ladder is being consulted, but is in all cases disheartening given already widespread resentment of legal and illegal immigrants and recent, high-profile Congressional debate over settlements for black farmers who have experienced

both outright and systemically embedded discrimination at the behest of the federal government.[18] Political conservatives have been anxious to paint the most recent settlement, a follow-up to 1999's Pigford v. Glickman, as an unmerited handout to yet another special-interest group clamoring for government dollars. But as Paul Conkin attests, compensation is long overdue, given the racial injustice embedded in farm history:

> Race is now a prominent issue in farm politics. This is a bit ironic, because the concern for African Americans, in particular, comes much too late. Most blacks have long since departed agriculture. Many reasons lay behind their exodus, but one was the unfair treatment they received from the federal government, beginning with the Morrill Act of 1862. In the South, they were excluded from the large, segregated land-grant colleges and had to make do with small, underfunded, academically inferior agricultural and mechanical schools for blacks. The outreach programs from the land-grant institutions also discriminated against blacks, with only a few black extension agents to serve their needs. Beginning in the New Deal, despite a long and bitter controversy in the Department of Agriculture, both sharecroppers in general and black sharecroppers in particular rarely received their legal share of payments to farmers. African American farm owners were rarely represented at all in the local committee system that determined allotments.[19]

While the concept of farm allotments is far too complex to fully explain here, suffice it to say that for much of the past century, federally established and monitored allotments (and related quotas and pricing and financial support mechanisms) determined what and how much farmers could grow. Farms were initially assessed as having a "base" or "base acreage" determined by previous production and area already under cultivation, and this base became the basis for a variety of regulations and monetary incentives down the line—a higher base meant greater potential profit, favoring established large landholders and those with the capital to amass more land (a property's base evaluation went with it upon sale). Though this may all sound a little murky, Conkin describes the procedure of establishing base acreage as "the foundation of an enduring aristocracy" akin to "primogeniture and entail laws in Europe." From the get-go, then, modern American farm policy enshrined inequality, and only recently have attempts been made to narrow the gap between large and small farming operations and to make amends for long years of racially motivated economic oppression.[20]

While an online, social farm game like *FarmVille* tends to offer customizable avatars—a limited range of skin colors, hairstyles, facial features, and attire—most of the story-based downloadable farm games feature a feistily optimistic, redheaded heroine:

Figures 3.3 and 3.4. Scarlett of the *Farm Frenzy* series and Maggie the farming witch of *Fantastic Farm*. Author screenshots.

Figures 3.5, 3.6, and 3.7. Ginger Agronovich of the *Farm Craft* series, *Farmer Jane*, and Anna of *Farm Mania*. Author screenshots.

If we were to extrapolate from these images, the formula for a catchy farm game seems to involve some incongruous combination of overalls and plaid shirts, no-nonsense ponytails or pigtails, and flawless cosmetic glamour. But what is by far the most striking is the complete absence of brown skin—in fact, these fair-skinned ladies sport nary a freckle or sunburn even after toiling in the hot sun for months on end.

Though *FarmVille* offers a range of male and female avatars and the popular Namco *Harvest Moon* franchise generally features a young boy as protagonist, male avatars are on the whole much less common in downloadable farm games, presumably because the games are targeted at the growing audience of female "casual" gamers. The men that do appear in these games are generally

relegated to the status of either sidekick or villain. Thus, one common narrative demands that the game's sassy, young heroine return to the family farm in order to save "Gramps" (*Farm Mania*) or some other elderly relatives' homestead (*Fantastic Farm*) from financial ruin, neglect, or even the ruthless machinations of global agribusiness (*Farm Craft*):

Figure 3.8. *Farm Mania*'s "Gramps" and Anna. Author screenshot.

One might reasonably argue that these "Ginger v. Goliath" plotlines reflect a growing preference for local, farm-fresh food—less automation, more community-based farming, fewer megastores, more farmer's markets—but despite their earnestness the games still read as covert forms of wishful thinking designed to suppress the messier, less palatable aspects of agricultural labor. In these games, farm life is hard work, but always profitable; the work is voluntary, not forced upon you by unemployment or transnational labor crises; and the work is often done singlehandedly or with the help of at most one relative or a handful of workers.

At best, the onerousness of real farming is mimicked by the endless series of mouse clicks required to play such games, which rarely, if ever, require keyboard input. However, most of the games quickly introduce means, usually technological (though sometimes magical), with which to condense efforts or displace them onto the game's built-in artificial intelligence. In *Fantastic Farm*, a witch-becomes-farmer tale, a few waves of the magic wand allow non-manual watering by sending errant rainclouds to dispense precipitation over dry plots. In *Farm Craft*, you can save up money to purchase sprinkler systems that free you from having to water each plot with a watering can. The *Farm Craft* series also offers a "worker-hiring" mechanic, so as Ginger, you can hire men to water, fertilize, pick fruits and vegetables, or take care of livestock, and even a manager to manage all the rest. In this, *Farm Craft* comes closer to the reality of farm work, namely its distribution over a network of people, but if we take a closer look at the workers, again we see both the persistence of the country rube stereotype and the continuing absence of racial and ethnic diversity:

Figure 3.9. Temporary workers available for hire in *Farm Craft*. Author screenshot.

The *Farm Craft* games were developed by a Russian game studio, but sold in the United States. Like most farm games, they fail to acknowledge that almost half of seasonal agricultural laborers in this country are migrants, predominantly Mexican, though as Alderete et al. report:

> In recent years, an increasingly diverse farm labor pool has come to California from Latin America and Asia. Among these are indigenous people such as the Hmong from Southeast Asia, the Mixtec and Zapotec from Mexico, and the Maya from Guatemala.[21]

In depicting a kind of agricultural utopia void of workers but replete with labor-saving technology, farm games thus inadvertently reprise the capitalist drama of modern agricultural history and economics. They also unwittingly cleave to one side of a longstanding divergence of opinions between agriculture's boosters and dissidents—favoring those who believe modern industrial agriculture represents "an outstanding, and somewhat neglected, success story" (Giovanni Federico, in the tellingly named *Feeding the World*) over those who see contemporary agribusiness as either delivering a monopolistic deathblow to ancient and inherently anti-consumerist forms of peasant culture (John Berger in *Pig Earth*) or willfully ignoring natural limitations on growth (ecological economists like Herman Daly and environmental scientists like Mitchell Thomashow, who raises an eyebrow at "the optimistic, green revolution projections of plentiful food and filled tummies").[22] Despite the typical farm game's vision of agriculture as a single-player adventure (even social games like *FarmVille* are essentially single-player, though each player can have multiple neighbors that can visit and help tend your farm), agriculture in the real world has never been a reclusive affair. Agriculture cannot simply remain the cultivation of land and livestock for sustenance, because it is inevitably bound up with the question of sustainable population and the promises and prayers of American foreign policy and philanthropy through export and food aid.

Farm Ecology: Nonhuman Labor and Ecological Economics

Taken in its most general sense as productive activity applied toward economic gain, labor cannot be restricted to purely human forms. Of the many nonhuman forms of labor, there are those obvious examples provided by working animals, most commonly horses or dogs, and the more ambiguous cases of environmental labor—natural processes like plants' conversion of carbon dioxide to oxygen, without which our atmosphere could not sustain life as we know it. Economists have traditionally designated both renewable and nonrenewable "natural resources" like sunlight, breathable air, precious metals, and fossil fuels and "environmental services" like air purification and waste treatment as free gifts to the market economy, but as human impact on the natural world has become more and more pronounced, threatening to exhaust and disrupt an environment poorly protected by perceptions of its vastness and resiliency, a number of prominent economists have attempted to develop economic and philosophical models that more adequately express human

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dependence on the natural world. Current debates among environmental economists and ecological economists (not the same people despite their nomenclatural similarity) rage over the appropriate way to value natural resources and environmental services: if not as free gifts, as classical economics would have it, then perhaps as forms of natural capital with mathematically amenable values (Herman Daly and Robert Costanza), or more radically, as entities and activities to which we cannot sensibly ascribe monetary worth (Paul Burkett and John Bellamy Foster).

Daly, one of the founders of ecological economics, has built his heretical economic philosophy around proving that the mantra of "sustainable growth" is a destructive oxymoron. Across his many writings, Daly directs economic behavior away from quantitatively oriented growth toward qualitatively oriented development and the ideal of a "steady-state economy." Influenced by economist Kenneth Boulding's well-known articulation of two fundamentally opposed economic systems—the unconstrained, immoderately wasteful "cowboy economy" and the deeply constrained, minimally wasteful "spaceman economy," or life on the open plains versus life in a tiny capsule— Daly has long urged a forsaking of the avarice and negligence of what he calls "empty-world" economics in favor of the practical humility of "full-world" economics. While the frontiersman's disregard for environmental impact may have excited little censure in days of sparse settlement, abundant supplies, and feebler technology, when people were still very much aware of their vulnerability to external natural conditions, the same attitude appears wildly anachronistic in our current moment of exponential population increase, resource scarcity, and pervasive technological dominance over our environment.

Ecological economics, without entirely discarding classical economics, inverts the latter's priorities by embedding a Latourian attention to nonhuman representation in its models:

> Today's newly emerging paradigm (steady state, sustainable development), however, begins with physical parameters (a finite world, complex ecological interrelations, the laws of thermodynamics) and inquires how the nonphysical variables of technology, preferences, distribution, and lifestyles can be brought into feasible and just equilibrium with the complex biophysical system of which we are a part. The physical quantitative magnitudes are what is given, and the nonphysical qualitative patterns of life become variables.[23]

Responding to classical economics' axiomatic treatment of economies as closed, self-sustaining systems populated by abstract, largely symbolic producers and consumers, Daly insists that human economies must be regarded as subsets of the material world with the consequent imposition of natural contingencies and limitations, not the least of which is the bounded, finite character of our physical planet and its energetic inputs.[24] To this end, Daly grounds his models on thermodynamic principles, in particular the first law regarding the conservation of energy and the second law regarding entropy. Thus economic "throughput" continuously turns less-ordered, high-energy materials into more-ordered, low-energy commodities, but never with complete efficiency. The environment serves not only as "source" but also as "sink," as we make use of its resources and return to it the often toxic byproducts of manufacturing and a questionable legacy of near-immortal plastics and radioactive waste. Though the environment offers potent absorptive and regenerative capabilities, Daly recognizes that the scale of human activity now threatens to overwhelm the world's "ecological carrying capacity", putting us squarely in the midst of what some scientists have dubbed the "sixth megaextinction" in our planet's history, or a massive reduction in biological diversity triggered by humans and their unprecedented industriousness.

Despite their outward natural orientation, agriculture-themed games like *FarmVille* imitate the artificially closed systems of classical economics, rather than the environmentally open systems of Daly's theories. Just as farm games overlook the politically unpalatable realities of exploited and

historically excluded agricultural workers, they also turn a blind eye to nonhuman labor and the equally unpalatable ecological realities of industrial waste, entropy, and resource finitude. The lack of sobering ecological limitations—what classical economists like to call externalities to the market, in a mirroring of the rhetoric of environmental gifts and services—make such games dubious models for any genuine back-to-the-land sentiment. Farm games offer bucolic paradises where the use of machinery and intensive agricultural methods never leads to environmental degradation, where animals may be harvested for their products without coming to noticeable harm, and where key natural resources like clean water and nutrient-rich soil are always available and never subject to competition. Along with the inevitable depletion of soil and other resources, farm games also bypass the typical constraints of climate, season, and weather, both by excluding them from instantiation in the game and encouraging the clever use of technical solutions, ranging from the plausible, such as greenhouses and chemical fertilizers, to the fantastical, such as the "unwither" spray in *FarmVille*. Given this range of technological conveniences and magical cheats and saves, virtual farmers possess effective mastery over their cultivated landscapes as well as the broader environment that subsumes them.

Perhaps the most important way in which farm games could become more environmentally intelligent would be through their treatment of soil, which is for Conkin "the one resource most closely tied to farming."[25] At present, in *FarmVille*, players begin on a featureless green square of flat land, noticeably devoid of trees, flowers, rocks, and other topographical markers. The bland monotony of the terrain begs for alteration, and conveniently enough, the plowing "tool" (that rare software tool that is actually a tool) is automatically selected, so that clicking anywhere on the land creates a square of plowed earth. Hard-working farmers plow their entire allotment of land and use it for endlessly repeated cycles of planting, seeding, and harvesting, but here the game's environmental logic breaks down in a crucial way. While in *FarmVille* harvested land becomes "fallow land" and must be re-plowed to accept new seeds, the game applies no production penalty for continuous land use, which is also to say it offers no encouragement for leaving land idle, as the same plots can be planted and replanted without any material difference in yields or soil quality. In the real world, high yields cannot be achieved indefinitely without the use of fertilizers to replace depleted stores of nitrogen in the soil, or without planting nitrogen-fixing cover crops, legumes like clover and alfalfa, between other harvests, or without leaving the land fallow for an extended period of time to allow natural restoration of soil nutrients while preventing soil erosion.[26] Even then, fertilizers are far from a panacea, often creating problems that outweigh their admitted benefits. Conkin observes that "modern fertilizer-based agriculture has a greater pollution risk compared with traditional farming."[27] So, for example, nitrogen-based fertilizer applied at the wrong time will be poorly absorbed by crops, and the resulting runoff poisons waterways via eutrophication.

Farm games avoid confronting environmental limitation as carefully as environmental degradation, though such realities lie at the heart of the thermodynamic principles underlying ecological economics. Just as always ready, nutrient-rich soil is a given in farm games, rather than an objective, fresh water is also plentiful and available at no cost—this despite water's deeply contested status in the real world, and the many limits on its quantity and quality. Tremendously convoluted water-rights laws have evolved to adjudicate competing claims on this resource that perversely falls, flows, and seeps irrespective of cartographical boundaries, while billions of federal and state dollars have been spent on dam and irrigation projects in often questionable attempts to guarantee consumer and agricultural water supply. As a case in point, although much of California is semi-arid desert, it is the nation's top agricultural producer; its key Central Valley farming regions could not exist without the millions of gallons of water pumped hundreds of miles from the Sierra Nevada and the Colorado River watershed. As *Cadillac Desert* author Marc Reisner has scrupulously documented, water has become the defining resource of the American West not due to its natural abundance but

rather its inevitable scarcity. Farmers all over the nation have recklessly depleted groundwater supplies deposited over millennia, perhaps most famously in the case of the massive Ogallala Aquifer found beneath the Great Plains. In the United States and elsewhere, agriculture has also been effectively stymied by rising soil salinity, caused in large part by improper irrigation practices and inadequate drainage. As experts predict growing shortages of fresh water alongside global warming and population expansion, with the increasing likelihood of armed conflict over water rights, farm games and their insular disregard for water sourcing and disposal smack of ecological fantasy.

Incredibly, *FarmVille* ignores the problem of water almost entirely. Though wells, fountains, and ponds are available for purchase, they are primarily decorative objects. At best, you can give ducklings a home or trade pennies for gifts in a quaint wishing well. Without transporting a single drop of water, *FarmVille* players may repeatedly raise bumper crops of their favorite virtual fruits, vegetables, grains, and flowers.[28] Most farm games, both online ones like *Happy Farm* and *Sunshine Ranch* and downloadable ones like *Farm Craft* and the aptly named *Virtual Farm*, do require their players to water crops in a timely fashion or the crops will die. In some games, players must bring the water up by hand from old-fashioned pumps or wells, in order to water plots with a watering can; in others, watering is made vastly easier with hoses or automated sprinkler systems, presumably connected to a municipal water supply, though in the case of *Fantastic Farm* the player simply summons magical rain clouds to drizzle over parched land. While these games usefully acknowledge water as a necessary factor in agriculture, the water used is abstract, uniform, and endless. These generic qualities allow players to feel "blissfully productive" within the closed, perfectible systems of their imagined farms, without worrying over the broader, environmental context.[29] Unlike real-world farmers, virtual farmers need not understand where their water comes from, or where it goes after serving its purpose. There are no water tables or downstream neighbors in these worlds, where water never runs out, costs nothing, and is always pure. Virtual farmers have no reason to suspect that the water is materially transformed by its use, though as Conkin notes, "the majority of nonpoint water pollution in most of the world derives from agriculture, followed by household wastewater. Nonpoint sources are small but widely distributed sources of pollutants that are difficult to identify and control, unlike the point-specific pollution of a factory or a large hog or poultry farm."[30] They might be shocked to learn that "Irrigation accounts for more than 80 percent of all fresh water utilized in the United States,"[31] or that the largest energy consumer in California is the state water project that supports agricultural operations. In their glib treatment of water, farm games could be said to model the very opposite of informed localism, or the kind of geographically specific knowledge advocated by bioregionalism, in which bioregions are most commonly defined by shared watercourses.
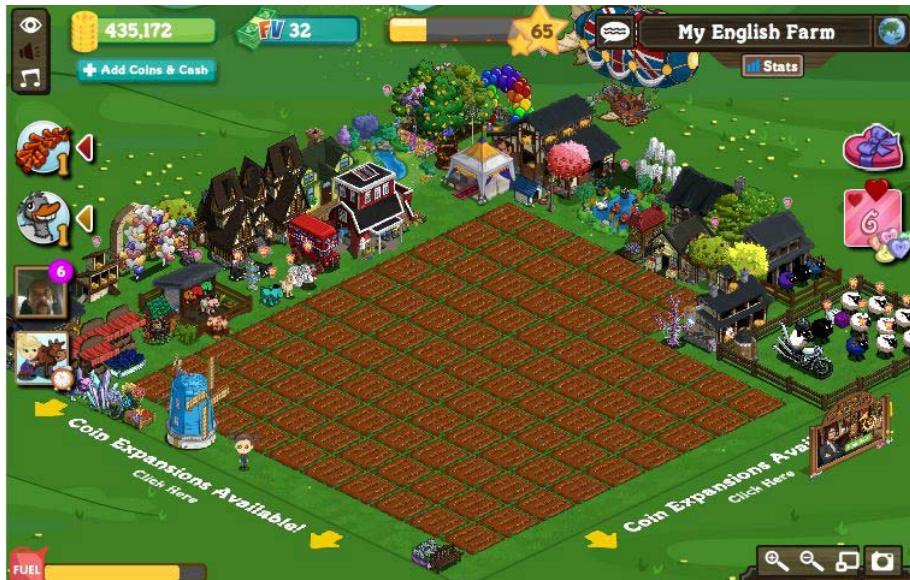
Figure 3.10. My crowded farm in the *FarmVille English Countryside* in 2011. Author screenshot.

Perhaps the clearest evidence of entropy and environmental externalities to economic systems lies in waste, whether it is legally and ethically marked as pollution or trash or, as is more often the case, goes unnoticed or is deliberately overlooked until its sheer size and severity cannot be ignored. Though capitalism would prefer to imagine otherwise, commodities cannot be created out of whole cloth, and production can never achieve one hundred percent efficiency—such are the fantasies of perpetual motion, Dyson spheres, and the lossless Carnot engine. Fascinated where others have been repelled, concerned where others have been indifferent, literary ecocritic Timothy Morton has given the name "dark ecology" to all those ugly substances lurking beneath the glossy veneer of consumerism, in a philosophical attempt to counteract luxury culture's repression of death, excess, and decomposition.[32] For Morton, typical invocations of ecology speak in superlatives, stressing positivity and harmonious living, but this is, in its own way, as closed a system as the abstract ideal of classical economics. Where the marketer and the effete consumer see grocery and department store shelves lined with a reassuring panoply of products—say not one but twenty different kinds of toothbrushes, in a range of cheery colors, some with short bristles, long bristles, soft bristles, hard bristles, injected foam handles, rotating heads, or cartoon imprints for the young or young-at-heart—dark ecology looks beyond the point of acquisition and the brief lifetime of a toothbrush's use. It trails behind a toothbrush after it has been tossed in the garbage bin, while it makes its way from household waste to landfill, or washes out to sea and joins the growing rafts of plastic-based flotsam circling in the North Pacific Gyre, or what has been called the Great Pacific Garbage Patch. Delighting in the scatological, Morton mocks our failure to think "beyond the U-bend," teasingly referring to that crooked spot at the base of our toilets beyond which our own excrement travels, leaving an overtly pristine bowl of clear water but joining the feces of a thousand others in aging pipes and pools at waste treatment plants or flowing directly seaward. Dark ecology reminds us that ecology is not solely about the bright optimism of interconnection and interdependence, a warm, furry, mammalian comfort in our cohabitation, but also a universe of waste, dirt, shit, and trash that does not disappear, though it may fade or become otherwise as it gets taken up again and again by a sprawling web of organisms and inorganic actors.

By this standard, farm games at best mimic or at worst perpetuate distaste for the murkier sides of a consumer culture based on convenience, choice, plenty, and growth. Virtuality becomes

both blessing and curse in this respect: on the one hand, it serves as an opportune shield against criticisms of ecological inaccuracy, but at the same time it is the very basis for a vital disconnect between the raising of food and the politics of its consumption. Currently, *FarmVille* farmers assiduously raise crops only to sell them to an abstract marketplace. While a few harvested bushels can be sold to neighbors via homey-looking farmer's market stands, crops bought in this way can only be used as raw materials, turned into pig slop, or expended for metaphysical "mastery" bonuses (players "master" crops by planting and successfully harvesting them in great quantities). Crops transformed into goods in bakeries, wineries, and other structures cannot provide gustatory satisfaction, but can be traded for fuel, which powers farm machinery. Incidentally, fuel can also be found while plowing one's own land or tending a neighbor's fields, as if nature itself rewards agricultural diligence and considerate visitation. Ultimately, even as farm games leverage the growing grassroots interest in organic, locally sourced food and what we might call "personalized agriculture," their clean, carefully antiseptic landscapes more closely resemble the impersonal bounty of bulk discount stores than artisanal farmer's markets or roadside stands. Sunlit, verdant fields admit no suggestion of consumer waste, let alone the industrial waste generated by intensive farming or concentrated animal feeding operations. Viscerally lacking, farm games treat animal and plant life little better than innocuous parcels of prepared, packaged, and frozen food—designed for quick, mindless consumption within a flattering master narrative.[33] Not surprisingly, Zynga regularly negotiates corporate partnerships or advertising agreements that allow outside content to appear directly in their games, and in the case of *FarmVille*, many of the featured brands play directly to the game's promise of wholesome, direct-from-the-farm food. McDonald's, Stouffer's, and Frito-Lay have all made "guest farm" appearances in *FarmVille*, and players that take the time to visit and tend these temporary farms are rewarded with in-game bonuses and branded farm décor (for example, a Frito-Lay delivery truck or my all-time favorite, a Stouffer's macaroni-and-cheese tree).

Cynics might well argue that farm games all too accurately model the basic nature of agriculture as manipulation and alteration of land, as well as the longstanding affinities between farming, capitalism, and technology—a triad now so deeply engrained across the world that only a tiny minority of hobbyist or subsistence farmers might claim to operate outside of it. To speak specifically of farm ecology, one must recognize that all farms constitute artificial ecologies that reduce the complexity and biodiversity of natural ecosystems to monoculture, an approach that has proven inherently susceptible to pests and diseases as well as troublingly reliant on synthetic fertilizers to replace depleted components of the soil. Far from embodying the evolutionarily rich interconnections of Darwin's entangled riverbank, farms replace variety with uniformity, or the smooth, heterogeneous spaces of natural systems with the striated, homogenous land of rows and fields. Even for Conkin, the devoted farm historian, agriculture and environmentalism suggest an unavoidable antipathy:

> Of all human activities, the cultivation of crops has had the largest impact on the face of the earth, beginning with the elimination of up to half of all forests. If one places a high value on an environment little affected by humans, then agriculture by necessity is hostile to environmental health. It has eliminated wilderness, shifted the balance of plant and animal species, altered the hydrological cycle, and, in a limited way, altered climate.[34]

Though Conkin clearly favors the anthropocentric end of the decades-old preservation versus conservation debate, siding with those who seek sustainable use over those who seek to enshrine wild land, Conkin reserves a Dalyesque skepticism for the concept of sustainable farming: "I doubt that, in the strictest sense, any system of farming is fully sustainable, because of at least a few nonrenewable inputs such as fossil fuels."[35] Conkin ultimately recommends that we reinstitute crop

rotation practices, use integrated pest management to reduce toxic pesticide use, and return to alternative forms of agriculture that minimize tillage or soil disruption. Transitioning back to what he calls "low-input" agriculture, with its emphasis on the recycling of nutrients, might bring farming back in line with the ideals of natural escape and country simplicity sought by players of farm games all over the world.

That *FarmVille* and games like it inevitably caricature complicated biological and economic processes comes as no surprise. Games, like other media, must selectively present or order experience without attempting to replicate reality. Already, games of all stripes simplify what would otherwise be very difficult tasks to perform: firing a gun, scaling walls, piloting intergalactic spacecraft. At the same time, games can easily enliven tasks which in the real world would seem onerous: waitressing in *Diner Dash*, or running a household while working 9 to 5 in *The Sims*. Farm games partake of both strategies, offering cheerful simulations that render the dull, offensive, or harsher aspects of agricultural work reassuringly mundane. Though the results can seem vaguely parodic, especially when viewed with socioeconomic or ecological interests in mind, game designers would no doubt protest that their priority is entertainment, not verisimilitude. Games play upon widely recognized, culturally encoded frameworks—pastoral retirement, rags-to-riches entrepreneurship—but stop well short of accuracy when that entails alienating drudgery and demoralizing failure. Their aim is less total fidelity than just enough realism to produce imaginative play that is both familiar and relevant.[36] Accordingly, farm games are deliberately simple affairs; only a few minutes of exploration will teach you what you need to know to operate successfully in their domain.

But while there may be little worth in holding farm games to an impossible standard for environmental truth, the games nevertheless exert an important influence on how millions of players conceptualize country life, food production, and right relations between humans, animals, and the environment. For this reason, if nothing else, these games matter in ways that go well beyond their ability to divert and amuse. Furthermore, as farm games continue to multiply and evolve, iterations that emphasize greater environmental sensitivity will likely hold player interest for a longer time, because the games themselves will feature more knowledge-based connections and challenges. A few representatives of the genre are already taking positive steps in this direction, and three implemented trends in particular are worth mentioning here: cross-species interaction, environmental variability, and ecological localization.

When I first began playing farm games, the absence of meaningful cross-species interaction irked me to no end. Though my virtual farms appeared to teem with different forms of life, the actual experience of play felt oddly disconnected. My avatar, crops, trees, and livestock had as much significant contact as marbles clattering about in a glass jar. While I still dutifully fed my animals and tended my plants, I was painfully aware that my farms were less lively ecosystems than outdoor showrooms, equipped with coded to-do lists skillfully masked as cute and colorful country decor. As someone with an interest in the natural sciences, I quickly began to long for farm games that would make crop selection less arbitrary and more biologically meaningful, not only by encouraging smart crop-rotation practices (for example, planting crops with nitrogen-fixing bacteria after crops that leach nitrogen from the soil) but also by instituting important interspecies dynamics, among them predation, pollination, scavenging, and decomposition. As a player, I wanted to be able to increase my crop yield or grow healthier plants by considering their temporal or physical proximity to other species, both plant and animal, for instance, by planting a symbiotic Three Sisters garden (squash, beans, and corn), or using my animals' waste to improve the soil. At the moment, farm games favor very precise, Cartesian planting that requires orderly squares on a grid with only one plant type allowed per square. Only a few games model any kind of congress between animal and environment, as in *Farm Craft* when harvested crops are fed directly to hungry livestock. One could easily imagine

a more interesting farm game that attempted to capture any portion of the multifarious dealings between plants, animals, people, fungi, bacteria, and inorganic matter. We might learn much from a game version of farmer Joel Salatin's Polyface Farms in Virginia, which is prominently featured in Michael Pollan's writings as a paragon of sustainable farming that engineers mutualism between domesticated animals and the land.

Some farm games have introduced honeybee pollination and both plant and animal breeding mechanics, though the latter is accomplished with an ease that obscures the morally and legally fraught nature of such manipulation and the various technologies necessary to its success. Though *Farm Craft*, *FarmVille*, and *FrontierVille* all offer beehives, *Farm Craft*'s beehive only produces honey and does not materially affect the plants nearby, though the beehive must be placed near flowers in order for honey to be produced. In *FarmVille*, bees may occasionally pollinate your crops, yielding special, time-limited pollinated seeds that guarantee greater bushel production, but this version of pollination seems independent of actual crop reproductive practices. So for example, my honeybees have correctly and industriously pollinated my carrots, but they have also pollinated my wheat, although wheat is for the most part self-pollinating.[37] Lastly, *FrontierVille*'s recently added beehive offers "crop ready" boosts, which can be used to instantly mature a crop for harvesting, but has little to do with genuine pollination. Cases like these exemplify a troubling tendency to use real ecological processes as little more than environmental flavoring or additional delivery mechanisms for player-centric production boosts.

Farm games' forays into virtual breeding prove even thornier, albeit very entertaining. *FarmVille* recently allowed players to construct greenhouses that enable seed hybridization, as well as animal pens that permit the cross-breeding of sheep (as of now, only in *FarmVille English Countryside*). Thus far, players can only create hybrid crops pre-specified by Zynga, such as "squmpkins" (a hybrid of squash and pumpkin) or "purple tomatoes" (a hybrid of blueberries and tomatoes). The means by which this hybridization is accomplished are entirely mysterious, as once the starting seeds are selected for combination, players need only return three days later to reap their mutant rewards. In the more recent spinoff *FarmVille English Countryside*, players may breed any combination of ram and ewe available to them in order to develop new sheep breeds in an eye-popping array of colors and patterns. Surprisingly, radical changes are produced almost immediately via one-time ovine trysts, rather than emerging slowly and laboriously over multiple generations. Lambs that exhibit bizarre and unexpected phenotypes when grown—bioluminescent flashing, polka dots, and star-covered wool—make clear that amused pride was more the aim than any semblance of scientific accuracy.[38] While these whimsical sheep are obviously the delight of many a virtual farmer and hybrid crops offer imaginative alternatives to conventional species, again we risk regarding the natural world as mere template for playful customization, as previously identified in the unabashed terraforming of *Spore*.

Environmental variability refers to a game's capacity for treating its in-game environment as a dynamic system, one that changes and develops with or without the intervention of the human player. Presently, most farm games unfold within a game environment that is largely static, rather than homeostatic. In *FarmVille*, for instance, cleared land remains cleared no matter how long it is left idle. *FarmVille* farmers have little sense of weather or seasons, though players may purchase "snow cover" or other terrain colorings to decorate their farms for certain holidays. In marked contrast, Zynga's game *FrontierVille* (later renamed *The Pioneer Trail*), released on Facebook in June 2010, achieved greater ecological complexity because it encoded environmental variation and did so in a less arbitrary fashion. This difference may be in part a function of *FrontierVille*'s broader narrative mandate: players took up farming as only one aspect of life on the historical American frontier. Whereas *FarmVille* was distinctively pastoral, *FrontierVille* evoked classic Western. Thus *FrontierVille* players took on the role of aspiring homesteaders looking to stake and tend a claim in

the "untamed" wilderness (unfortunately, the game largely avoids suggesting previous Native American presence or dramatizing conflict between white settlers and native peoples). As in *FarmVille*, players began on a modest square of unoccupied land, but in *FrontierVille* the square was conspicuously filled with mature trees and natural "debris"—thorns, rocks, grass, cacti, even bleached animal skulls—and these must be cleared before planting and building can occur.[39] Should you have assiduously cleared a quarter of your land, then logged off with the intent to later build a cabin and raise some potatoes, you would return a few days later to discover that the land you had so carefully cleared had been partially repopulated by grasses, wildflowers, and even sapling trees. If other commitments kept you away from your homestead even longer, those young trees would eventually grow to their full size and the tall-grass prairie would happily reclaim your land. Every day brought its own weather, though it was not visually reflected in the game and had little tie to the natural processes on your land. Rather, each forecast brought with it special action bonuses or gifts, seemingly random in their association, so that some days you could receive extra coins and collectibles when chopping wood, or more food when harvesting fruit trees, and so on. Finally, *FrontierVille* seasons mirrored season changes in temperate North America, with tree leaves changing color in the fall, dropping entirely in the winter (at which point snow covers the ground), and returning in the spring. Though still arbitrary in some regards, *FrontierVille* usefully modeled a much deeper game ecology that responded to change and seemed to possess life independent of the player's actions.

A final development worth some attention is the growing opportunity for people to play farm games from all over the world, simply by going online. Since most farm games take as their environmental template plant and animal species endemic to their region, playing a range of foreign farm games may help to educate players about unfamiliar foods, animals, and products as well as the environmental conditions necessary to their continuance. In the Chinese game *Happy Farm*, for instance, I planted carrots, turnips, peppers, potatoes, and corn and imported those raw materials into the dubiously named *Happy Factory* extension, where workers then converted them into several types of Korean kimchi, vegetable chips, and vegetable oil. In the Japanese game *Sunshine Ranch*, I planted lychee, tea, taro root, and countless gourds and melons, while raising red-crowned cranes, golden frogs, and ducks, chickens, and cattle of all kinds. Meanwhile, the original *FarmVille* still features fairly standard American fare but has increasingly ventured into more exotic species in a form of agricultural ecotourism. In addition, the more recently released *FarmVille Jade Falls*, *FarmVille Lighthouse Cove*, and *FarmVille English Countryside* offer provincially characteristic arrays of crops, flowers, and livestock, as in *English Countryside*'s barley, hops, cara potatoes, cornflowers, squill, and of course, the aforementioned take on heritage sheep breeds. While games often undergo what is called "localization" as they cross into new regional markets, this localization typically refers to linguistic translation—dubbing or subtitling in the new region's primary language. My hope is that game developers will eventually devote equal time and energy to ecological localization, whether that means producing games with a distinctive regional character or customizing games for target regions in a creative nod to the philosophy of bioregionalism.

From *FarmVille* to *CityVille*

> It is significant that the common image of the country is now an image of the past and the common image of the city is an image of the future. The pull of the idea of the country is towards old ways, human ways, natural ways. The pull of the idea of the city is towards progress, modernization, development. In what is then a tension, a present experienced as

tension, we use the contrast of country and city to ratify an unresolved division and conflict of impulses, which it might be better to face on its own terms.

Raymond Williams, *The Country and the City*

One December morning in 2010, as I made my rounds on nearly half a dozen online farms, I discovered that a sizable billboard had been installed overnight on the perimeter of my *FarmVille* land. The billboard featured a smiling, smartly dressed businesswoman pointing the way to a city on the horizon, inviting me to lay down my virtual farm tools and experience instead the novel and decidedly metropolitan delights of Zynga's newest release, *CityVille*:

Figure 3.11. A billboard advertising the release of *CityVille* by my *FarmVille* farm. Author screenshot.

Players familiar with the *SimCity* or *Zoo Tycoon* games will no doubt recognize *CityVille* as yet another human ant farm—a population simulation based on a limited range of internal and external variables such as tax rate, housing quality, marketing budget, and the likelihood of natural disasters. *CityVille*, however, is much less meticulous and far more sanguine than the SimCity games about the practical challenges of urban planning. At its core, *CityVille* is a game obsessed with expansion and the acquisition of wealth, and thus sets regular goals for players to raise the populations of their cities, forcing them to acquire more and more land and build increasingly dense residential structures. Though the game begins with a few cozy cottages and country homes along a single, main street, mature cities soon feature a railroad, shipping ports, and multiple neighborhoods crammed with townhouses, apartment buildings, and condominium towers that accommodate more people per zoning permit. In a curious bit of game logic, *CityVille* treats grandiosity as nearly interchangeable with size—more elaborate homes, although they may be single-family dwellings in the real world, often raise the population more than pedestrian multi-family dwellings. Thus for example, a "bay point duplex" represents 230 people, a "sprawling mansion" represents 140 people, and an "apartment complex" a mere 90.

In what may seem like a corrective to growth, cities also earn a happiness rating based on the ratio between current and maximum population. If the number of citizens living in your city comes too close to the existing population limit, which is determined by the number of community buildings (banks, police stations, schools, etc.) you have built and staffed, the citizens become

unhappy. However, because of the way that housing and community infrastructure goals are interwoven, the happiness level in effect is less tied to crowding than it is to the lack of room to grow—so for *CityVille* residents, bigger generally means better, and the game as a whole becomes a paean to population growth, urban sprawl, and blatant consumerism. Recent additions to the game's content include the ability to build and open factories, skyscrapers, and an ever-greater variety of shops, reinforcing the sense that the game is essentially a treadmill of material expansion and acquisition. Perhaps hoping to ease the transition from one game to another, Zynga includes farming in *CityVille*, though players grow and harvest crops only to supply the city's restaurants and stores, not citizens' homes. Significantly, by later stages of the game, international shipping and railroad-delivered goods render farming largely unnecessary, while mounting housing pressures mean large fields quickly become untenable.

If we grant that *FarmVille*'s success was at least in part predicated on its promise as a retreat from everyday urban and workaday life, the call to *FarmVille* players to explore a game that celebrates all things metropolitan may seem misplaced. But as Raymond Williams has discussed at length, ideas of country and city have so long served as conceptual foils for each other that, even in their opposition, *FarmVille* and *CityVille* are practically fated complements. Williams insists that rural and urban social and economic histories are necessarily intertwined, though we are often tempted to separate them by means of facile ideological contrasts. The reasons behind this difficulty include the nature of agriculture's evolution into agrarian capitalism, and the ability of landowners to transmute their property and income into other assets and forms of capital. As Williams notes, "we cannot distinguish wholly separate industrial and land-owning classes in the developing capitalist system. Eighteenth-century landowners were already involved in early extracting and manufacturing industries"; moreover, "there was a constant interchange between landed property and other kinds of property and income,"[40] making it impossible to deny "the intricate interconnections of urban and rural property, industrial and agricultural production, and industrial and agricultural labour and settlement."[41] Simply put, "The complications of this interaction [. . .] make it impossible for us to conceive a simple 'rural England' set over against a simple 'industrial England'."[42] By the end of *The Country and the City*, Williams seems quite willing to equate farming with capitalism, yet portrays country and city less as immobile ideals than as changing worldviews. The former describes a more natural way of living in the world, based on direct experience and respectful cohabitation with other living things, including other people; the latter harbors a profit-induced willingness to regard the natural world and other human beings as abstract entities amenable to total exploitation.

In the end, then, Williams foreshadows Conkin's sentiments, the latter's "sense of loss as the traditional farm is passing away, and with it the noncommercial, nonconsumer values that Americans purportedly once held dear."[43] Conkin, remembering his childhood on his family's farm and a time when "the ties between animals and family members were close, in a sense personal," both recalls and calls for a return to "farming on a small, human scale," as "more of a way of life than a means to gain profits, or as a form of artful engagement rather than just a job."[44] Both Williams and Conkin might be sympathetic to Martin Heidegger's claims in "The Question Concerning Technology," in which Heidegger deplores modern machinery and its ability to sequester the potential energy latent in nature to an unprecedented degree and oftentimes for nefarious uses, most pointedly in the case of modern physics. Like Williams, Heidegger distinguishes between cooperative forms of nature use, for instance the "old windmill," and those that relegate nature to the status of "standing-reserve" for humankind, like the hydroelectric plant. His emphasis on *techne* as poesis or artmaking over and against a kind of *techne* as mere craft or mechanical skill speaks to Williams's socially based distinction between bonded communities of people and land and the fragmentary, alienated masses characteristic of capitalism.

Despite their limited purpose as entertaining diversions, *FarmVille* and *CityVille* cannot help but contribute to that enduring and "unresolved division and conflict of impulses" Williams suggests that we only label rural and urban, country and city, past and future, out of conceptual convenience, or laziness. We would do well to remember that our terms economy and ecology both derive from the Greek root oikos, meaning household, and that the commonality is not merely linguistic—rather, it speaks to the necessary imbrication of the social and the ecological, the monetary and the natural. We cannot hope to make strides in one area without also making strides in the other.

Reimagining the Real-Time Strategy Genre

It is worth considering, in conclusion, what genre of game farm games belong to, and whether or not particular game genres, not just individual games, offer more or less environmental promise than others because of their core design principles. To my mind, farm games partake of several key game genres, though they are most often identified as part of the recent trend toward small-scale, "casual" and ostensibly "social" games on platforms like Facebook, MySpace, and Yahoo. When asked to define the nature of social games, over two dozen leading game designers and tech pundits came up with the following answers: "a game that has a very gentle learning curve, easy-to-understand UI, and lives on a social network, taking advantage of your friendships in meaningful ways within the game" (John Romero, the creator of *Doom*); "those where there is more emphasis/enjoyment playing with friends than there is playing against them. It's more about a shared, fun experience with bragging rights than classic 'winning'" (Ian Livingstone, President of Eidos); "games that use the platforms of the social web to propagate" (Tadhg Kelly, game designer).[45] Many of the respondents felt that "social games" was a clear misnomer, because "these games tend to feel very asocial, turning people into resources rather than friends and agents you have to negotiate and communicate with" (David Love, indie games conference organizer), while others took issue with what is largely Facebook's and Zynga's market capture of an entire realm of game interaction labeled "social" that in many respects better describes, say, a family gathering to play Wii Sports games in their living room, or a group of friends playing simultaneously (synchronously, rather than asynchronously) over a network on Xbox Live.

Many of these criticisms of social games' supposed sociality echo my own frustrations with the genre, particularly the lack of meaningful social interaction with friends who prove useful only as senders of in-game gifts and evidence of social status—for instance, in *FarmVille*, you cannot expand the perimeter of your farm unless you have a certain number of in-game neighbors (drawn from your Facebook friends list) or you consent to pay real-world money to bypass the limitation. Social games quickly begin to feel rather asocial when the interaction is limited to annoying, asynchronous requests for help and people-gathering for in-game advancement. Again and again, should you wish to pester your friends a little less or to succeed in the game without asking your third cousins, twice removed, to join you as neighbors, the obvious option is to pay to play. Thus these ostensibly social games become not only asocial but also aggressively monetizing, leveraging social discomfort or desires for privacy for profit. Not surprising, then, is this definition of social games from a managing director of a social game company in the United Kingdom: "A 'social game' is any game which uses the social graph to increase and improve the gaming experience, while utilising game theory and psychology to generate revenue from the active user base from a combination of virtual goods, advertising and offers" (Andy Rogers, *enteractive*).

My own contention is that farm games are thus a modified manifestation of the older, much more venerable genre of real-time strategy (RTS) games, the history of which has been well documented by Henry Lowood. RTS games themselves evolved from tabletop and turn-based

wargames, and their military simulation genealogy tends to reveal itself in the consistent focus on resource management, base- and army-building, and tactical combat against either AI or, more commonly now, other players. *Dune II* (1992) and *Warcraft* (1994), often recognized as the genre's founding titles, already exemplify the strategies involved in successful RTS gameplay: extractive mineral, gas, or oil mining, lumber harvesting, using peons or civilian workers, with resources then applied toward the construction of unit-producing structures (for example, a barracks for soldiers) or technology upgrades (research and development). Oddly enough, farming is not part of this picture, as the labor forces embodied by both army and civilian corps seem to require no sustenance or maintenance beyond the initial creation and training cost.

"Real-time" in this context simply refers to a style of play that is no longer about turn-based gameplay. The quintessential turn-based game might be chess—one player takes a turn, then the other, and on and on, and as Lowood points out, this leads to a very different experience of the game based on meditation and strategic thinking. In some sense, Lowood argues, the application of "strategy" to RTS games is something of a misnomer, as the "real-time" genre forces players to focus more on tactics, or "micro," at an often frenetic pace in which multiple theaters of action are unfolding simultaneously.[46] "Real-time" means both player and opponent are acting simultaneously—gaming is no longer a polite exchange of carefully calculated moves, but rather a loosely orchestrated melee that rewards quick thinking and muscle reflexes, attention to both "micro-" and "macro-" scales (terms that reflect the genre's unwitting adoption of economic metaphor). Most social games are not real-time (what pundits now tend to call synchronous), as their asynchronism is meant to appeal to casual game players who may not have the time or interest to play regularly or coordinate play times with others. Players of a word game like Lexulous, "the first breakthrough social network game,"[47] are thus free to exchange moves at their convenience, whether minutes, hours, or even days have elapsed between them.

Despite this important dissimilarity, I believe farm games, as a subset of social games, could be seen as a "civilian" outgrowth of the militarily oriented bulk of RTS games, because both kinds of games clearly model the extractive logics of resource use and development. Both stress resource gathering, structure building, and the manipulation of agential units, though in a brilliant or disturbing twist, depending on who you ask, social games have engineered actual people—whoever you are linked to in an online social network—into units, rather than giving you command of imaginary troops of soldiers. Though social game companies like Zynga would prefer that players regard their games as promoting positive social interaction, connecting relatives and friends across great distances, or providing the grist for the occasional friendly competition or challenge (of the "I beat my mom at X!" variety that Jane McGonigal adores), the games are lackluster models of the social contract, let alone the natural contract Michel Serres would prefer that we enact.

Farm games are also related to any number of other game genres, including hunting games, pet-care games, and "god" games, but each of these genres models a very different relationship between human and animal or human and environment. My intent is less to pin farm games to some eternal place in a genealogical tree than to tease out the various developmental influences that contribute to how such games model relations between humans and the natural world. Far from condemning hunting games as overly violent or gruesome, one might argue that they more effectively tear the veil between representation and reality, at the least making no bones about the kinds of outdoor experience being imagined. Others might claim, in the vein of Temple Grandin or Donna Haraway, that the closest understandings of nature and other species come through the relationship between a trainer and an animal, not at the other end of a rifle or fishing rod. Still others may prefer the visions of cosmic order or chaos made possible by sandbox games like *Spore*, *SimEarth*, or *Populous*, where the player is less a terrestrially bound being trying to muddle through everyday life than an omniscient, omnipresent deity hovering above the world like an invisible

puppeteer. Farm games' innate resemblance to "god" games is made evident by the fact that many of the games (*myFarm*, *Happy Farm*) bypass avatar use entirely in favor of a disembodied subjectivity either meant to represent the player herself or some godlike agency. In these games, the mouse pointer alternately becomes hoe, watering can, fertilizer bag, or pesticide spray, and the player's clicks translate directly to change on the field without the intermediary of a denim-wearing farmer or farmhand.

Game theorist and designer Ian Bogost, whose notion of procedural rhetoric I introduced earlier, has hilariously lampooned the entire genre of social games, with the farm game at its center, by designing and offering his own satirical Facebook game entitled *Cow Clicker*. *Cow Clicker* takes the farm game to its absurd extreme, removing any semblance of virtual pasturage and loving husbandry in favor of the most bare-bones care imaginable. The game is stubbornly 2D, appearing as a 3x3 grid on your screen, in which, at first, only one large, blocky, cartoon cow appears. Your only challenge is to click on the cow every six hours, in order to earn "Mooney," though should your friends join you in the clicking of cows, their cows will appear in your grid and benefit from your attentive clicking. Resembling little more than bovine Tic-Tac-Toe, *Cow Clicker* invites players to pay real money to customize their cow, turning it say, plaid or virulently purple, all in the name of meaningful individuality (my cow is a cheap, dusty yellow, because I barely have any Mooney). Bogost deliberately thumbs his nose at the laughably basic mechanics behind most "casual" or "social" gameplay—repeated mouse clicks, at arbitrarily set intervals (for example, in *FarmVille*, why does rhubarb takes 16 hours to mature while wheat takes 12? And raspberries 2? Who gets to determine that?)—and by making the game's commercialization so blatant, also pokes fun at the constant incentives to players to invest more heavily in their virtual agricultural experiences. What may be surprising is that millions of players have taken to *Cow Clicker*, whether in support of its antiestablishment ways or because of a genuine love for the game, leading the game to offer its own "swag" (*Cow Clicker* T-Shirts and mugs) and increasingly bizarre custom "skins" or graphics for its bovine avatars (my favorite is perhaps the ASCII cow, rendered entirely in punctuation marks).

Perhaps it is too easy to dismiss farm games as trite, all too evident attempts to milk players for money. Perhaps Ted Friedman was right to praise *FarmVille*'s gift economy, or what alternate-reality game (ARG) designer McGonigal has called "a virtuous circle" rather than the vicious ones we all abhor. While McGonigal has enough sense to admit that playing *FarmVille* is "not a good substitute for real interaction,"[48] she does believe that games can "build stronger social bonds and lead to more active social networks."[49] She urges the creation of games that generate "prosocial" emotions, as well as games that "make us part of something bigger and give epic meaning to our actions."[50] McGonigal's focus is on social interaction, what people or more specifically gamers can accomplish when they put their heads together, with the support of a game scenario or framework that helps them to organize their activity and measure their progress. My own concern with games as environmental constructs might add to this the importance of player context and perspective—less a desire to bypass human agency and intention than a call to wonder actively at the place of such agency within natural, physical environments, whether real or virtual. As we struggle to come to terms with the scale of environmental change and injury, games that make the leap from single-player to multiplayer, that channel the collective, social action of players toward more than just virtual farming or mafia wars, may show us the way past apathy and individual limitation.

The theoretical attentions that scholars and designers have recently lavished on digital games have more recently been substantiated by arts institutions like the National Endowment for the Humanities (NEH) and the Smithsonian network of museums. While Zynga's *FarmVille* may not find itself aesthetically enshrined any time soon, in 2011, the NEH revised its charter to include videogames as an art form potentially worthy of financial support. Digital games, mobile and interactive media, online content, and satellite-transmitted content may now compete with more traditional media like film and television in the "Arts in Media" funding category, which was once called the "Arts on Radio and Television." According to an NEH informational webcast about these changes, this reformulation will allow the NEH to fund "innovative media projects" that are "about the arts" as well as "those that can be considered works of art" (the latter is a noteworthy extension, since previously the NEH only considered projects that were about the arts).[1]

2012 subsequently marked the opening of trendsetting game exhibits at both New York's Museum of Modern Art (MoMA) and the Smithsonian American Art Museum in Washington, DC. While the MoMA exhibit falls under "applied design" in the Museum's architecture and design galleries and initially included only 14 acquisitions from 1980 through 2009, the Smithsonian's exhibit on *The Art of Video Games* sought broader coverage via an online nomination process begun in 2011. Members of the public were asked to vote for their favorite titles among those preselected by exhibit curator Chris Melissinos, all organized within a three-category matrix spanning five eras (roughly dividing the years between 1970 and 2010), four genres or game types (action, adventure, target, and combat/strategy), and numerous historically significant game platforms (systems created by the likes of Sony, Nintendo, SEGA, and Microsoft). In the end, the nomination website, www.artofvideogames.org, registered some 3.7 million votes from approximately 119,000 people over a two-month period, resulting in the selection of 80 games out of 240 potential choices.[2]

The Smithsonian exhibit offers a useful glimpse into one retrospective organizing rationale for the relatively short history of video games, revealing one set of assumptions about what makes games significant, or memorable, and why they should be preserved. Despite public input, the exhibit foregrounded rationales ultimately amenable to both industry and art establishments—video games as evidence of technological and aesthetic advancement. As stated in the document announcing the voting competition's winners:

> *The Art of Video Games* exhibition will explore the 40-year evolution of video games as an artistic medium, with a focus on striking visual effects, the creative use of new technologies, and the most influential artists and designers.[3]

For curator Melissinos, a longtime video game enthusiast as well as "chief evangelist" and "chief gaming officer" at Sun Microsystems, a key criterion in the overall classification scheme was game platform, which emphasized differences among various commercial game systems. This criterion had the effect of highlighting not only divergent corporate strategies, for example Nintendo's recent emphasis on interactive, family-friendly games versus Microsoft's emphasis on high-caliber graphics and networked play, but also the distinctive aesthetics of different hardware and software configurations, for example those of early 8-bit processor games, which have recently experienced a "retro," "faux 8-bit" resurgence as game designers willingly submit themselves to tiny memory constraints, pixellated 256-color palettes, and tinny "chiptune" sound in an attempt to recapture the essence of early classic video games.[4] Though the exhibition conspicuously omitted the growing ranks of mobile or handheld game devices in favor of traditional computer or console systems, the platform story remains one of proprietary gadget proliferation: not surprisingly, the first exhibit era, labeled "Start!", included only three platforms (Atari VCS, ColecoVision, and Mattel Intellivision) for a total of 12 category winners, while the final era, "Next Generation," expanded the number of platforms to seven, for a total of 28 winners.
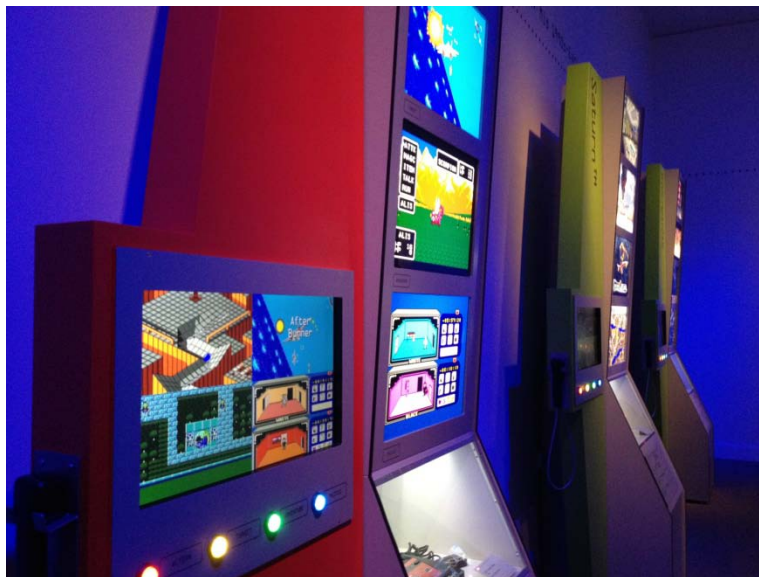

Figure 4.1. Games selected for exhibition in *The Art of Video Games*. Author photo.

Figure 4.2. Five seminal games (*Pac-Man*, *Super Mario Bros.*, *The Secret of Monkey Island*, *Myst*, and *Flower*) were featured as playable in the main exhibit space. *Flower* is shown here. Author photo.

The exhibit's organizing principles also included notably genealogical and formalist logics; in other words, the games were largely considered as products of both their historical period and their generic conventions. History's role, however, was etiolated, encompassing only a technological and commercial history divorced from larger social and political concerns. Though Melissinos insists that games are "a unifying, multi-generational medium,"[5] connections reaching across time and beyond the game object were largely left aside. While useful on an archival level, the Smithsonian exhibit's classificatory scheme neglects methodologies that approach games from outside the pale of technical game design and cut across generic expectations to look at games in terms of their broad cultural import. In the games that form the basis of this volume, environmental trends—even alarming ones—are prominently featured; where would such games fall in terms of the Smithsonian's action, adventure, target, and combat/strategy categories? These categories implicitly grant precedence to the player's role or goals in such games, rather than the games' environmental content. Though one could argue that the category names actually address players' varying relationships to game environments, for instance exploration in the case of adventure, or strategic mapping and military exploitation in the case of combat/strategy, this anthropocentric stress still fails to describe games that prioritize environment over player or games that promote modes of player engagement that extend beyond seeing and using.

Nevertheless, these high-profile steps toward the cultural legitimation of games are welcome ones, and even as games gain footholds in galleries, they are also taking to less circumscribed corners of everyday life. Most of the games discussed thus far have been commercial projects designed to entertain without necessarily challenging players to consider their relationship to environments, real or virtual. That many of them have accomplished the latter while pursuing the former speaks to the potential synergy of the two objectives: creating game environments that reward diverse modes of engagement and depict nature less as dumb show than interactive theater can generate more interesting and absorbing gameplay. What happens, then, when a game takes the real world as its playable space? Or when a game takes on actual problems, for instance, health risks or the ever more elephantine carbon footprints of American consumers? Do these kinds of games contradict my initial contention that a game's environmental realism does not always correlate with its fidelity to

real environments, or that any game, no matter how simply rendered, may be read as an environmental text? While proponents of unmediated natural experience, like author Richard Louv, might be tempted to automatically grant such games a key advantage in addressing environmental ills because they follow a paradigm based on direct, physical interaction with the real world overlaid with a game-like scenario, I am reluctant to grant them an inherent superiority over exclusively digital games. Furthermore, the current industry trend toward "gamification" of everyday operations from marketing to personal care represents a desire to coopt the attractions and motivational efficacy of games in an indiscriminate manner that may ultimately prove detrimental to games' civic value.

Before we turn to the increasingly high-profile genre of "serious" games and its intersections with so-called alternate-reality games (ARGs)—that is, games that deliberately tackle social and political content and render permeable the usual barriers between game world and real world—it is worth returning for a moment to Lawrence Buell's four criteria for literary "environmental texts" and the ecomimetic conundrum posed in Chapter 1. While writers like Dana Phillips and Timothy Morton see mediation as the central issue for the constitution of environmental literature, Buell's criteria neatly sidestep the debate by invoking the language of "interests," "accountability," and "process"—like Latour's parliament of things, the environmental text is as much legal as literary, and its efforts at "representation" must be understood as both a signifying and a speaking for. Rather than hitch a text's environmental quality to its ability to immerse a reader in a linguistically performed natural setting, Buell assesses the rigor of the text's ethical and ecological attachments. Succinctly put, Buell suggests that the environmental text is less about personal than intersubjective experience. In it, environments are more than the objects or scenes of human action, but dynamic agents in their own right as well as the loci for shared human understanding.

My approach to game environments is noticeably similar. I am less concerned with graphical fidelity, the kind of realism that comes with hundreds of hours of painstaking, 3D modeling work by artists using expensive software packages, than with responsiveness and responsibility—an accuracy regarding the kinds of relationships that inhere between humans and their environments and between elements within those environments, whether or not humans are present. Though I am not proposing that serious games and alternate-reality games are the most effective means to bring environmental considerations to the forefront of game design and experience, they certainly offer some promising avenues. They may also furnish important limit cases for games' potential to cross over into more explicitly civic and political arenas.

After providing a general outline of the development of both genres, I will deal specifically with the location-sensitive health games of new media artist Greg Niemeyer, including *Black Cloud* (2008) and *AirQuest* (2013), as well as environmental "what if?" games like *World Without Oil* (2007), produced by San Jose-based writer Ken Eklund and the Independent Television Service (ITVS), with support from the Corporation for Public Broadcasting. Niemeyer's games integrate players into urban environments in ways that create awareness of pollution sources and disease vectors while generating methods of coping and response, while games like *World Without Oil* invite players to make present realities out of potential ecological futures. Extending the broad range of game types and player participation models already covered thus far, I turn now to the impact of new forms of networked interaction on the ecological instruction that games can provide, including the leveraging of social networks, mobile or handheld devices, augmented-reality applications, and a few relevant objects for comparison: a German nondigital environmental board game called *Power Grid* and a game-like, interactive art installation called "Polar Ice."

Of Bees and Beasts

While serious games can take many forms, only one of which is the alternate-reality game, I consider the two types here together because both deliberately collapse traditional barriers between real life and gameplay, or ordinary and extraordinary realms of interaction. For some, serious games' explicit handling of real-world problems automatically disqualifies them from status as games, whether because the playing is not entirely voluntary (as in the case of occupational training games) or because the games lack a strong sense of an imaginatively removed "magic circle" that demarcates play while excluding normal life. Serious games often fit more comfortably under the auspices of art or education than recreational gaming, a classificatory quandary evident in the very paradox of the term "serious game." Examples include the scientific protein-folding game, *Foldit*, developed by researchers at the University of Washington, and journalistic and political newsgames of the kind found at newsgaming.com, for instance the deceptively simple commentary on the war on terror implied in *September 12th*.

ARGs do not necessarily engage directly with social issues, like serious games, but they do even more to blur the usual boundaries between game worlds and real world. Though the ARG genre clearly has ties to many earlier game and story forms, including tabletop and live-action role-playing, theater, scavenger hunt, and conspiracy theory, ARGs are widely considered a product of the new millennium. Many experts cite the 2001 game *The Beast* as the first of its kind, and also credit it with setting the genre's as yet unsurpassed high-water mark. Microsoft and DreamWorks commissioned the game as an innovative promotional device leading up to the June 2001 release of the Steven Spielberg film, *Artificial Intelligence* (*A.I.*). Never officially announced as such, *The Beast* and its principal "puppetmasters" (Sean Stewart, Elan Lee, and Jordan Weisman) instead relied on suspicious clues embedded in the movie trailer and poster to bring curious players into the game itself— ludic and narrative introductory devices known as "rabbit holes," an expression that pays homage to the similarly fantastic world-crossing in Lewis Carroll's *Alice in Wonderland*. As it turned out, the film *A.I.* disappointed both critics and moviegoers while *The Beast*'s penultimate entertainment was lauded as an unparalleled success, having captured the nearly undivided interest of over 10,000 players over a period of nearly two months, many of whom went on to become loyal adherents of the genre.

Now little over a decade old, the growing ARG community has witnessed a succession of failures leavened by occasional triumphs. ARG designer Dave Szulborski (*Chasing the Wish* and *Urban Hunt*) describes the commercial entertainment landscape as littered with poorly developed attempts to leverage an ARG as transmedia mass-marketing campaign, including *Push*, *TerraQuest*, and Electronic Arts' *Majestic*. Fortunately, another highly successful ARG and touchstone for future work arrived in 2004 with 42 Entertainment's *I Love Bees*, developed in advance of Microsoft's game *Halo 2* for Xbox Live. Intended to foster "a narrative bridge" between the first *Halo* game and its sequel, *I Love Bees* presented a fragmentary story of an alien intelligence forced to express itself through human communication systems.[6] Then lead community designer, now veteran puppetmaster and game designer Jane McGonigal describes *I Love Bees* as "a Web-based interactive fiction that used websites, blogs, emails, jpegs, Mp3 recordings, and other digital artifacts to create an immersive back-story for Microsoft's sci-fi shooter videogame *Halo 2*."[7] In a published case study, "Why *I Love Bees*," McGonigal stresses the ARG's functions as "a game-based digital learning environment", or "a kind of investigative playground", and as "a tutorial in CI [collective intelligence]".[8]

This last mandate stems directly from French theoretician Pierre Lévy's writings on collective intelligence as a new, technologically driven stage in humanity's development.[9] McGonigal suggests that alternate-reality games are ideal vehicles for teaching today's youth the strategies and

skills necessary for success in a networked media- and technology-saturated global communications environment. These would include "the ability to parse complicated problems into distinct parts and a facility for real-time virtual coordination" and the recognition of the need for "differentiation" or specialization, given that large-scale problems generally prove greater than any one individual's capacity to solve. Moreover, McGonigal imagines a collective intelligence curriculum that would also allow students to acquire competency with modern software and hardware tools—to "develop a new kind of digital network literacy, one specifically tuned to the techniques, challenges and rewards of massively-scaled collaboration."[10]

Players puzzled by the game's repeated references to beekeeping eventually discovered that the industrious flying insects had no relation to the *Halo* universe but everything to do with the requisite methods of information gathering and collaborative detective work. Bees served as a metaphor for the player collective, and a signal from the game's designers to its players that extensive organization and coordination was necessary to achieve their goals. Without their "hive mind",[11] the game's more than 600,000 players would not have been able to assemble and decode the game's massively distributed and deconstructed content, "revealed in clue-sized pieces over the course of four months across hundreds of web pages, dozens of blog posts, thousands of emails, and over 40,000 live Mp3 transmissions."[12] Significantly, not all game content was made available to every player; many bits of the storyline were offered only to players in certain regions, either via IP address identification or calls to public payphones in very specific locations suggested by GPS coordinate data. As a result, players labored to collect and interpret thousands of fragments of the *I Love Bees* storyline, often separating into teams based on methodology or geography, in line with Lévy's particular emphases on knowledge sharing and a holism that preserves distinctions between its parts.

To comprehend why ARGs have proven so compelling, we might turn again to ARG designer Dave Szulborski, who argues that the terms "alternate-reality game" or its common synonym "immersive game" are, in fact, largely misnomers.[13] Well-crafted alternate-reality games, he writes, actually do their best to disguise the fact that they are games, attempting to blend into players' real daily activities in a seamless fashion by using media and communications devices such as print, cell phones, and the World Wide Web that players already routinely use in the course of their normal lives. Referring to classic definitions of games that highlight their necessary separation from the ordinary, for instance Johan Huizinga's notion of the ritualistic "magic circle," Szulborski notes that ARGs actively work to conflate "real life" with the played universe, encouraging players to see the game as actuality rather than an alternate or immersive reality (in the sense that it transports you away from normal life or makes you lose your sense of immediately present physical reality).

ARGs tap the inherent power of good storytelling along with the simultaneous instantaneity and anonymity of the Internet and related communication forms—text messaging, instant messaging/live chat, email, web sites, video clips, phone calls, even discoverable crafted artifacts—in order to engage participants in play that is seemingly not play, or what Szulborski identifies as the "This Is Not A Game" (TINAG) philosophy. Unlike most traditional computer or console games, ARGs at launch are often only partially scripted. In other words, ARG puppetmasters leave themselves ample room to accommodate both major and minor alterations in plot, character and puzzle design, and pacing, as players may fall short of or exceed expectations. In the case of *I Love Bees*, certain players proved startlingly successful at working out a fictional programming language used in the game, playfully dubbed Flea++ in reference to both an in-game character and the popular C++ programming language. Though Flea++ was never intended to be fully functional, players' remarkable efforts to breathe life into the language led puppetmasters to add late-game challenges that drew from the players' own Flea++ wiki lexicon. This constant interplay between game designers (including writers, community leads, actors and actresses, artists, and so forth) and

game players, in which the emergent skills, expectations, and demands of the participant base influence game outcome and structure, Szulborski calls "interactive authoring" and McGonigal calls "real-time redesign".[14] In their flexible capacity to evolve over time, ARGs are in one important sense close cousins to social and casual games like Zynga's *FarmVille*, which are often released in unfinished form or kept in perpetual beta, incorporating player feedback and distributing new content in a "just in time" fashion. Just as ARGs diminish the standard line between reality and simulation, they also trouble any hard and fast line between game design and gameplay.

Curiously, while many ARG purists stipulate that a true ARG can never publicly declare itself *as* a game, some ARGs, particularly commercial rather than independent enterprises, have deliberately announced their releases on sites like the Alternate Reality Gaming Network (argn.com) or in publications like *Wired*. Szulborski indicates that this may have been an attempt not only to guarantee a following but also to preempt potential legal complications in our notoriously litigious society. Some may find it quite surprising that ARGs have not encountered greater difficulties with either players or bystanders, given that such games often rely on personal contact with the player that is not predictably inscribed within a game world. In theory, problems might arise if a player mistook the game for real-life, or vice versa. Do immersive games represent the best of both worlds?[15] Or are ARG proponents sidestepping the obvious dangers of conflating real and virtual worlds, from relatively innocuous cases of mistaken identity to psychologically fraught episodes of delusion or paranoia, of the kind taken to a terrifying extent in a film like David Fincher's 1997 thriller, *The Game*, starring Michael Douglas? ARGs lack both clear physical and temporal demarcation, of the sort provided by an on/off switch or the logon/logoff//login/logout events in a virtual world like *World of Warcraft*, so some games, like EA's *Majestic*, actually limited game progression by introducing new content according to a schedule of predictable daily doses, though with less than stellar results.

In an earlier essay, "'This is Not a Game': Immersive Aesthetics and Collective Play," McGonigal discusses a particularly organized group of immersive gamers, known as the Cloudmakers, which formed in response to *The Beast*. What McGonigal notes as most interesting is the Cloudmakers' desire to apply their collective organizational and intellectual expertise to problem areas outside of the initial game—once *The Beast* was over, many Cloudmakers continued to long for engaging problems to which they could apply their "hive mind," and surprisingly, this included well-intentioned attempts to "solve" the 9/11 terrorist attacks as well as the mysterious Washington D.C.-area sniper attacks in the fall of 2002. While the Cloudmakers were not successful in either scenario, and in fact argued amongst themselves over the morality of treating real-world crises as game-like puzzles, McGonigal suggests that the Cloudmakers' willingness to try nonetheless challenges the common stereotype of gamers as politically and socially disengaged escapists.

Location, location, location

To return to the framing question of environmental representation, I would emphasize that one key to the apparent draw of immersive games is their ability to put real environments at the service of a game state, an unusual but ultimately captivating meeting of physical space and virtual place. McGonigal places this juxtaposition at the heart of the alternate-reality game's absorbing qualities:

> [. . .] the immersive aesthetic proposed by the Beast sought to use *natural settings* as the immersive framework. Rather than creating virtual environments that were (hopefully)

realistic and engaging, the Beast's producers co-opted real environments to enable a virtual engagement with reality.[16]

Put another way, we could say that ARGs bypass the inherent representational limitations of virtual environments by using real environments in a virtual manner; or, we might linger just as productively on the humble "this" in the TINAG formulation as on the much-contested "game."[17] A linguist would label this "this" as a proximal demonstrative pronoun, meaning that it refers to something near at hand (as opposed to the distal "that") and replaces the given noun in a deictic fashion, in effect referencing or pointing to the contextual situation. We might argue that "this" is really "this" and "that" in the case of ARGs—both the physical, phenomenologically real experience of the player in a location and the virtual discourse networks and imaginative overlays of the storyline. Perhaps the "this" of the player's world balances or gives substance to the less tangible digital and narrative frameworks of the "game." As I will discuss momentarily, ARGs may offer one innovative approach to environmental and sociopolitical tensions between local and global scales, as they both transpire in players' home communities and leverage worldwide information and communication networks.

World Without Oil

Consider the "serious game" *World Without Oil* (*WWO*), which in 2007 over the course of 32 days simulated a 32-week global oil crisis, challenging its players (who played themselves) to imagine an alternate reality uncomfortably close to our present times, in which demand for oil has risen five percent over supply. Taking as its motto the dictum "Play it—before you live it," *WWO* asked its participants, including many educators and their students, to "play" by submitting narratives of their own methods of navigating the crisis. Some planted gardens, others biked to work; some bought hybrid vehicles, others embraced biodiesel, and so on. *WWO* was never solely the stuff of bits and bytes, and that was, perhaps, the reason for its success—while players toiled endlessly on the worldwithoutoil.org website to share photos, stories, videos, and more, ultimately gameplay demanded a deliberate conflation of on- and offline social networks, environmental imagination and lived experience.

Recalling my discussion of flow in relation to Jenova Chen's work in Chapter 1, McGonigal explains in her recent book, *Reality is Broken*, that "The variety and intensity of feedback is the most important difference between digital and nondigital games. In computer and video games, the interactive loop is satisfyingly tight."[18] Another trait that distinguishes "historical, predigital games" from contemporary ones is the latter's sense of "ambiguous play";[19] we often enter into modern games without knowing exactly what we need to do, without referring to instructions, and figure out the rules as we go along. McGonigal also stresses the findings of positive psychology, particularly the work of Mihály Csíkszentmihályi. While the adult world stresses "extrinsic rewards," that is, "money, material goods, status, or praise,"[20] games provide intrinsic rewards, "the positive emotions, personal strengths, and social connections that we build by engaging intensely with the world around us."[21]

A game like WWO encourages its players to see the real world as a problem space capable of supporting innovative environmental solutions. In a way, the game defamiliarizes (whether in the Brechtian or Russian formalist sense) the mundane, everyday character of our surroundings and our actions in them by imposing a narrative and a procedural interface that in this case highlights the follies of reliance on fossil fuels. Games need not be "serious," however, to draw on and influence "real" life. In "Will Wright: Games Invade Real World," Forbes contributor Brian Caulfield summarizes Wright's predictions about the future of games, quoting from an interview given at a Web 2.0 expo in San Francisco in April of 2009:

Wright sees games moving toward tighter connections with a player's real-world identity, latching onto social networks and reflecting what is going on in a gamer's real life. "We're starting to see more and more games where who you are matters," Wright said. "You can map things on top of that world and play games."

According to Caulfield, Wright cites as an example the Nintendo Wii console, which acts as a platform for what he calls "non-immersive" games. "Wright also wants to use games as just a starting point for exploration and creativity outside of games," notes Caulfield, who then cites Wright's willingness to open *Spore*'s massive creature database up to alternative inspirations: "'We're putting up an API [application programming interface] so players have access to that database so they can build their own applications,' Wright said. 'Spore,' the game is just one instance of what you can do with that data set. In some ways, I want this data set to be the nexus of this community."

Black Cloud

In part inspired by *World Without Oil* and the *Continuous City* work of The Builders Association, directed by Marianne Weems, *Black Cloud* began as a game proposal for the Digital Media Learning Competition sponsored by the MacArthur Foundation. Designed for high-school students in south central Los Angeles and downtown Cairo, Egypt, *Black Cloud* was described as "a game, where students study local air quality by searching for secret neighborhood air quality sensor stations based only the air quality data the sensors transmit."[22] Game organizers argued that their goal was to "bring suspense to environmental studies," bringing game mechanics and narrative devices to real-world scenarios. Participating students were challenged to try to determine the sensor locations, get to know their local neighborhoods, and contribute content to the game web site, with the top contributor receiving an award that included funding for pollution abatement. University of California, Berkeley researchers Greg Niemeyer, Ilse Mercado Ruiz, Laura Greig, and Stephanie Gerson developed the game in collaboration with two institutions in the chosen cities (Manual Arts High School and El Sawy Cultural Center).

Seen as a form of "pedagogic innovation" and an intervention into traditional climate change studies, the game was billed as "an alternate reality mystery game" using "the framework of a fictional contest between green NGO's and market-driven real-estate companies." The mystery itself is climate change, notorious for being difficult to pinpoint and understand in local terms; however, the mystery is also the fictional scenario provided by the game organizers: why has the fictitious real-estate company, the Xylon Corporation, destroyed most of the sensors provided by the equally fictitious charity organization, First Breath? And who are the "sentients" or neighborhood residents that have tasked themselves with safeguarding the remaining sensors?

Figure 4.3. One of the air-quality sensors used in *Black Cloud*, an environmental alternate-reality game.
Image courtesy Greg Niemeyer.

The wireless air-quality sensors used in the game were built to detect and transmit information about ozone, carbon monoxide, and carbon dioxide levels, along with temperature, and were placed strategically at critical locations like highway ramps, gas stations, supermarkets, and construction sites. The students, or "agents," in the game were tasked with determining the sensor locations by correlating the fluctuating data with real-world activities. For example, a spike in sensor levels might correspond with rush-hour traffic.

AirQuest

In October of 2011, I joined a project initially called *Pwning Asthma Triggers*, funded by a seed grant from the Center for Information Technology Research in the Interest of Society (CITRIS), a multi-campus initiative in the University of California system.[23] Directed primarily by professors in Art Practice, Engineering, and Atmospheric Science from UC Berkeley and UC Merced, including *Black Cloud*'s Greg Niemeyer, the development team proposed a short, online role-playing game aimed at educating at-risk individuals about the causes and dangers associated with environmentally triggered asthma—in particular anthropogenic air pollution. As an interdisciplinary project, the game's novel take on the growing field of "serious games" was its potential to incorporate actual scientific data collection.

The first game prototype was developed in 2012 for the city of Fresno, California, located in the heart of the San Joaquin Valley, the southern portion of California's Central Valley.[24] The Central Valley constitutes one of the nation's primary agricultural production regions, and Fresno, once a small railroad town, is now a city of approximately half a million residents and a hub for agricultural processing and industry. This has earned Fresno the dubious distinction of being called the "asthma capital" of the state by a local paper, *The Fresno Bee*, while official evaluations of the area's asthma problem have called it an "epidemic," as in the 2004 report "Struggling to Breathe: The Epidemic of Asthma Among Children and Adolescents in the San Joaquin Valley," produced by the Central California Children's Institute at California State University, Fresno. Extensive data has also been collected for particularly vulnerable populations, as by the Fresno Asthmatic Children's Environment Study (FACES), over a period of eight years from 2000-2008, sponsored by the UC Berkeley School of Public Health.[25]

In January of 2012, the development team made the first of several research visits to the city of Fresno to begin meeting with local residents and community leaders. We hoped to learn more about asthma and air-quality issues by interviewing and eventually conducting game testing with a range of relevant focus groups: a family with at least one member suffering from respiratory ailments, a class of students from Fresno High School, a coalition of health advocates, and an occupational group especially impacted by poor air quality. In the end, we consulted with all of these groups and more, attempting to balance activist and public perspectives with those espoused by official employees of the San Joaquin Valley Air Pollution Control District.

What emerged from this unusually research-intensive game-development process was *AirQuest*, what we cheekily like to call a *civic*-action game (not just an action game) designed to motivate young people ages 12-24 to learn more about air-quality issues in their local communities, as well as the triggers and risk factors for asthma. Unlike most games, *AirQuest* represents a specific geographic and sociocultural reality, highlighting the irony that though the Central Valley is one of the most productive agricultural regions in the nation, it faces high unemployment and poverty levels and severe air-quality problems arising from the Valley's unique topography and weather. In fact, according to the California Air Resources Board, ozone and particulate-matter (PM) air pollution in the Valley is among the worst in the state. In addition to its regional specificity, *AirQuest*'s primary innovation lies in making scientific models and data—from regional wind patterns to Environmental Protection Agency (EPA) sensor readings—accessible and playable to non-specialists. The game's main character, Kean, is a 14-year-old high school student with asthma, who initially feels weak and isolated as a result of his condition. As the game progresses, Kean learns to manage his asthma, decode climate maps, and neutralize common air pollutants, and ultimately to see asthma as a special form of environmental intelligence. The game thus shifts perceptions of air pollution and asthma away from the realm of negative, individual experience to that of an immediate and concrete issue for everyone who breathes.
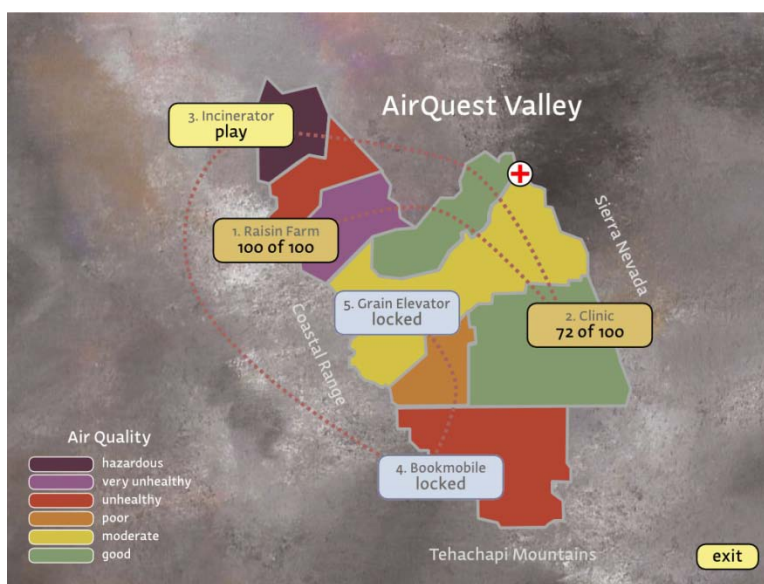

Figure 4.4. The *AirQuest* in-game map depicting the eight counties of California's San Joaquin Valley. Image courtesy Greg Niemeyer.

Though the Pew Internet & American Life Project has released several suggestive but inconclusive reports about possible links between teen gaming and civics, our prototype playtests

with almost thirty Fresno High School students and survey questions administered before and after exposure to the game revealed some limited, but intriguing results.[26] For instance, although over 90 percent of the respondents acknowledged that they knew an asthmatic friend or family member, most also felt that they knew only a modest amount about air-quality issues in the region. And despite having lived in the Valley their entire lives, most of the students felt little civic empowerment, gauged by the question "Do you feel like your knowledge and/or actions can make a difference in your community?" Only 22 percent of students answered with a yes, while the vast majority (70%) returned a cautious maybe. Our ultimate hope is that *AirQuest* may effect a positive change in these kinds of attitudes, though I suspect that our process of collaborative game design, with professors and students from the University of California system visiting high-school classrooms and soliciting student feedback on repeated occasions, may have generated a more robust outcome than the game itself. For me, *AirQuest* provides ample evidence that game development need not be divorced from social and environmental realities, and that even unfinished games can be invaluable pedagogical tools.

  AirQuest is now slated for release sometime in 2013, first as a downloadable game for the Apple iPad series. It will be one of many recent outgrowths of the new Social Apps Lab at the University of California, Berkeley, which "focuses on the potential of cell phones and other mobile locative media to harness the participatory energies of gameplay to address social issues."[27] The Social Apps Lab has already developed a number of cell phone apps for healthcare, participatory citizenship, and social engagement, including *Pathways*, a game version of the Purdue Pegboard test used to help rehabilitate patients with brain injuries, and *Dengue Torpedo*, a service directed toward identifying and eliminating breeding sites for the mosquitoes that transmit dengue fever.

Power Grid
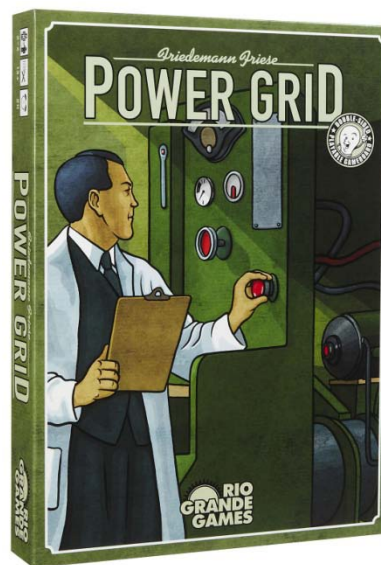
Figure 4.5. The German energy-management board game *Power Grid*.[28]

  Though my primary focus has been on digital games, it is well worth acknowledging that many traditional and non-traditional non-electronic games have sallied into the environmental arena. While Ian Bogost limits his consideration of procedural rhetoric to software, an artist like Mary Flanagan has usefully extended game studies both historically back into the 19th and early 20th centuries and generically, to include everything from doll play to improvisational and situational

theater.[29] Fortunately, Bogost's treatment of procedure and process can easily be extended to other media, given that much of our experience in the world is driven by "rule-based operations." (Of course, Bogost actually refuses to explore procedurality on the level of code, instead preferring to treat games as the black boxes that most consumers confront following purchase.) For an example of non-digital procedural rhetoric, one can take the board game *Power Grid* (2004), developed in Germany, not incidentally the home of one of the most active Green Parties in the world. The most recent version of *Power Grid* is described on the Rio Grande Games website as follows:

> The object of *Power Grid* is to supply the most cities with power [. . .]. In this new edition, players mark pre-existing routes between cities for connection, and then vie against other players to purchase the power plants that you use to supply the power. However, as plants are purchased, newer more efficient plants become available so you're potentially allowing others to access to superior equipment merely by purchasing at all. Additionally, players must acquire the raw materials, like coal, oil, garbage, or uranium, to power said plants (except for the highly valuable 'renewable energy' wind/solar plants), making it a constant struggle to upgrade your plants for maximum efficiency while still retaining enough wealth to quickly expand your network to get the cheapest routes.[30]

Clearly, just because a game does not use transistors or computer chips does not mean that it is not procedural. *Power Grid* is still turn-based and rule-driven, though it may place more of the onus of execution on its human players. Moreover, *Power Grid* embeds a variety of arguments within its procedures: in its operational universe, demands for energy must be met, cities are the most valuable nodes in an energy network, and environmentalism can be profitably melded with capitalism. In *Power Grid*, power is power—success lies in the canny use of natural resources, and those living off the grid might as well be nonexistent. The game has become successful enough to support the production of several board expansions. The original board modeled Germany on one side and the United States on the other. This was quickly followed by boards representing Benelux and the Netherlands, France and Italy, and most recently, China and Korea.

Altered States

While contemporary computer and video games are clear examples of digital interactivity, they certainly do not exhaust the interactive potential of the digital medium. At the end of September 2008, the California Academy of Sciences in San Francisco's Golden Gate Park reopened its doors after a nearly decade long, $500 million-dollar renovation that made the historic institution, founded in 1853, into a Platinum-rated Leadership in Energy and Environmental Design (LEED) building according to the U.S. Green Building Council. Home to a planetarium and aquarium, the Academy also encompasses the Kimball Natural History Museum, which greeted visitors in late 2008 with a variety of new exhibits. A large portion of the main hall was devoted to a section entitled "Altered State," which turned out to be a play not only on consciousness as a state of mind but also the implications of climate change for the state of California, already internationally known as a leader in environmental initiatives. Dr. Peter Roopnarine, an Academy scientist, served as lead curator for the exhibit, and Jonathan Katz, CEO of Los Angeles based Cinnabar Inc., worked as the executive producer for the new exhibits. According to Katz:

> Climate change doesn't have a fixed outcome—what we do as individuals and as a community will affect the next part of the story. That's why it was important to design and produce the new "Altered State" exhibits—which account for 10,000 square feet of the 35,000 square feet of exhibits we created for the new California Academy of Sciences—as a

participatory guest experience. The issue becomes real in terms of people's daily lives—the choices we make—and how we perceive California.[31]

Part of a module called "melting snow and ice," one activity was called "Polar Ice: Critical Zone" and took place within an approximately 12 x 7 screening area. The focal wall supported the projection of a northern sea populated by broken ice floes. In one corner stood a female polar bear, in the opposite, her cub, and rising worldwide temperatures had apparently fragmented the once contiguous ice sheet and separated the two from each other. To save the stranded cub, visitors were encouraged to use their bodies in interactive ways to "block" the sun's (projector's) rays, thereby casting cooling shadows on the image. Where a shadow falls, the sea's surface temporarily hardens, and once enough visitors work to link their shadows, the hapless cub bounds across the restored ice to his waiting mother.

The exhibit reproduces one of the signature wounds of the contemporary environmental imagination—the idea that climate change, which has had the most dramatic effects at the Earth's poles, has had a disproportionately negative effect on the species that rely on pack ice and subfreezing temperatures in their Arctic/Antarctic zone. The polar bear drifting hopelessly on a lone berg of melting ice in the middle of a thawing sea has been popularized by Save the Earth Foundation and National Resources Defense Council campaigns, commercials for the Nissan LEAF, and a nature feature film like *Arctic Tale* (2007). But in marked distinction from helpless viewing of advertisements where a lone polar bear is shown adrift in an ice-less ocean, visitors to the Academy exhibit felt empowered to take action. Stretching their arms in the air or waving bags and clothing to block as much of the "sun's" rays as possible, participating visitors turned the exhibit into a kind of impromptu shadow choreography, a solution that was both playfully collaborative and active.

Environmental Aesthetics and the Procedural Sublime

"[. . .] really part of this is about bringing the beauty of this, of the natural world to somebody, in very imaginative ways [. . .]."

Will Wright, admiring *Spore*'s galaxy
in motion during his TED talk

While most of us rely on an elementary opposition between "natural" and "built" environments, such an opposition can be immediately problematized by the classification of the virtual environments of games. Such environments are both built—that is, graphically rendered in great detail and programmed to operate within certain physical constraints (for instance, gravity and the use of collision detection)—and natural, in that they tend to mimic environments we encounter here on earth. Most games also employ dual aesthetic and functional approaches to their environments: first, as vivid, immersive spaces of the kind present in virtual worlds, primarily defined by rich visual quality, and second, as embodiments of procedural arguments writ large, in the Bogostian sense. Unfortunately, as demonstrated by my earlier analysis of real-time strategy games, the majority of games adopt a procedural rhetoric that is markedly utilitarian, within which game environments are primarily zones populated by resources for player extraction. Thus, both the aesthetic and functional approaches offer distinctive benefits and dangers—the former encourages a sense of wonder and artistic appreciation, but threatens to relegate the environment to pictorial backdrop; the latter allows the environment to move beyond mere setting or scenery by inviting interaction, yet often constrains gameplay to the instrumentalization of nature. In other words,

nature as a game space solicits both exploration and use, but the scale of player action can range from passive absorption to active exploitation. Granted, environmentalists and scientists alike might cringe at the oversimplification of the biological, chemical, and physical composition of ecosystems in favor of frameworks of economic gain, but at the same time, allowing the natural environments of games to rest on the level of picturesque calendar images represents an important missed opportunity to proceduralize nature in ways that demonstrate its fragility, complexity, and growing dependence on human foresight.

Contemporary developments in environmental aesthetics reflect these divergent approaches. As charted in *The Aesthetics of Natural Environments*, environmental aesthetics has undergone a recent resurgence after being almost entirely subsumed by the nineteenth- and twentieth-century trend toward seeing art objects as the only proper recipients of aesthetic interest. Editors Allen Carlson and Arnold Berleant lament "the ascendance of works of art and the decline of landscapes as paradigm objects of aesthetic appreciation" and the corresponding offense of "virtually equating philosophical aesthetics with philosophy of art."[32] According to them, dismayed reaction to this trend was first expressed by Ronald Hepburn in his 1966 article "Contemporary Aesthetics and the Neglect of Natural Beauty," followed by Carlson's own call for finding "a central place in the aesthetic appreciation of the natural world for the knowledge provided by sciences such as geology, biology, and ecology."[33] What has emerged is a division between cognitivists like Carlson who call for approaching nature with knowledge of what it is and how it works, and those who call for a more intuitive and emotional response to the natural world, as epitomized by Berleant's "aesthetics of engagement."

At first glance, Carlson's method more closely reflects a functional approach to game environments, resembling both Ian Bogost's determination to unravel game logics on the procedural level and Will Wright's description of software toys as being able to recalibrate our perceptual powers. However, Berleant's commitment to an aesthetics of environment also leads to some rich insights into the potential player/environment relationship in virtual worlds, problematizing the traditional form/function boundary in its own distinctive way. Berleant's own *Aesthetics and Environment* assembles essays published over the course of almost twenty-five years, all in some way concerned with the aesthetics of "natural" and "built" environments, as well as what Berleant calls "social aesthetics."[34] As even the first chapter makes clear, Berleant favors a phenomenological approach to the human relationship to environment. In his words, "the perception of environment is not of an alien territory surrounding the self. The environment is rather the medium in which we live, of which our being partakes and comes to identity."[35] This sense of the contiguity of perceptual space and time with the self is taken up again in a later chapter, cheekily titled "Is there Life in Virtual Space?" In this essay, Berleant points to the increasing dynamism of modern space/time as influenced by technologies like film, telephones, and e-mail, as well as by the theories of modern physics. For him, "A contemporary transcendental aesthetic is therefore incomplete without adding motion to space and time."[36] Here, he also takes to task the term "virtual" in reference to computer and electronic environments—in his mind, calling such spaces and times "virtual" opposes them to the "real" and contains the implicit and dubious value judgment that the "real" is to be preferred. Regarding something as "virtual," he says, does not do justice to our perceptual experiences of such environments—in fact, "there is actually no virtuality at all, and [. . .] what we have are actually different modes of reality." Ultimately, Berleant wants to dismantle "All those forms of ontological priority that infest the realm of art as well as the realm of ordinary life, all those discriminations that devalue great regions of experience by dismissing them as dream, illusion, imagination, wish, fiction, or make-believe."[37]

Berleant also investigates the theoretically fashionable notion of "place" and attempts to find its various determinants. Again, his phenomenological (and thus essentially anthropocentric)

leanings lead him to conclude that "human focus is what distinguishes place from the surrounding space or from simple location."[38] In other words, "it is in the interaction of human sensibility with an appropriate physical location that place acquires its distinctive meaning."[39] Berleant's concept of aesthetic experience is accordingly based largely on the powers of human perception—for him, "Aesthetic perception" is "not a purely conscious act and not a merely subjective occurrence; rather it is grounded in the human body and the existential conditions of human life."[40] While it is possible to question the emphasis on "physical location" and human agency, for instance, from the vantage point of actor-network-theory or deep ecology, Berleant's analysis does provide one way to understand a player's experience of virtual environments. It also brings to mind studies of virtual worlds that have likened them to "third places," sociologist Ray Oldenburg's term for public, civic spaces such as coffeehouses and bowling alleys where society enacts itself outside of the first and second places of home and office. Constance Steinkuehler and others have even suggested that virtual worlds are increasingly replacing traditional third places in the building and maintenance of family and community, through social organizations such as in-game guilds or clans. However, such sociological theory has had notably less to say about how virtual environments influence social interaction, both within the game and beyond it.

The work of Carlson and Berleant thus provides some foundation for an understanding of virtual environmental aesthetics. First, Berleant's refusal to distinguish or to privilege the real over the virtual grants equally important perceptual status to digital environments, and his phenomenological methodology places the emphasis on the human's interaction with any environment, be it virtual or real. Berleant also treats the environment as a medium, a move that allows us to consider game environments in light of scientific and media theories more generally. Meanwhile, Carlson's beliefs dovetail nicely with Galloway's notion of algorithmic culture—the idea that scientific knowledge can enhance our aesthetic appreciation of natural environments is not far from the idea that an awareness of the processual mechanisms behind a digital representation would enhance our understanding of the representation and influence our relationship to it. In contrast, Berleant's "aesthetics of engagement" recall Bogost's concept of procedural rhetoric, in that knowledge of science or code's internal mechanisms is not necessary to appreciate and engage with the natural or digital environment. Whatever the depth of the protocological analysis, however close the critic and/or player comes to the understanding of the programmer or designer, all of these approaches suggest that the term "environment" more than ever must move beyond its traditional designation as natural wilderness toward more expansive definitions that include, as theorists like Gregg Mitman and environmental justice activists like Robert Bullard have suggested, everyday urban spaces and, as Berleant proposes, virtual places. While the former individuals urge us to recognize that environment is more and more constructed and that non-wilderness spaces also merit our care, the latter reminds us that virtual environments can be both beautiful and meaningful.

While Carlson and Berleant concentrate on the more rational aspects of environmental aesthetics' roots in the eighteenth century, emphasizing (Kantian) disinterestedness, the picturesque (seeing landscapes as one would a picture), and the formalistic method of appreciation, those aspects must be contextualized against the equally longstanding tradition of the sublime. In *Sublimity: The Non-Rational and the Irrational in the History of Aesthetics*, James Kirwan attempts to "provide a more complete history of the sublime," one that centers on "phenomenological, epistemological, and ethical dimensions—what [the sublime] is supposed to feel like, to signify, and to do."[41] Kirwan uses the work of Longinus, Kant, Schiller, James Boswell, Edmund Burke, Schelling, Hegel, and Lyotard, among others, to chart the rich complexity of the concept of sublimity in the eighteenth century and its subsequent decline in the nineteenth and twentieth centuries. At the same time, Kirwan tries to show "how certain attributed characteristics of the sublime, particularly with regard to its effect,

were gradually transferred to the description of aesthetic experience in general,"[42] paralleling Berleant and Carlson's own observation about the natural landscape's loss of status as an art object.

Kirwan carefully documents what other thinkers have conceived of as sublime, from grand aspects of the natural world (mountain vistas, stormy seas, etc.) to larger-than-life personages to abstract conceptions (space, mathematical conundrums, etc.). Throughout, Kirwan explores sublimity's relation to beauty, to morality, and even to self-preservation, favoring Kant's notion of the sublime as containing elements of both awe and terror, "an experience that somehow combines fear and pleasure."[43] In other words, the sublime is that which produces a "complex of feelings of elevation and revelation."[44] Kirwan eventually reveals that he himself believes the sublime must always necessarily be a construct, one that depends on its situatedness in a particular culture and historical moment.

To what extent, then, can game environments be said to provide the experience of the sublime? In the simplest sense, games with rich graphic surroundings, particularly those that do not limit players to the horizontal dimension, can offer thrilling sensations of lift and speed. In *World of Warcraft*, for instance, players can ride swift aerial mounts; movement is allowed in all directions and players can explore dramatic vistas—snow-capped peaks, floating cities, and broad expanses of ocean—with relative ease. In *Spore*, a simple roll of the mouse wheel can take your spacecraft from the surface of a single planet out to a galactic perspective. Like nature documentaries and their staple sweeping cinematography, games with rich virtual environments have the ability to cultivate experiences of the sublime, perhaps even more so because of their license to invoke the stuff of fantasy.

Beyond game sublimity as an aesthetic experience, however, lies the possibility of a *procedural* sublime. On one level, procedural sublimity could mirror Kant's notion of the mathematical sublime, especially for those to whom code is opaque—it would encompass the sense of knowing just enough to know how much you do not know. Like the mathematical series that reveals to one a sense of infinitude or the imperceptible, a game embodies algorithms or processes that suggest both the ingenuity and the limitations of human design. This version of the procedural sublime not surprisingly echoes age-old debates in the artificial intelligence and artificial life communities and brings to mind Sherry Turkle's child philosophers, who treated first-generation electronic toys as objects to think through the nature of life, death, and intelligence. However, the procedural sublime can also describe the player's experience of highly evolved procedural rhetoric, or the playing through of a game's complex processual argument. Games are filled with both implicitly and explicitly crafted encounters with algorithmically generated environments, and some of these encounters qualify as sublime ones—combining admiration and fright in ways that can potentially stir players to action, judgment, or reflection beyond the games themselves. The sublime has always suggested an irrational basis for ethical action—proof of the divine, a shrinking of human significance relative to the environment, and even wonder and sadness in the face of apparent mortal limitations.

Others have supported the concept of a computational sublime or, more generally, aesthetic computing. Notably, Lev Manovich has argued that "data art" actually represents the "anti-sublime". Manovich contemplates the relationship between data, science, and contemporary art through the notion of "meta-media," or an enhanced modern form of media that maps "old" media into a newer incarnation through the addition of a metadiscursive level of searching or manipulation, not unlike Galison and Daston's sense of modern scientific atlases. For Manovich, "A meta-media object contains both language and meta-language – both the original media structure (a film, an architectural space, a sound track) and the software tools that allow the user to generate descriptions of this structure and to change this structure."[45] According to Manovich, the impulse to visualize data in aesthetically pleasing or informationally effective ways, à la Edward Tufte, is not particularly

new: "The desire to take what is normally falls outside of the scale of human senses and to make visible and manageable aligns data visualization art with modern science. Its subject matter, i.e. data, puts it within the paradigm of modern art":[46]

> Having looked at the particular examples of data visualization art, we are now in the position to make a few observations and pose a few questions. I often find myself moved by these projects emotionally. Why? Is it because they carry the promise of rendering the phenomena that are beyond the scale of human senses into something that is within our reach, something visible and tangible? This promise makes data mapping into the exact opposite of the Romantic art concerned with the sublime. In contrast, data visualization art is concerned with the anti-sublime. If Romantic artists thought of certain phenomena and effects as un-represantable [sic], as something which goes beyond the limits of human senses and reason, data visualization artists aim at precisely the opposite: to map such phenomena into a representation whose scale is comparable to the scales of human perception and cognition.[47]

Manovich assumes that data art in effect humanizes or personalizes the otherwise impersonal, inscrutable, and overwhelming reams of data in existence and thus renders it knowable. Data art, in effect, defangs the threat of unsorted data. But does that necessarily mean that the sublime cannot exist in such media? Does the experience of the sublime allow for both that which exceeds human experience and the experience itself?

In this vein, perhaps, Jane McGonigal has dubbed the grandiose scale of modern games "epic environments." Likening them to ancient stone cathedrals that reflected the handiwork of thousands, McGonigal explains that "Our experience of these epic game environments isn't physical, but it is real in one crucial sense. The engineering of the virtual environment represents, today, a collaborative feat on an extreme scale."[48] The purpose of an epic environment is "to create a space that completely absorbs and envelops the player in a sense of awe and wonder."[49] Though not concerned specifically with games, Manovich ultimately retains something of the same optimism. "For me," he writes, "the real challenge of data art is not about how to map some abstract and impersonal data into something meaningful and beautiful – economists, graphic designers, and scientists are already doing this quite well. The more interesting and at the end maybe more important challenge is how to represent the personal subjective experience of a person living in a data society."[50]

Social Realism: Translating Play to Action and Transmediality

Can games really promote education, activism, and lifestyle change? The designers of educational games, primarily for children, and the more recent "serious games," most often tools for instruction, workplace training, or social change, would certainly answer in the affirmative. As Henry Jenkins and Alexander Galloway have pointed out, however, granting games this ability also renders them susceptible to the criticism of media effects theories, most prominent among them what Galloway calls the "Columbine theory" (namely, violent video games make players more violent in "real life"). At the same time, some studies cast doubt over the permeability of games and the "real world"—in 2008, for instance, the Pew Internet and American Life Project released findings from a report on "Teens, Video Games and Civics," which essentially concluded that while almost all young people today play games, their game-playing did not correlate with higher or lower civic participation rates.

Galloway has published in several venues his take on what he calls "social realism," investigating this increasingly vital question of how video games do or do not impact on "real life," or rather, how real life can increase its impact through games. Interested in reversing or moving past previous discourses on video game violence, Galloway highlights gaming in terms of potential political and social action. Realism in gaming, he argues, should no longer apply only to the realism of representation, but also to that of action. Discussing the game *Toywar*, the Internet art collective etoy.com's counter to legal steps taken by eToys.com regarding perceived name infringement, Galloway notes that Toywar managed to construct "a meaningful relationship between the affective actions of gamers and the real social contexts in which they live."[51] In other words, it "did" something—the game was not limited to self-contained depiction, and the player was not limited to self-indulgent play.

In fact, "Realism in gaming is about the extension of one's own social life."[52] Categorizing this under the idea of a "congruence" requirement, Galloway sees games as achieving "true realism" only when they offer gamers this kind of experience. Galloway's major example involves two different military simulation games, one played from an Israeli perspective, the other from a Palestinian perspective, and their impact on players of different religious and national backgrounds. Ian Bogost similarly acknowledges that the effectiveness of a game's procedural rhetoric depends on the preconceptions that a player brings to the game.[53] Though at times he argues that there is no necessary correlation between a player's experiences in-game to that player's experiences out-of-game (for instance, in denigrating dynamic in-game advertising), Bogost grants that some games can be truly persuasive, even potentially empowering (for instance, a non-farmer can play the John Deere game and thereby gain a better appreciation of agriculture).

Galloway's take on social realism also recalls Berleant's exploration of social aesthetics. Having discussed environmental aesthetics, Berleant considers art's social function, artists' social responsibilities, the relationship between aesthetics and ethics, and cultural and social influences on individual perception. Berleant aims to convince his readers that aesthetics can be usefully aligned with anthropology and sociology, whether in studies in comparative aesthetics (that is, differences of aesthetic experience across cultures) or in revising standard conceptions of disinterested aesthetic perception to include social and cultural variables. Both Galloway and Berleant, then, admit relativism to their respective considerations of realism in gaming and aesthetics.

In general, Galloway stresses that gaming is "active" and "participatory"—though some may regard games primarily as eye candy, from his player's perspective Galloway argues that video games as a mass medium have displaced the former primacy of vision in favor of the "action-based medium."[54] Galloway notably allows agency in terms of both machine and operator, that is, the computer and its user, claiming that "games are fundamentally cybernetic software systems involving both organic and nonorganic actors."[55] Like Bogost, Galloway recognizes that interaction is fundamental to gameplay. Most importantly, perhaps, Galloway demonstrates that a new hermeneutics regarding video game interpretation is needed, summed up in his own appropriation of "deep play" from Clifford Geertz: "Because play is a cultural act and because action is textual, play is subject to interpretation just like any other text."[56] The analysis of a game requires an understanding of not only the unique affordances of the game itself, but also the contributions made by the player and her cultural milieu.

Games, then, are transmedial in more than the fashion imagined in Henry Jenkins's and Justine Cassell's foreword to *Beyond Barbie and Mortal Kombat*. Though in this context they are discussing ways to interest girls in playing games, transmediality might usefully apply to games that model ecology and the environment, especially if we are willing to see social life as a medium with its own aesthetics (Berleant) and procedurality (Bogost). Having acknowledged the limitations of a game based on the hit television series *Desperate Housewives*, Jenkins and Cassell note the following:

Creating a game based on the series, however, represents the kind of transmedia strategy that has been successful in generating female interest elsewhere in the world. Mimi Ito (this volume), a USC anthropologist who does work on games culture in Japan, argues that a key factor in closing the gender gap among gamers there had to do with the integration of game content into larger "media mixes", such as the transmedia strategies which have emerged around hot anime and manga properties. She suggests that girls in Japan embraced games as another source of content that interested them as it flowed organically from one medium to the next.

Games are seen as transmedia when they blend or overlap with content in other areas: films, music, literature, and so forth, as seen in the example of *Mission: Planet Earth*, discussed in Chapter 1, which attempted to translate a documentary film series into a web game. This kind of transmediality is symptomatic of much of the mainstream media's vertical integration tactics—every film or TV franchise seems to be accompanied by its own website, video game, stuffed toys, books, and even lunchboxes and towels. However, I think the concept of transmedia can be fruitfully pushed further to explore the correlation between the real and the virtual, lived life and played life. For many, this has already been enacted in the current rise of serious or alternate-reality games, which implicitly define themselves in opposition to more traditional games, regarded perhaps unfairly as frivolous or unrealistic. In transmedia, someone takes interests from other areas and brings them to games; in serious games, someone first and foremost interested in games winds up learning something unexpected, be it about medicine, politics, or occupational safety.

In the end, both McGonigal and Jenkins suggest that games may be the ideal training ground for knowledgeable consumers and politically active citizens. Speaking of *I Love Bees* and collective intelligence (CI) work, McGonigal writes: "I am suggesting with this case study that for young students learning about CI for the first time, popular culture and online entertainment will remain the most effective spaces for learning how real-world massively collaborative participation works."[57] Similarly, Henry Jenkins in *Convergence Culture* implies that we may naturally migrate from entertainment-oriented, pop-culture applications toward more mindful ones.[58]

There is, of course, a danger in investing games with too much revolutionary power—most still partake in circuits of capital and consumption that work against environmental preservation and consciousness. McGonigal has been faulted for the instrumentalist tenor of her claims, and Bogost and others have penned scathing critiques of gamification. Games offer very few solutions, but like other cultural forms and media objects, they shape our perceptions of what is at stake in the world and may move us to reconsider, question, and act beyond the margins of imagined play.

CONCLUSION
GAME OVER?

It is interesting to contemplate an entangled bank, clothed with many plants of many kinds, with birds singing on the bushes, with various insects flitting about, and with worms crawling through the damp earth, and to reflect that these elaborately constructed forms, so different from each other, and dependent on each other in so complex a manner, have all been produced by laws acting around us.

Charles Darwin, *The Origin of Species*

Let me conclude, then, by saying that as I understand the whole point of media ecology, it exists to further our insights into how we stand as human beings, how we are doing morally in the journey we are taking.

Neil Postman, Keynote Address Delivered
at the Inaugural Media Ecology Association
Convention, Fordham University, June 2000

We owe contemporary media admittedly tenuous thanks for ensuring a baseline of environmental literacy through their constant rehashing of a recent, but undeniably powerful, master narrative—that of impending, human-wrought ecological disaster. While we have become accustomed to films, novels, scientific journals, and news reports incorporating the latest on species, habitats, and climates in crisis, increasingly even computer and video games are grappling with similar anxieties and fears. We could, for instance, consider *The Legend of Zelda: Majora's Mask* (2000), in which a falling moon threatens to extinguish all life on a home planet, or *Braid* (2008), an Impressionistic platformer that has been interpreted as an anti-nuclear parable. One might also note the sharp uptick in the number of horror-based or post-apocalyptic game narratives that inevitably

spring from the starting point that something has gone terribly, terribly wrong with the world as we know it.

It seems only appropriate, then, to conclude this study of game ecology by returning to a consideration of how games grapple with finitude, aftermath, and loss, first introduced in Chapter 1's discussion of dark ecology and later expanded in Chapter 3's brief excursion into the natural constraints of ecological economics. To do so, I end with a short reflection on thatgamecompany's most recent title, *Journey* (2012), the third and final game in a trilogy of sorts that began with the games *flOw* and *Flower*.

Figure 5.1. A *Journey* player faces her distant mountain destination during the first level of the game.[1]

In *Journey*, players begin inexplicably alone in a desert littered with apparent grave markers and the occasional ruin. In the distance, a mountain beckons. What follows gradually evolves into an eight-level quest toward the mysteriously lit peak, and along the way, the player can activate dormant wall carvings and experience meditative visions that together hint at the reasons for the land's unpopulated barrenness and the player's coming into existence.

Speculative readings of *Journey* abound, but I tend to agree with those that see the ancient glyphs and end-of-level cutscenes, which picture a white-robed ancestral race, as signaling that *Journey* players, red-robed and diminutive by comparison, have come along well after the destruction of the earlier civilization. Glyphs that seem to depict a harmonious agricultural way of life replaced by energy-intensive industrialization and internecine war suggest a powerful civilization annihilated by its own overreliance on technology:

Figure 5.2. A *Journey* player activates a wall of ancient glyphs, which reveals a portion of the game story.[2]

Others deem the game a more general deliberation on the nature and meaning of life, encapsulated in the trite old saying that one's life should center on the journey, rather than the destination. This interpretation takes a variety of forms in player posts on blogs and messageboards, from friendly prescriptions to stop and smell the proverbial in-game roses, or in this case, bask in the rich detail of the game's art and sound design, to metaphysical ruminations on the afterlife, as when player "Laurie Lou" refers to red-cloaked players as pilgrims, or when some liken the final stage of the game on the mountain's summit to heaven (which takes place after the player collapses and seemingly succumbs to driving snow while climbing the mountain).[3]

Promotional language on thatgamecompany's web site lends credence to such views: "Journey is an interactive parable, an anonymous online adventure to experience a person's life passage and their intersections with other's [sic]." Notably, when I interviewed one of thatgamecompany's founders, Jenova Chen, at the Game Developers Conference (GDC) in San Francisco in 2010, he was already thinking about *Journey* and had been impressed with the emotional impact of Jason Rohrer's minimalist art game, *Passage*, which uses a side-scrolling mechanic to depict the process of aging and moving through life either with or without a partner, as well as the benefits and drawbacks of each choice. Now known for experimental, artistically stunning games that foreground natural environments and invite atypical modes of player experience, Chen intended *Journey* to invert many of the canonical tenets of "good" game design—convenience, legibility, and mastery prominent among them. Instead, *Journey*, as its title suggests, celebrates duration, distance, and insignificance, promoting precisely those qualities of a desertified world that minimize player agency while provoking feelings of wonder and humility. The mountain, while the obvious goal, may signify less than many think—it barely draws closer even after many minutes spent slogging in its direction, and even after you reach its icy slopes, you evidently perish, at least physically, in the ascent. Teleological analysis becomes even more suspect after players complete the game and are rewarded by a speedy return journey to the starting point, albeit in an impressive, shooting-star form. Deposited once more in the desert, you may opt to begin the journey again, though this second time around you have earned the option to don a white robe.

While there is no single, correct way to explicate a player's experience in *Journey*, how can we best appraise a game environment so heavily imbued with intimations of ruin and salvation, in which

nonhuman landscapes seem to function as human aspirations and follies writ large? Perhaps surprisingly, we might turn to two theoretical systems familiar to disciplines far afield from game studies.

Umwelt

The first is that of protoecological naturalist philosopher Jakob von Uexküll, an early 20th-century forerunner to systems theory, who espoused a theory of environment that placed the living subject at the center of space and time. Interested in "subjective realities," von Uexküll made an important distinction between a meaningful environment (Umwelt) and mere surroundings (Umgebung):

> Without a living subject, there can be neither space nor time.[4]

> Every subject spins out, like the spider's threads, its relations to certain qualities of things and weaves them into a solid web, which carries its existence.[5]

In other words, von Uexküll conceives of an animal's perception and effect spaces, both visual and tactile, as selective and subjective recognition and interaction with the physical world, almost like "soap bubbles" of varying sizes existed around each creature.[6] In his well-known example of the tick, von Uexküll argues that the insect attends to only three stimuli in its limited life-world: the first chemical (butyric acid as olfactory evidence of a passing mammal, which signals the tick to drop onto its prey), mechanical (bodily impact with the mammal after releasing from its perch, which tells the tick to search for a puncture site), and finally thermal (the warmth of a patch of the mammal's exposed skin triggers the tick's feeding).

The tick world's relative spatial simplicity is also evident in its temporal minimalism. von Uexküll notes that while in experiments, ticks have successfully been kept alive in a dormant state for eighteen years, waiting for their next meal, human time is much more extensively subdivided:

> Our human time consists of a series of moments, i.e., the shortest segments of time in which the world exhibits no changes. For a moment's duration, the world stands still. A human moment lasts one-eighteenth of a second. [. . .] the duration of a moment is different in different animals [. . .].[7]

Referencing the perceptual illusion of projected film frames as support for his estimate, von Uexküll concludes that "[. . .] the subject controls the time of its environment,"[8] though in von Uexküll's holistic theory of natural systems, only humans possess the ability to pursue goal-oriented action, while most creatures simply act according to "Nature's plan".[9]

How does this relate, if at all, to *Journey*? Perhaps von Uexküll's theories give us one way to describe players' experiences in the game, as well as a vocabulary with which to approach the game's fascination with distance and duration. While human players, in this conceptual scheme, are constrained by their humanness to experience the game *as* humans, the game's sprawling landscapes, narrative, and varied cast of non-player characters seem to invite complex considerations beyond the present moments of play: the player becomes the scalar figure by which human and nonhuman longevity, mortality, history, and archaeology are measured. What are the territories and lifespans of a humanoid, as compared to those of a god, or a comet, or a piece of reanimated cloth?

Topophilia

      A second, potentially relevant theory was put forward in 1974 by geographer Yi-Fu Tuan, who suggested that analyzing what he called topophilia, or "the affective bond between people and place or setting,"[10] could offer a better sense of how people operate within natural environments than surveys and statistics. In a very broad cross-cultural and historical survey that touches on Western and non-Western societies, classical mythology and indigenous folklore, rural and urban dichotomies, art, architecture, and anthropology, Tuan reminds us that "Environment [. . .] is not just a resource base to be used or natural forces to adapt to, but also sources of assurance and pleasure, objects of profound attachment and love."[11] In *Journey*, the topophilic "affective bond" is one of mixed loss and redemption, likely related to environmental and technological disaster. The player finds herself bound to the game world through feelings of confusion, loneliness, longing, and awe, and conceivably hope for a kind of cross-generational redemption.

      Tuan also offers thoughts on spatial psychology and symbolism, for instance in his condensed look at attitudes toward what he calls the "recalcitrant aspects of nature," or those that "defy easy human control," in particular mountains, deserts, and seas.[12] Decades in advance of the signature sands and distant peak of the game *Journey*, Tuan notes: a) the vertical versus the horizontal dimension is commonly seen to represent "transcendence" versus "immanence," or a "disembodied consciousness (a skyward spirituality)" versus an "earth-bound identification"; b) "Vertical elements in the landscape evoke a sense of striving, a defiance of gravity, while the horizontal elements call to mind acceptance and rest";[13] and c) The vertical dimension also "has affinity with a particular notion of time."[14] Tuan claims that vertically oriented cultures, such as those of peasants and subsistence farmers, tend to live by cyclical time, to see themselves as part of a religious cosmos and seasonal shifts, rather than the secularized and aestheticized horizontal expanses of modernity, indicated in our terms landscape, scenery, and countryside. Tuan's at times uncomfortably broad-stroke observations support an interpretation of *Journey* that prioritizes its manipulation of the player's experience of time and distance. Rather than instantiating the physicist's standard formula, distance = rate x time, or the min-maxing, "hardcore" gamer's investment in efficiency and speed, *Journey* treats both distance and time as subjective indications.

      In his recognition that even "intensely humanized worlds can have their own ecological richness and beauty,"[15] Tuan's work may be extended to imply that what binds peoples and players to place, both real and virtual, are their mythologies, their belief systems, and their suprarational understanding of their environments. In an echo of von Uexküll's natural holism, Tuan confidently declares that "People pay attention to those aspects of the environment that command awe, or promise support and fulfillment in the context of their lives' purposes."[16] Taken together, von Uexküll's organismic perspective and Tuan's sociogeographical vantage complement each other and provide orthogonal but illuminating entries into the lore and virtual environments of *Journey*, less comprehensive interpretations than means to fuse the interests of scientists and social scientists with media scholarship.

      My contention regarding *Journey*, which in some ways extends Ian Bogost's recent admonition that games can function in many ways beyond entertainment—as art, kitsch, political statement, worship, exercise, and more—is that games also offer unprecedented opportunities to examine and experience our most feared ecological outcomes, both past and future, through the imaginative and unencumbered spaces and moments of play. More than complex narratives or visual spectacles, digital games increasingly feature sophisticated environments that respond to player exploration in novel and suggestive ways. As *Journey* in particular demonstrates, games may serve as both archaeology and premonition, warnings to the wise as well as evidence of past folly.

In the end, *Playing Nature* has endeavored to meld the ecological perspectives represented in the two concluding epigraphs from Darwin and Postman, thinkers separated by well over a century but united by their ability to articulate a broader view of their subjects, one sensitive to connections even among scattered elements. Digital game worlds straddle the observed richness of the entangled bank and the metaphorical ecology of media, tying together universes of matter and media in ways that merit our continued scrutiny and support.

NOTES

Introduction

1. Nixon, *Slow Violence and the Environmentalism of the Poor.* Nixon's book is a novel recent effort to bring postcolonial theory into conversation with environmental discourse.
2. As will be briefly discussed in the conclusion, it is possible to distinguish more carefully between the terms "environment" and "surroundings," given naturalist philosopher Jakob von Uexküll's differentiation between environment (Umwelt) as a system or life world experienced by a subject and what he would deem mere surroundings (Umgebung), autonomous of the sensing subject.
3. Buell offers these and other observations on trends in the field in *The Future of Environmental Criticism.* See also Buell's earlier, seminal work, *The Environmental Imagination.*
4. Buell, *Future of Environmental Criticism*, viii.
5. See, for instance, Jane Bennett, *Vibrant Matter*; Félix Guattari, *The Three Ecologies*; Gilles Deleuze and Félix Guattari, *A Thousand Plateaus: Capitalism and Schizophrenia*; and Neil Postman, "The Humanism of Media Ecology".
6. Gregg Mitman's *The State of Nature* provides an exhaustive account of competing schools of ecological thought in the early twentieth century, at the University of Chicago and other research centers in the United States.

Chapter 1

1. Katie Salen and Eric Zimmerman, eds. *Rules of Play* and *The Game Design Reader*; Alexander R. Galloway, *Gaming*; Jesper Juul, *A Casual Revolution*; Noah Wardrip-Fruin, *Expressive Processing*; Ian Bogost, *Persuasive Games*; Constance Steinkuehler and Dmitri Williams, "Where Everybody Knows Your (Screen) Name"; Bonnie A. Nardi, *My Life as a Night Elf Priest*; and Edward Castronova, *Synthetic Worlds* and *Exodus to the Virtual World*.
2. Rita Raley, "Code.surface || Code.depth".
3. Here and elsewhere Galloway draws from Gilles Deleuze's notion of contemporary "societies of control," which have replaced modern "disciplinary societies."
4. Galloway, *Gaming*, 90.
5. Starbucks's *Planet Green Game*, developed by Tree Media, was once found at http://www.planetgreengame.com, while *CO2Fx* lived online at http://www.globalwarminginteractive.com. However, both games are presently defunct.
6. Different player "races" embody different perspectives on conservation—while humans send logs to the sawmill and the undead Scourge blight the land they build on, the nature-loving night elves plant living buildings and somehow manage to collect timber without harming any trees.
7. An example of an explicitly environmental game that eventually failed despite its creators' marked success as a distributor for casual games is *Faunasphere*, developed by Big Fish Games. *Faunasphere* was an attempt to create an online, massively multiplayer world with distinct climate zones populated by hybrid genetic creatures. For more detail, see Jason Begy and Mia Consalvo, "Achievements, Motivations and Rewards in Faunasphere".
8. Jose Leiva, "How to Mine for Copper Ore on World of Warcraft," accessed November 4, 2009, http://www.ehow.com/how_4493968_mine-copper-ore-world-warcraft.html.

9. Tellingly, Louv's most recent book moderates his earlier stance on technology by allowing for greater potential benefits, while still advocating for lives best lived "outside the electronic bubble" (*The Nature Principle*, 17).

10. All games emerge out of what are interestingly termed "programming environments" and are also, of course, played in particular domestic and commercial environments. However, my focus is on in-game environments.

11. Game AI concerns itself with operations like pathing and collision detection, ensuring that agents in the game world travel by logical routes without bumping into walls and each other. Game AI is typically considered "weak AI," what some consider behavioral as opposed to cognitive AI—the difference between thinking and acting like a human and truly thinking and acting. My proposal to extend game AI to game environments recognizes that game AI derives its strength from the interaction of players and non-players within an intelligently crafted game world. Games invite us to blur the traditional boundaries between human and nonhuman, organic and inorganic, in ways that invalidate or render secondary AI's customary preoccupation with self-contained, artificially isolated intelligent programs. For more information on traditional game AI, see John David Funge, *Artificial Intelligence for Computer Games.*

12. Artist Cory Arcangel effectively parodies this layering with his *Super Mario Clouds* series, which plays hacked Nintendo game cartridges in which all content but the background fluffy white clouds on blue has been erased.

13. Though "localization" is a common practice in game development, it generally refers to language translation, for instance, English subtitling or voice dubbing for what was originally a Japanese release. A game that has been localized has thus been made linguistically (though not necessarily culturally) intelligible as a requisite for international distribution, but the in-game environment remains the same across all versions. By environment, I mean not only topography, but also the flora and fauna that should be coextensive with such topography, and their manifestation via images, sound design, and potential for interaction. Thus localization is somewhat of a misnomer, as it is an attempt to universalize the game with customized veneers. Of course, this is not to say that all games must assiduously eco-localize their games—beyond the obvious impracticality of such a mandate, clearly one joy of the fantasy environment is that it need not be tied to real-world equivalents. For more on game localization, see Stephen Mandiberg, "Translation (is) Not Localization".

14. Raymond Williams, *The Country and the City*, 54.

15. Industry badboy Rockstar Games seems to be moving in this direction. The *Grand Theft Auto* games evolved from taking place in "Anywhere, USA" to site-specific installments like *GTA: San Andreas*, which unfolds in fictional cities modeled closely on San Francisco, Las Vegas, and Los Angeles. The company also released the "open world" game *Red Dead Redemption* in 2010, which plays out in the last days of the frontier in the American West and features over forty species of wildlife (including bison) as both potential predators and prey.

16. The recent trend toward using motion-sensing technology, which distinguishes the Nintendo Wii, Xbox Kinect, and PlayStation Move platforms, gestures to a collapsing of the in-game and out-of-game experience, but does not necessarily imply a richer experience of game environment.

17. The genre of "god" games is also noteworthy here, as the player often has the power to actually design or alter the landscape, for example via terraforming in *Spore* or *SimCity*.

18. Nardi, *My Life as a Night Elf Priest*, and Nick Yee, "The Virtual Skinner Box".

19. Timothy Morton, *Ecology Without Nature*, 31.

20. In its early years, game studies addressed much of its energy to bridging internal rifts, most prominent among them that between ludologists and narratologists. While narratologists insisted

on the continuity between games and other storytelling media, ludologists sought to disentangle themselves from methodologies traditionally associated with literature and film, stressing the unique mechanics of game design and predicating the computer and console game's medium specificity on the basis of code and microchip, binary streams of data and algorithmic or procedural operation. In recent years, this division has given way to the phenomenal outgrowth surrounding the term play, which conveniently seems to bypass the lingering stigmas surrounding games in favor of articulating a broader cultural phenomenon. However, even the fashionably vague concept of play has made it difficult to posit a more explicitly environmental approach to games, one that might dethrone the reigning player- or designer-centered paradigms in order to acknowledge game environments as determining components of player experience, with the potential to edify and spark curiosity about the out-of-game world. When game designers and theorists take game environments for granted, they perpetuate, at worst, indifference to one's lived surroundings, at best, a shallow specular consumption.

21. Morton, *EWN*, 34. Morton quotes the following passage from Buell as an example of ecomimetic writing: "The grove of second-growth pine trees that sway at this moment of writing, with their blue-yellow-green five-needle clusters above spiky circles of strophied lower limbs" (*EWN*, 33).

22. Dana Phillips, *The Truth of Ecology*, 6.

23. Ibid., 7.

24. Ibid., 17.

25. Morton, *EWN*, 1.

26. Morton, *EWN*, 3. Perhaps because the nature writing tradition and poetic precursors in the Romantic period are so strong, ecocritical perspectives have thus far been largely confined to the status of text in conventional literary objects.

27. Phillips, *The Truth of Ecology*, 15.

28. James Paul Gee, *What Video Games*, 26, and Bogost, *Persuasive Games*, 120.

29. ELIZA was a natural-language processing program written by Joseph Weizenbaum at MIT in the 1960s that most famously simulated a Rogerian psychotherapist in its interaction with users.

30. Dennis Jerz, "Somewhere Nearby Is Colossal Cave." Jerz reminds us that "Caver terminology often employs architectural metaphors. For instance a 'room' is any discrete space, no matter the shape; a 'hall' is any long space, a 'chimney' is a pit when seen from below, and a 'dome' is the roof of a pit."

31. Rick Adams, "Colossal Cave hints," http://www.rickadams.org/adventure/d_hints/index.html.

32. Brucker and Watson, *The Longest Cave*, 109.

33. Jerz also points to the divergent textual styles that become apparent as one traces the changes in *Adventure* from Crowther's original to Woods's adaptation: "Where Crowther was an efficient minimalist, Woods was comparatively lavish with scenery."

34. Nick Montfort, *Twisty Little Passages*.

35. Morton, *EWN*, 33 (his emphasis).

36. Henry Jenkins, "Game Design as Narrative Architecture," 676.

37. The emphasis on the second person may seem at first glance to offer a distinct difference from the usual first person of ecomimetic description. Notice, however, that Morton's first example of ecomimesis in "The Art of Environmental Language" is Denise Levertov's poem, "To the Reader," which addresses its reader with the repeated strain "As you read," which for Morton is simply an inversion of the ecomimetic "as I write". According to Morton, in Levertov's poem "the effect is the same, or even stronger, for, as in advertising language, 'you' becomes a niche in the text, specifically designed for the actual reader" (*EWN*, 30). Thus the use of the second person does not automatically invalidate the walkthrough's ecomimetic properties.

38. Morton, *EWN*, 32.
39. Ibid.
40. Morton, *EWN*, 34, 35, 36.
41. Morton, *EWN*, 26.
42. Henry Jenkins, "Complete Freedom of Movement," 263.
43. Nakamura, *Cybertypes*.
44. "Industry Facts," Entertainment Software Association, accessed May 11, 2013, http://www.theesa.com/.
45. Ursula K. Le Guin, *The Lathe of Heaven*.
46. An example of the former would be the popular genre of "real-time strategy" (RTS) games, in which resource management is a key component of gameplay. Though RTS games tend to enforce resource limitations (mines that can be depleted, timber stands that do not grow back), this valuable ecological lesson gets trampled by the basic premise of "use it or lose it." Some might argue that games by definition must present limits: competition over scarce resources, whether those be time, mineral deposits, food, or screen space (think of the falling blocks in Tetris). But without disputing the centrality of constraints to gameplay, I might still point to something like Roger Caillois's taxonomy of games in *Man, Play and Games*, in which games of conflict (agôn) constitute only one, albeit primary, category. Caillois also includes the categories of alea (games of chance), mimicry (improvisational and theatrical games), and ilinx (games of vertigo).
47. *Flower* is largely the vision of artist and game designer Jenova Chen, whose first game *flOw* modeled microbial life and whose most recent game *Journey* instills in players a sense of insignificance in relation to their surroundings, allowing them to experience distance, duration, and scale in ways that decenter typical player fantasies of mastery and control.
48. Screenshot available at thatgamecompany's website, http://thatgamecompany.com/games/flower/. *Flower* is a trademark of Sony Computer Entertainment America Inc. © 2008 Sony Computer Entertainment America Inc.
49. Buell, *Environmental Imagination*, 6.
50. Ibid., 7.
51. Timothy Morton, *The Ecological Thought*. Morton sets his vision of ecological thinking against many of the established precepts of modern environmentalism, arguing that we should think globally, not locally, big, not small, celestial, not terrestrial, and so on.
52. Antonio Damasio, *Looking for Spinoza*, 54.
53. Henri Lefebvre, *The Production of Space*.
54. Damasio, *Looking for Spinoza*, 57.
55. Ibid., 7.
56. A law named after Intel co-founder Gordon Moore, who predicted in the 1960s that integrated circuits could contain roughly double the number of transistors about every two years (20 months). The law is often used to predict the exponential growth of computer processing power.
57. Mori hypothesized that humanoid robots designed to look more and more lifelike would trigger positive emotional responses from humans only up to a critical point, just before true verisimilitude, at which human response would actually be less favorable because the robots would appear eerie, or uncanny. This notion of the "uncanny valley" has been applied to numerous objects, often products of digital special effects, from horror films to children's toys to video game art (for example, the *Final Fantasy* series).
58. Castronova, *Synthetic Worlds*, 88.
59. Castronova, *Synthetic Worlds*, 89.

60. Barthes, "The Reality Effect."
61. Huizinga popularized the term "magic circle," which has become somewhat of a tired catchphrase in game studies, invoking the boundary crossing that occurs when players enter game worlds, setting aside the rules and habits of the world exterior to the circle and taking on new personas and agendas within the circle. It is not by accident that the term also conjures up fantasies of dark necromancy and the ritual summoning of spirits.
62. Galloway's double-axis game classification model in *Gaming* presents another way of evaluating the environmental quality of games. Games that are meaningfully environmental distribute agency and intelligence more evenly between the machine and operator poles, and necessarily draw a connection between the diegetic world of play and the nondiegetic world of the player.
63. Andy Clark, *Natural-Born Cyborgs*, 5.
64. Ibid., 11.

Chapter 2

1. danah boyd and Kate Crawford, "Six Provocations for Big Data," 2.
2. Mary Gray, "Anthropology as Big Data."
3. EA purchased Maxis in 1997.
4. Irwin, "Ten Things You Should Know About 'Spore'."
5. Lovelock, *Gaia*, and Watson and Lovelock, "Biological homeostasis of the global environment."
6. VanOrd, "Spore Review."
7. Bohannon, "Flunking Spore."
8. The same design software is used later in the game to create land, air, and sea vehicles; houses, factories, and entertainment centers for your cities; and finally your spacecraft.
9. "Drake Equation," SETI Institute, accessed May 12, 2013, http://www.seti.org/drakeequation.
10. Jones, "Performing the Social Text," 284.
11. Ibid., 287.
12. Ibid., 289.
13. Ibid.
14. Ibid., 283.
15. Ibid., 289.
16. At a popular science level, *Spore* seems to have succeeded. *National Geographic* unreservedly featured both *Spore* and its creator Wright in a short video and accompanying online article entitled "How to Build a Better Being." In the latter, author William Lee allowed *Spore* a wide margin of ludic license, using *Spore*'s Creature Creator to recreate a primitive ancestor of man.
17. Wright, "Will Wright makes toys that make worlds."
18. Although writing over a century and a half ago, Oliver Wendell Holmes uses sporulation in a similar manner, to express a buoyant uncertainty in the realm of ideas:

    > The spores of a great many ideas are floating about in the atmosphere. We no more know where all the growths of our mind came from, than where the lichens which eat the names off from the gravestones borrowed the germs that gave them birth.

    Holmes ruminates here on unintended plagiarism in an essay from *Pages from an Old Volume of Life* (1891), remarking on the use of the same poetical image of diverging flows by half a dozen different thinkers (including himself), without conscious borrowing. Rather than labeling such

use as flagrant copying, Holmes sees it as harmless and inevitable coincidence, a kind of convergent evolution.

19. *Oxford English Dictionary Online*, s.v. "spore," accessed May 12, 2013, http://www.oed.com/view/Entry/187452?redirectedFrom=spore&.

20. Where *SimEarth* was bafflingly complex, *Spore* is reassuringly simple. Neither version of environmental play achieves the ideal balance of realism and wonder, though *Spore* I think comes closer to leveraging the power of play for environmental purposes.

21. Robinson, *Red Mars*, *Green Mars*, and *Blue Mars*.

22. In actuality, this memorable picnic scene was filmed in Florida, for a better-looking lawn.

23. The Eames' *Powers of Ten* film has been made publicly available on the Eames Office official website for the film as well as on YouTube.

24. Philip and Phylis Morrison and The Office of Charles and Ray Eames, *Powers of Ten*, 145 (my emphasis).

25. Colin Milburn, *Nanovision*, 77.

26. Daston and Galison, *Objectivity*, 368.

27. Ibid., 363.

28. Ibid., 367.

29. Ibid., 381.

30. Morrisons and Eames Office, *Powers of Ten*, 8.

31. Daston and Galison, *Objectivity*, 47.

32. Ibid., 382.

33. Ibid., 383.

34. Ibid.

35. Ibid., 47.

36. Ibid., 392.

37. Ibid., 382-3.

38. *Nanovision*, 69. For Milburn, Heidegger provides a recurring frame of reference, both in the techne/poiesis distinction from "The Question Concerning Technology" and the tyranny of technoscientific representation elaborated in "The Age of the World Picture." In its hyperbolic promise to remake the world "atom by atom," Milburn argues, nanotechnology "marks the terminus of the age of the world picture by reducing the worldness of the world to a molecular image"; it signals "the encroachment of the molecular map over the economies and ecologies of the globe" (*Nanovision*, 71).

39. Milburn, *Nanovision*, 73.

40. Daston and Galison, *Objectivity*, 371, 235.

41. Ibid., 46.

42. The Futurefarmers were granted a multi-year residency at the Berkeley Art Museum/Pacific Film Archive and the Berkeley Center for New Media at the University of California, Berkeley beginning in 2010. Many of these observations come from a personal interview with Amy Franceschini.

43. For example, Shapiro brought a butterfly net and index cards, as well as Pabst Blue Ribbon (a nod to his annual Butterflies for Beer competition in northern California); Roy asked for whole foods ("philanthropy through grocery shopping"); and Chapela requested local, microbial food (cheese, bread, and wine).

44. *A Variation on the Powers of Ten*, Futurefarmers, accessed March 19, 2012, http://www.futurefarmers.com/powersoften/.

45. Thomashow, *Bringing the Biosphere Home*, 139.

46. Ibid., 149.

47. Ibid., 155.
48. Ibid., 141.
49. Ibid., 157.
50. Ibid., 140.
51. Ibid., 139.
52. Ibid., 152.
53. Ibid., 154.
54. Ibid., 160.
55. Ibid., 161.
56. Ibid., 148.
57. Ibid., 155.
58. Heise, *Sense of Place*, 10.
59. Ibid., 9.
60. Ibid., 10.
61. Ibid., 13.

Chapter 3

1. Chris Kohler, "The 15 Most Influential Games of the Decade," *Wired.com*, December 24, 2009, http://www.wired.com/gamelife/2009/12/the-15-most-influential-games-of-the-decade/.
2. Randall Munroe, "Online Communities," *xkcd*, accessed November 2, 2011, http://xkcd.com/256/. Free to copy and share, under a Creative Commons Attribution-NonCommercial 2.5 License.
3. Randall Munroe, "Online Communities 2," *xkcd*, accessed November 2, 2011, http://xkcd.com/802/. Free to copy and share, under a Creative Commons Attribution-NonCommercial 2.5 License.
4. "FarmVille – Facebook application metrics from AppData." AppData. http://www.appdata.com/apps/facebook/102452128776.
5. "Demographics | Ag 101 | Agriculture," United States Environmental Protection Agency, accessed May 12, 2013, http://www.epa.gov/agriculture/ag101/demographics.html.
6. Ted Friedman, "FarmVille: The Garden in the Machine," *In Media Res*, December 8, 2010, http://mediacommons.futureofthebook.org/imr/2010/12/08/farmville-garden-machine.
7. Drabble and Stringer, eds., *Concise Oxford Companion*.
8. Marx, *The Machine in the Garden*, 4.
9. Ibid., 5.
10. Ibid., 11.
11. Conkin, *A Revolution Down on the Farm*, 100.
12. Ibid., 101.
13. Williams, *Country and the City*, 21.
14. Ibid., 22.
15. Ibid., 172.
16. Alderete, Ethel et al., "Lifetime Prevalence," 608.
17. Conkin, *Revolution Down on the Farm*, 147-8.
18. Ashley Southall, "Black Farmers Settlement Approved," *The Caucus: The Politics and Government Blog of The Times*, November 30, 2010, http://thecaucus.blogs.nytimes.com/2010/11/30/black-farmers-settlement-approved/.
19. Conkin, *Revolution Down on the Farm*, 166.

20. When public representatives like Congresswoman Michele Bachmann (R-Minnesota) alleged fraud in this most recent settlement case, because the number of claimants exceeds the estimated number of black farmers at that time, we would do well to remember Conkin's explanation of the "exodus" of African Americans from farming due to institutionalized discrimination. When others complain that such settlements pave the way for further, equally unappealing suits, like those currently in progress for female and Hispanic farmworkers, we need only remember the largely invisible masses even now supporting our nation's prized food economy.
21. Alderete et al., "Lifetime Prevalence," 608.
22. Thomashow, *Bringing the Biosphere Home*, 31.
23. Daly, *Beyond Growth*, 4.
24. Most concede that sunlight and the benefits it provides through heat and photosynthesis are technically finite but for all practical purposes infinite.
25. Conkin, *Revolution Down on the Farm*, 169.
26. In *FarmVille*, applying fertilizer to one's fields is optional, but as fertilizer is made readily available and has the appealing effect of boosting your crops' size and yield, its use is effectively constant.
27. Conkin, 171.
28. In late 2010, Zynga gave *FarmVille* players the ability to purchase and build "orchards," with each orchard able to store up to 20 trees. Harvesting orchards may produce "mystery" tree seedlings, and to raise each seedling into an adult tree, players must apply ten watering cans.
29. For an explanation of "blissful productivity" in games, see Jane McGonigal's *Reality is Broken*.
30. Conkin, 170.
31. Ibid.
32. Morton, *The Ecological Thought*.
33. In *FarmVille*, farm animals are glorified pets that can be bought and sold but never slaughtered for food. Many yield nonsensical products (horses are brushed for horsehair, geese give feathers, and penguins produce ice cubes). In *FrontierVille*, harvested animals do yield the relevant food products (pigs produce bacon, pork chops, etc.), but still come to no visible harm. In this respect, virtual farm animals are more like fruiting trees than livestock.
34. Conkin, 169.
35. Ibid., 185.
36. That said, many games rely on claims of especial realism for their appeal ("the most realistic first-person shooter ever") or strive to incorporate realistic detail either for political statement or ambience.
37. "Wheat." Last modified December 12, 2006, http://www.gmo-compass.org/eng/safety/environmental_safety/188.wheat.html.
38. Big Fish Games's *Faunasphere* offered a much more detailed animal-breeding game for a short time. Players were encouraged to create custom animal avatars with different abilities using genetic tools and multi-generational cross-breeding. Certain traits were dominant, others recessive. However, the game was discontinued on March 15, 2011 due to lack of resources. See also Note 7 to Chapter 1.
39. Either way, the assumption is that farming can only begin after fields have been scraped clean of contours and organic life. Unfortunately, this premise replicates costly real-world mistakes committed by industrial agriculture and forestry via clearcutting and monoculture.
40. Williams, 186.
41. Ibid., 187.
42. Ibid., 186.
43. Conkin, 165.

44. Ibid., 152.
45. Nicholas Lovell, "What is a social game?", *Gamesbrief*, January 11, 2011, http://www.gamesbrief.com/2011/01/what-is-a-social-game/.
46. Lowood, "'It's Not Easy Being Green'."
47. McGonigal, *Reality is Broken*, 80.
48. Ibid., 81.
49. Ibid., 82.
50. Ibid., 98.

Chapter 4

1. More information can be found at "America's Media Makers: Production Grants," National Endowment for the Humanities, accessed May 12, 2013, http://www.neh.gov/grants/public/americas-media-makers-production-grants.
2. Predictably, the exhibit featured both what are by now antique games with a high nostalgia quotient, such as *Space Invaders* and *Donkey Kong*, as well as newer, more experimental work, such as *Flower*, discussed at length in Chapter 1 (*Adventure* was nominated but lost to fellow nominee *Pitfall!*).
3. "*The Art of Video Games* Exhibition Checklist," Smithsonian American Art Museum, accessed May 12, 2013, http://americanart.si.edu/exhibitions/archive/2012/games/winninggames.pdf.
4. For more on retro video games, see Brett Camper, "Fake Bit."
5. "Chris Melissinos," Smithsonian American Art Museum, last modified February 2011, accessed July 25, 2011, http://americanart.si.edu/pr/library/2012/taovg/melissinos_bio.pdf.
6. Jane McGonigal, "Why *I Love Bees*," 202.
7. Ibid., 201-202.
8. Ibid., 202, 202, 203.
9. Lévy, *Collective Intelligence*.
10. McGonigal, "Why *I Love Bees*," 200.
11. Ibid., 208.
12. Ibid., 206.
13. Szulborski, *This Is Not A Game*.
14. McGonigal, "Why *I Love Bees*," 215.
15. As McGonigal notes, immersive games are not the same as pervasive games. The latter tends to describe gaming using mobile devices and global positioning system (GPS) technology, without the necessary addition of an alternate reality game scenario. Pervasive gaming has also been more popular in Asia and Europe, while immersive gaming has been more popular in America.
16. McGonigal, "'This is Not a Game,'" 111 (emphasis in original).
17. McGonigal notes that "ting" can serve as either noun or verb in immersive gamer parlance, as in the This Is Not A Game credo or the following action: "To 'TING' a game now means to explicitly deny and purposefully obscure its nature as a game, a task" (Ibid., 113).
18. McGonigal, *Reality is Broken*, 24.
19. Ibid., 26.
20. Ibid., 45.
21. Ibid.
22. "The Black Cloud, 2007," accessed October 23, 2011, http://studio.berkeley.edu/bc/documents/black_cloud_game_v08.pdf.

23. The term "pwn" comes from gamer lingo, meaning to defeat or overcome an opponent or obstacle in such a decisive manner that you can claim to have "owned" it or the person. The misspelling supposedly derives from a typo that caught on and distinguished the term from its more mundane roots in sports and other competitive arenas, making it something peculiar to online or digital discourse enacted through keyboards and typed chatter.

24. Future versions of the game may include new playable locations, including Oakland, Los Angeles, and Riverside.

25. Asthma is a chronic inflammatory disease of the lungs that affects more than 17 million adults and 7 million children in the United States, including approximately 30 percent of K-12 students in Fresno.

26. Amanda Lenhart, Joseph Kahne, Ellen Middaugh, Alexandra Macgill, Chris Evans, and Jessica Vitak, "Teens, Video Games, and Civics." Pew Internet & American Life Project. September 16, 2008. http://www.pewinternet.org/Reports/2008/Teens-Video-Games-and-Civics.aspx.

27. "About | Social Apps Lab at CITRIS," last modified March 2011, http://socialappslab.com/about/.

28. "Power Grid," BoardGameGeek, accessed May 12, 2013, http://boardgamegeek.com/boardgame/2651/power-grid.

29. Flanagan, *Critical Play*.

30. "Power Grid," Rio Grande Games, http://riograndegames.com/games.html?id=5.

31. "At the New California Academy of Sciences, Cinnabar's Climate Change Exhibits Speak Up About State's Environment and Future," September 18, 2008, accessed December 28, 2011, http://www.blooloop.com/PressReleases/-At-the-New-California-Academy-of-Sciences-Cinnabar-s-Climate-Change-Exhibits-Speak-Up-About-State-s-Environment-and-Future/990.

32. Carlson and Berleant, eds., *The Aesthetics of Natural Environments*, 12, 13.

33. Ibid., 16.

34. Berleant, *Aesthetics and Environment*, vii.

35. Ibid., 13.

36. Ibid., 72.

37. Ibid., 73.

38. Ibid., 76.

39. Ibid., 77.

40. Ibid., 78.

41. Kirwan, *Sublimity*, vii.

42. Ibid., viii.

43. Ibid., 146.

44. Ibid., 143.

45. Manovich, "The Anti-Sublime Ideal," 5.

46. Ibid., 12.

47. Ibid., 11.

48. McGonigal, *Reality is Broken*, 107.

49. Ibid.

50. Manovich, 15.

51. Galloway, *Gaming*, 78.

52. Ibid.

53. Bogost, *Persuasive Games*, 188.

54. Galloway, *Gaming*, 3.

55. Ibid., 5.

56. Ibid., 16.

57. McGonigal, "Why *I Love Bees*," 222.

58. Henry Jenkins, *Convergence Culture*, 246.

Conclusion

1. Screenshot available at thatgamecompany's website, http://thatgamecompany.com/games/journey/. *Journey* is a trademark of Sony Computer Entertainment America Inc.

2. Screenshot available at thatgamecompany's website, http://thatgamecompany.com/games/journey/. *Journey* is a trademark of Sony Computer Entertainment America Inc.

3. "Whats your interpretation of the story? *Spoilers*," thatgamecompany, accessed February 23, 2013, http://www.thatgamecompany.com/forum/viewtopic.php?t=1985.

4. von Uexküll, *A Foray*, 52.

5. Ibid., 53.

6. Ibid., 69.

7. Ibid., 52.

8. Ibid.

9. Ibid., 86.

10. Tuan, *Topophilia*, 4.

11. Ibid., xii.

12. Ibid., 70.

13. Ibid., 28.

14. Ibid., 129.

15. Ibid., xiv.

16. Ibid., 120.

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