FROM:

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CHAPTER EIGHT Computer Games and the Aesthetics of Human and Nonhuman Interaction

HAL could never exist. The good news is that many Artificial Intelligence researchers have become sophisticated enough to stop imagining HAL-like machines. We can now envision a different class of intelligent machines that we will be able to build and that will be very useful. Such machines will be local experts; that is, they will know a great deal about what they are supposed to know about and miserably little about anything else. They might, for example, know how to teach a given skill, but they will not be able to create a poem or play chess.

—Roger Schank, "I'm sorry, Dave, I'm afraid I can't do that": How Could Hal Use Language?

Fantasy Play

Computer and video games are at the heart of new definitions of interactivity and immersion. The impulse to play video and computer games comes as much from the desire to play against the expectations of defeat as from the desire to collaborate with the game and understand its rules. The activities of play are infused with a process of testing, probing, and exploration. Will the puzzle be solved? What tricks, detours, and false directions has the designer included in the game? Players enter a labyrinth of possibilities and find their way through the maze. Some players conquer the games they play, but many don't, which suggests that process is far more significant than results or outcome. This illustrates why driving a car at high speed on a screen can still be exciting even though it is an imaginary activity. The fun comes as much from defeat as winning because players are responding to their own desires and to the game itself. Computer games are not treated as distant objects. They are owned by players, personalized and used as if players have had as much input into their creation as the original producers. This is why many of the games are centered on communities of interest and also why so many players end up joining clubs or meeting each other to explore the games and find solutions to the challenges posed by them. Computer games have always been about "telepresence" and "teleportation." Players seek to go into worlds that don't exist but nevertheless have enough empathy for what they are doing to encourage sensations of entry, emotion, and challenge. Sensations—the physical manifestation of psychological processes—allow the players to believe that even though they are inside spaces that have been built within the strict confines of algorithms, the visual landscapes and sounds are consistent with the world of the game. This is an intensely metaphorical environment constructed on a series of hypothetical possibilities that players explore with great intensity. The desire to fantasize is crucial to games and this enables players to "engage in socially unacceptable behavior in a safe environment" (Rouse 2001, 7). Rouse makes the point that players want to engage with their games in an incremental fashion, rather than solving the challenges all in one instant. Pleasure comes from failure as well as success.

Computer games are the firmest indication yet of the degree to which humans and their technologies have become not only interdependent but also profoundly interwoven. It takes over a million lines of computer code to produce a game. The result is an "engine" that keeps all of the parts of the game together and organizes the orientation, direction, and outcomes of the player's interaction with the game. In most games there is a direct relationship between the actions of the player and the results on the screen. Newer and more sophisticated games are now delaying the outcome of actions to make the plots more difficult and to enhance the mazelike effect of the games. Game engines are complex in large measure because so many elements of games have to be anticipated before any game can be put into the hands of players. In addition, the look and feel of a game (its aesthetic) is the result of the sophistication of the engine. The coding is so complex that many months can be spent on the testing process to see whether the coding has produced the anticipated results. There is nothing particularly romantic about writing and compiling code. In some respects it is like an old-style craft, which requires thousands of hours of work. The limitations of this approach are evident in the narratives of most computer games. The rhythms of creativity in this area are heavily influenced by action and reaction, by characters that "do" things or have things done to them.

This is why sports games are among the biggest sellers and are avidly sought after by fans. Most players know the rules beforehand. Some of the more sophisticated sports games like *Madden's NFL Football* are as much a product of the game industry as they are an outcome of fantasy game leagues that thousands of sports fans play all over North America. The Madden game tracks every player's statistics so that individuals can match each other's abilities, levels, and achievements. There are many Web sites devoted to this game that have been developed by players with tips, patches, and discussions of strategy. In Madden football, it is even possible to ask for a replay if a gamer disagrees with the decision of referees.

One of the most important facets of the game, which is also at the root of its attractiveness, is that players believe the game has enough intelligence to outwit them. Game companies and players talk about the use of artificial intelligence (AI) as if all the variables they encounter are evidence of cleverness and brainpower within the game. The irony is that AI is really no more than a series of random selections that are programmed into the engine such that it appears as if choices are being made by the game. Sometimes the variables are complex enough that the images appear to be thinking. From a gaming point of view, this is a very effective way to challenge players.

There is a long lineage of research in the fields of cybernetics, system dynamics, chaos theory, and adaptive systems that is at the heart of the push to make games more intelligent. There *is* intelligence in the games, but the question is does the game know? The answer clearly is that the game cannot know anything, and so once again it is the vantage point of the player that is at the heart of any assumptions about the location and effectiveness of intelligence within the game. This is in no way to downplay the complexity of the coding that makes it possible to anticipate so many different game "states" that gamers have to work for days to overcome some of the obstacles.

From another perspective, as the war in Iraq unfolded in April 2003, gamers involved in playing *Civilization* began to use maps and images from the war to discuss tactics and military strategies. As with many on-line games, the players went far beyond the parameters of the games they were playing, and in this way moved beyond the limitations of the engines and/or coding that had been developed.

The leakages from game to reality and from reality to game are essential parts of gaming culture. This is why the coding has to allocate so much of the direction of the games to alternative modes of action, reaction, and behavior. Otherwise, it would be unlikely that the players would "believe" in the game to a large extent because the measurement for a game's effectiveness is often the degree to which it lines up with the real world. This fragmentary approach to fantasy is itself summed up by the fact that the American military used computer-based games to educate some of its troops before they went off to fight in Iraq.

If the military games had guns that were not capable of shooting correctly, then the "physics" of weaponry would be undermined. There would be no point to the simulation. Yet, this contradiction is at the *heart* of the playing process. Part of the trickery and the magic is that the games must do things that by their very nature are antithetical to what would happen in the field and nevertheless "look" as if the impossible is possible. There have to be some rewards for engaging the enemy, and there have to be short- and long-term results. What an extraordinary paradigm! The bridges being built for players between different states of mind are now so dependent on game worlds and imagescapes that vantage point may be the only way of understanding the complexities of the interaction.

Hybrids

In her recent book *Modest Witness@Second Millenium. FemaleMan© Meets OncoMouse™*, Donna Haraway (1997) says the following: "The computer is a trope, a part-for-whole-figure, for a world of actors and actants and not a Thing Acting Alone. Computers cause nothing, but the human and nonhuman hybrids troped by the figure of the information machine remake worlds" (126).

Haraway makes a crucial point that will suffuse this chapter. As I mentioned previously, Modern culture tends to draw easy distinctions between machines (nonhumans) and humans, distinctions that encourage people to believe that the nonhuman is separate from human activity and that people simply use technologies such as computers as tools.

Rather, I believe technology has always been mapped into and onto human bodies. The distinctions that are drawn are not between machines and humans, but between disparate levels of involvement with technologies and many levels of synergy and interdependence, as well as alienation (Haraway 1997). This doesn't mean the tensions that exist between computers and humans, for example, are unimportant. Rather, the diverse levels of mediation that supplement and enhance the depth of the interaction largely define the outcomes of the relationships that humans have with technology in general.

Bruno Latour (1999) has described this set of relationships as a collective of humans and nonhumans, and by this he means that the links between humans and their technologies make things possible that neither could achieve without the other. For Latour, and it is a point with which I agree, technology is an inherent constituent of everything defined as human.

Latour suggests that machines and humans form a collective and are continuously acting together in an associative chain of relationships that is only interrupted as people move to different levels of complexity in the process. Computer games are a good example of the drive and energy humans put into their relationships with machines. Another good example of what Latour means is the way users interact with word processors. The word processor and the individual using it act together and produce many different results. The outcome of the relationship is not predictable although most word processors are basically the same. This unpredictability means that both the word processor and the user are changed as a result of their interaction.

This statement doesn't seem to be correct. How can a word processor change? These same issues of autonomy are at the heart of what keeps gamers working so hard to understand and meet the challenges of the games they play. Autonomy is only possible if a great deal of intelligence is attributed to the technology. As I have mentioned, this is the reason that artificial intelligence has become such a buzzword among players and computer programmers. The notion that the machine can work out problems on its own largely depends on vantage point. Does the machine know that it is acting in an autonomous fashion? Clearly, the player or observer makes the decision as to whether some sort of process has gone on to justify claims about the autonomy of the machine. Aren't the rules governing a computer program fixed?

Isn't the hardware an object that cannot be altered? Aren't all of the variables built-in? This is how Latour (1994) clarifies the question in talking about how humans interact with guns:

> *You are a different person with the gun on your hand. Essence is existence and existence is essence. If I define you by what you have (the gun) and by the series of associations that you enter into when you use what you have (when you fire the gun), then you are modified by the gun—more so or less so, depending on the weight of the other associations that you carry. This translation is wholly symmetrical.* You are different with a gun in hand; the gun is different with you holding it. You are another subject because you hold the gun; the gun is another object because it has entered into a relationship with you. *(Pp. 32-33)*

Latour is talking about a *third* level that is a combination of human usage and machine. It is not that the object changes, but the relationship developed with objects transforms all the partners in the exchange. This third level brings a process that seems fixed into a mediated encounter with a process that is not fixed. The result is a *mediated* space occupied by two partners where both partners are dependent upon each other. Their interdependence creates a hybrid that has a number of the properties of the technology and user. The hybridization is evidence for the ways in which the user and technology have found a common ground that often exceeds the design and engineering objectives built into the hardware and software. Of course, the changes in the technology are not material. Hybrid processes are about new levels of materiality that are the product of a series of interactions and transformations that may not have been built into the original technology, nor have anything to do with its initial purpose.

This hybridity is really another way of entering into the culture of technology. Gamers, for example, know that part of what entices them is the rapid manner in which the technology changes and responds to their needs. Companies like Electronic Arts make the effort to produce as much realism as possible and use motion capture to enhance the fluidity of movement of the characters in their games. Motion capture is an excellent example of the third level that I have been discussing. Football players, for example, wear sensors to record all of their movements as they engage in various actions commensurate with their positions on their teams. The sensors then relay the information to computers, and the information is translated into three-dimensional animations that can be incorporated into the rendering process for the games.

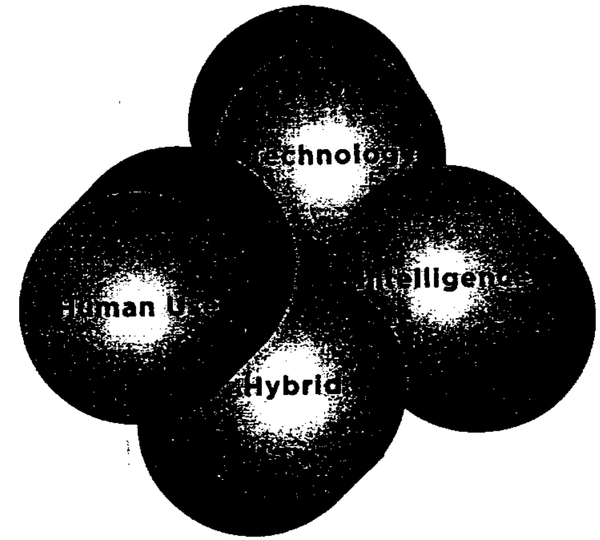

FIGURE 8.1 Intersections of human use and technology

The entire process is based on the biomechanics of human movement so that the size and weight of players will have an impact on how they run and interact with each other. These principles are integrated into the animation. Madden football is somewhere between reality and animation, and that "somewhere" is the third level of hybridity that I have been discussing.

Interaction and Computer Games

The word processor becomes a vehicle for the creation of this "third" space allowing users to feel as if they control the processes of interaction (figure 8.1). A computer game, for example, never brings the answers to the puzzles that it poses directly into the foreground for the player, but instead provokes an exploration of a hybridized new environment that also encourages the player to feel as if he or she were in control. In fact, learning the rules of this new environment is part of the challenge as well as one of the sources of the pleasure that games provide. Playing as an activity is about constructing hybrid experiences and overcoming hurdles that can only be circumvented through practice and interaction. Computer games encourage moving into and out of these worlds, which is why they are not only difficult, but require a lengthy apprenticeship in order to be mastered (Pesce 1998, 2000).

In this sense, interaction as it has been applied to digital technologies like computer games, is *not* just about use or the pragmatics of handling the challenges that the game sets for players. Rather, playing a game creates a mixed and complex space that exceeds many of the intentions built into the original structure, and it is this excess that is the site of potential mastery. In other words, game technologies are about continually evolving relationships undergoing constant change. It is precisely this lack of stasis that keeps human beings searching for innovative ways to solve the problems that games pose (Cassell and Jewkins 1998).

Humans assign a set of subjective values to the instruments and technologies that they develop. These values do not remain static, but evolve over time and are increasingly "manufactured" into the technology itself. In other words, the synergy generated by interaction is eventually included within the technologies; computer games are one of the best examples of this evolutionary process. The intersection of needs that connects humans to their machines means that neither side can work with the other unless they have shared some history (Johnson 1997).

Technologies are born out of needs, amplify and extend those needs, and then help in the redefinition of what it means to be human. This is a continually evolving interaction that shifts and changes in response to the social and cultural context in which it takes place.

Hybridization, then, is about more than a mixture of elements with a particular outcome or result; rather, hybrids underlie the process of change and evolution as technologies and humans encounter each other. To think in these terms is to put intelligence and the subjective back into human-technology relations. Rather than modeling technology in the broadest sense as a series of tools for pragmatic use, there is a need to think about how human subjectivity and the ability to self-reflexively examine identity has evolved out of the relationships humans have with machinery, artifice, and their creative engagement with technology.

The role of design, at the engineering and software levels, has become crucial not only to the ways in which technology functions but also to the manner in which the technology is used. Yet for the most part the design of

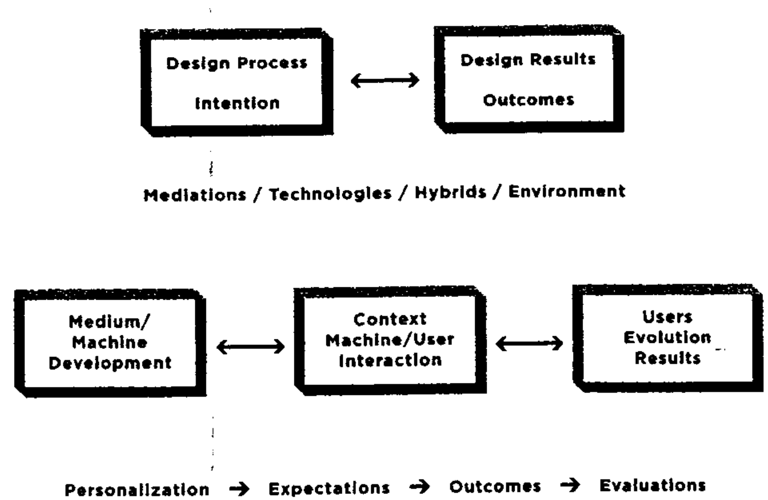

FIGURE 8.2 Design process/design results

games has been in the hands of engineers and computer scientists (Crawford 2002). This is largely because the programming languages that have to be learned to produce a game are so complex that artists and writers have rarely had the opportunity to create them. In this respect, the design process needs to be relatively transparent in order for players to take on the tasks of creating their own games, and in some instances players have modified the games that they play, but these are the exceptions and not the rule.

According to Beynon et al. (2001):

Current frameworks for developing technological products reflect a limited conception of their role. In designing such a product, the emphasis is placed on what can be preconceived about its use, as expressed in its functional specification, its optimization to meet specific functional needs, and *the evaluation of its performance by predetermined metrics. This perspective on design is not sufficient to address the agenda of cognitive technology; it takes too little account of the interaction between a technology, its users, and its environment. (P. 476)*

Beynon et al. (2001) make a crucial point about the relationship between intention and outcome in software design although the same questions exist in nearly all forms of design. In figure 8.2, I left out the ways in which the various elements connect, but I show the many different levels of mediation that exist in any usage of technology.

The process of design and use is not linear but circular, evolutionary, and often unpredictable. One of the most important features of good design in the software area is the ability of users to customize not only their relationship to what they are doing but the actual parameters of the software itself. Generally, however, most software prevents the kind of personalization that users might be interested in engaging with and developing (Lohr 2001).

In fact, in discussions with game designers at Electronic Arts, the largest studio in the world for the production of computer games, I was told that customization is crucial, but it must come from the layering of so many variables into the game that players feel "as if" they have control when they really don't. One of the game developers suggested that if players were actually able to alter the fundamentals of the game, then chaos would ensue, and the game would not be entertaining. For me, the point is that customization *is* the game (Adams 2001).

Learning is the crucial impulse in the evolutionary process of exploring and playing a game. Computer games are good examples of these stresses and strains between expectations and what users and players do with the constraints that govern both the design and playing process. At the same time, if all of the variables have been thought out ahead of time, then little room is left for players to transform the core (or engine, the term gamers and programmers use to describe the algorithmic structure that governs the game) of the computer game environment.

At the same time, hybridization (the process of moving beyond subject/object relationships) develops over time through personalization whether expectations are achieved or not. As a result, the *third* space that Latour talks about comes to play a much more significant role in the way users relate to what they do with hardware and software than the original process of design could *ever* anticipate. In other words, computer games, for example, are played within the boundaries of this third space (which is why the learning process is so central—and why it takes so long to learn all the levels of the games), which is the site of interactivity, intelligence, and creativity.

Another way of thinking about this third space is to examine how people communicate verbally. When an individual says something to a friend and he or she responds, there is no direct way to fully comprehend all the intentions that governed the communication. Instead, both parties agree by convention, habit, and the desire to understand each other that, to a certain degree, the gaps between them will not affect the content of the exchange. Although the gaps are present, they are *part* of the process. Awareness of the gaps, however, pulls the process of communications into a *metacommunication*, where individuals must develop an awareness of what works and what doesn't. They have to know how and why the process works or doesn't. They also have to be aware of the constraints that the gaps introduce into every part of the exchange. It is the combination of exchange, awareness, and communications that produces additional spaces of interaction and conversation—these are *third* spaces that can only be examined by looking at all parts of the exchange (Bateson 1979).

Brian Cantwell Smith has dealt with these issues in his book *On the Origin of Objects* (1998). Smith's most important insight is that the categories governing the creation of software, for example, need to be developed in recognition of their dynamic and evolutionary aspects. It is not enough to make ontological claims about the validity or purpose of programming code to the exclusion of the changes that usage both encourages and makes possible. The interaction of use and design is about parts and the whole, evolving processes of change and personalization.

This is close to what Bruno Latour is saying. It is very difficult to model the complex relationships among context, users, and design. In general, computer programmers use a behavioral approach that builds in many variables, but by its very nature software use often exceeds, if not overturns, the intentions that went into its design. At issue here is whether design can anticipate the process of hybridization, or even whether it should.

To program is to engage in higher-level logic and mathematical modeling. Clearly, the code for the word processor I am using works; otherwise, there would be no relationship between the keyboard, my hands, and the screen. Code is a kind of *virtual toolbox* into which a great deal has been placed and from which a great deal can be extracted. Yet with careful qualifications, the grammar for language is also a higher order system of tremendous abstraction—speakers don't need to know grammar (in the literal sense) in order to speak. If speakers had to think in grammatical terms, speech would become belabored since it would have to be constructed in a conscious rule-based manner. This is clearly the problem that develops when individuals learn a new language and why it is often so uncomfortable an experience.

It has been one of the major fallacies of software development and programming to assume that code is equivalent to grammar and that it is possible to postulate a rational relationship between creation and use. This is one of the reasons (though not the only one) that the human brain has increasingly been compared to a computer (Churchland 1992). It is important to recognize that the equation of code with grammar actually works against the best interests of programmers. This is because not only is grammar far more complex than code, it also is universal, innate to humans, and a genetic feature of the brain. Noam Chomsky (1980) responds to this issue in the following way:

Investigation of human language has led me to believe that a genetically determined language faculty, one component of the human mind, specifies a certain class of humanly accessible grammars. We may think of a grammar, represented somehow in the mind, as a system that specifies the phonetic, syntactic and semantic properties of an infinite class of potential sentences. (P. 35)

Code is a *product* of these and other properties of mind and thought. Code itself can only play a limited role in what people do with it. Given the opportunity, how would or could users characterize the code governing a word processor? Would it look the same as written music? Music scores are continually open to interpretation, transformation, and change not only in terms of their writing, but when they are performed. The syntactic properties of music writing are very specific, but no two performances are the same. While there may be conventions to the writing of music and while these conventions are often repeated, the beauty of performance is its unpredictability.

I would make the same argument for the use of the computer and most technologies. The outcome of written music and performance is as hybridized as using a technology. All of these spaces are multiple combinations, and cannot be constrained by any one of their parts. This is often why the arrival of a new technology seems like such a scary process. The elements that contribute to hybrid spaces seem to lose their identity for a while or at least until the partners in the process develop enough knowledge to permit their interaction to take on a particular and more conventional character.

The brilliance of Bruno Latour's book, *Aramis or The Love of Technology* (1996), is that he explores the institutional base upon which the hybridized process both develops and is sustained. Latour's book explores how a massive transportation project failed in Paris. The book is full of personal comments by the "players" in the drama and equally personal reflections by Latour. Most importantly, Latour explores the evolving relationship among projects, the way projects are visualized, and their development into "objects."

In this case, all of the plans for the project were quite far advanced before the project was killed. The project, as a hybrid, took on a life of its own. In a sense, the *project* began to make claims for what it was doing and what it could be, that the institutions that were responsible could not meet and often could not explain. This notion of a project "taking on a life of its own" is another way of talking about hybridized spaces.

Part of the problem is that so much of what makes technology work is not necessarily visible, which contributes to the feeling that the technology is very distant from users, participants, and viewers—distant enough to make it seem as if responsibility for what happens was *with* the technology and not with the relationship between humans and their machines. The gap between the systems that guide the operations of computers and the ability to change the underlying programming language is so vast that issues of responsible engagement seem to be insoluble. This gap tends to reinforce the idea that users are not acting in concert with the computer; rather, it is just seen as a device, and the human use of it is limited and circumscribed by the manner in which it was built and maintained.

In contrast, the Open Source movement has been far more important to the development and growth of new attitudes to computer technologies than initially thought. The idea that a computer operating system, such as Linux, could be constructed through a worldwide and quite spontaneous consortium of people suggests that both the computer and its programming logic are not as opaque as some would believe. But the level of specialization required to engage in this collective process excluded the vast majority of computer users.

As Eric Raymond (1999) has suggested: "Linux is subversive. Who would have thought even five years ago (1991) that a world-class operating system could coalesce as if by magic out of the part-time hacking of several thousand developers scattered all over the planet, connected only by the tenuous strands of the Internet?" (29). Raymond's point is crucial. The spontaneity, as well as the competence of the people involved, made it possible for a sizable community to produce unforeseen results in a dynamic and evolutionary way. Linux continues to evolve and has reinforced the credibility of hackers and aficionados of computers throughout the world. Most important, the history of Linux suggests that the organized and rather strict world of computer programming is in fact very messy.

Writing code appears to be the most concrete of activities—there is after all a direct link between coding and the operations of a computer. The power of this metaphor is initially very strong, but what happens when codes combine with other codes in an autonomous fashion and produce results that exceed anything that was programmed in the first place? Does this challenge the role of subjectivity and the position that humans have in hybrid spaces? Before I return to the importance of computer games in answering some of these questions, I will reflect for a moment on the contradictory and yet crucial role that the artificial life movement has played in suggesting a measure of autonomy to the way computers work.

Code and Artificial Life

The artificial life movement has been defined with great clarity by one of its founders: "Artificial life is the study of man-made systems that exhibit behaviors characteristic of natural living systems" (Langton 1989, 1). Genetic algorithms are designed to send instructions to a series of encoded "strings," and these mutate and change, "evolve" with results that cannot be predicted by what the algorithm originally put in place. "In GA's (genetic algorithms) computer organisms e.g., computer programs encoded as strings of ones and zeros (bit strings) reproduce in proportion to their fitness in the environment, where fitness is a measure of how well an organism solves a given problem" (Mitchell 1998, 7). Mitchell goes on to reproduce a classic example of a genetic algorithm (see figure 8.3.).

Mitchell (1998) makes the point that "reproduction" is really about copying, which is an idealized version of the evolutionary process. In the end, a highly evolved and very fit "string" can be used to solve complex questions. Mitchell mentions how problems in circuit design as well as robot navigation and the economy have been dealt with using genetic algorithms.

The point to retain here is that although there are many different kinds of programming, and many languages have been developed over the last thirty years (assembly languages, procedural programming, functional programming, logic programming, object-oriented programming, and so on), they are all abstract representations of potential actions and behaviors on the part of users. In the instance of artificial life, biological metaphors are used to

Assume the individuals in the population are computer programs encoded as bit strings. The following is a simple genetic algorithm.

1. Generate a random initial population of *M* individuals.

Repeat the following for *N* generations.

2. Calculate the fitness of each individual in the populations. (The user must define a function assigning a numerical fitness to each individual. For example, if the individuals represent computer programs, the fitness of an individual is calculated by running the corresponding computer program and seeing how well it does on a given task.)

3. Repeat until the new population has *M* individuals:

   (a) Choose two parent individuals from the current population probabilistically as a function of fitness.

   (b) Cross them over at a randomly chosen locus to produce an offspring. That is, choose a position in each bit string, form one offspring by taking the bits before that position from one parent and after that position from the other parent.

   (c) Mutate each locus in the offspring with a small probability.

   (d) Put the offspring in the new population.

This process is iterated for many generations, at which point hopefully one or more high-fitness individuals have been created.

FIGURE 8.3 Genetic algorithm

describe mathematical codes that "evolve" as a result of autonomous processes among the various programming strings.

This level of abstraction is difficult to understand, but, ironically, it depends increasingly upon a hypothetical space. This hypothetical space can develop its own autonomy. It can even appear as if the algorithms were evolving on their own without the apparent influence of their creators. The reality is that unless the machines become completely autonomous and cease to be viewed, interpreted, fixed, and so on, it is unlikely that they will survive on their own.

The most important issue here is once again vantage point, which was analyzed in great detail in the introduction and in chapter 1. How can the evolutionary process be observed if it is autonomous? If this issue is approached from the point of view that the *notion* of autonomy were a hybridized outcome of human-machine relations, then it becomes possible to conceive of programming logics that might operate independently of human observation. Artificial life proponents would argue that they are creating "animals" and other "living" beings within virtual worlds. This is more than a question of nomenclature, because it goes to the heart of what is meant by life and, certainly, the mind.

If, as I have argued throughout this book, the virtual were an extension of reality, then artificial life is only possible as a product of human interference and engineering. The idea that there is autonomy results from confusing the hybridized third space of interaction with the computer itself. Although artificial life deals with simulations and models, its origins and the ways in which those models are observed are derived from a behavioral approach to phenomena.

A behavioral approach has taken root in software development with the result that programs are written in anticipation of certain actions and responses on the part of users. It is this behavioral template that dominates the way code is written, even though when thousands of lines of code are needed to make a system work, many things can and do go wrong. An input/output model dominates behavioral approaches in this area, which is why it appears as if autonomy were possible, if not desirable, and why artificial life seems to be so attractive since it reinforces the seeming autonomy of the computer and its activities.

The "Life" in Computer Games

Ironically, computer games are one of the best examples of the effort to break down the behavioral model. When gamers play a snowboarding game, they input certain actions into a PlayStation, such as turning and following the route that the game lays out for them. A certain amount of information has to be processed by the software in the PlayStation in order for their commands to be translated from hand to machine and so on. There are numerous variables from which gamers can choose, but the game has strict limits, which are defined by its primary purpose to offer players a photorealistic experience of going down a hill. This major constraint conditions everything from the graphics to the coding. And observing a player or deriving certain conclusions from his or her behavior will not help too much in understanding the experience.

It may seem as if there were countless choices available to the player, but the "trick" of the game is that there are actually very few choices. To "win" the game, players must discover the constraints of the game and the limitations of their own experience as well as solve the problems the game sets for them. The player, the game, and the context of the playing provide the foundation for a process of *hybridization* that doesn't need all the characteristics of its parts. This is one of the sources for the "magic" of digital games. There seems to be a kind of sorcery involved in the subjective intensity with which players engage with their games—an enchantment that quickly moves from reality to imagination and back again, and only some of this can be attributed to the game itself.

The most important point to remember is that the magic comes from the unexpected exploration of a space and time that seems to be outside the constraints posed by the game. This is partially because the game may have the qualities of the virtual attached to it, but the "place" of the player remains quite conventional. Irrespective of the intensity, the person playing is not going down a hill. However, he/she agrees to imagine that the hill is there and, in so doing, supports and enhances his/her relationship to the game.

A simple but elegant way of understanding how a computer game is created can be seen in figure 8.4. Inside a game certain problems can be posed that cannot be replicated anywhere else. For example, when gamers begin to play the snowboard game, the character flies off the edge of the course, crashes, screams, and so on. Yet, this leads to even more effort and a strong desire to control the character and its movements. Game controllers and all the various accoutrements that come with games from steering wheels to accelerators for car games are all based on controlling an object

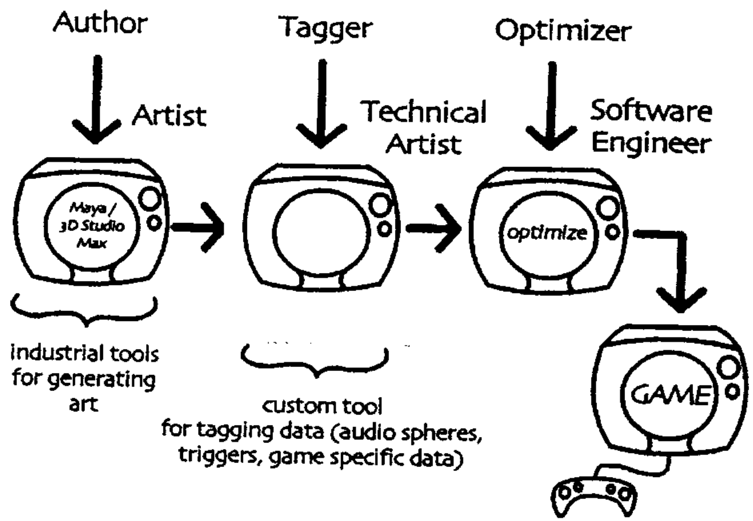

FIGURE 8.4 Elements in the creation of a computer game (John Buchanan, Electronic Arts) (drawing by Maija Burnett)

from a distance. Yet, much of that control is not necessarily related to what the player is doing; rather, the game is providing a number of opportunities that limit the quantity of choices that can be made. The magic is that those limitations seem to be within the user rather than within the game. Actually, the limitations are a product of the interaction and therefore not entirely within the control of either the player or the game.

At a deeper level, the desire to overcome the limitations of the computer screen as an interface among experience, doing and seeing has resulted in a paradoxical desire to transform the screen itself into a device of interaction. The joy of traveling through the screen in an imaginary fashion is partially about taking some control over the technology and exercising a degree of power over the images and sounds that computers produce (Cubitt 1998). But, for the most part, games remain spatially bounded by frames and hindered by the characteristics of the screen as a two-dimensional device.

The extraordinary thing is how ready users are to "play" with these limitations and how so much energy has been devoted to conquering the problems that the interfaces pose. This is evidence of the collective effort in which participants are engaged. And the interesting thing is how this is fundamentally altering the material basis for the player's experience of the world. If people were not already collectively engaged with technology in this fashion, they would not be able to adapt to the cultural shifts that computers are generating (Herz 1997). So, in this carefully delimited sense, humans are constructing simulations that have all of the appearances of modeling life, but the key word to keep in mind is *model:* It is a big jump from model to life (Burnham and Baer 2001).

The cover of the video game *SSX* says the following: "SSX (an Electronic Arts game for PlayStation 2) delivers knee-pounding, board-clattering rides on the wildest runs ever imagined. No matter how you carve it, you're hauling tail with some of the sickest speed freaks to ever hit the snow. Push the edges, hang off ledges, and stomp killer jumps in an insane push to the finish line" (cover). The key to the language here is the inclusive way in which the player becomes the game. The tensions between identification and the reality of being in front of a television set produces the "thirdness" of which I have been speaking. It is only in the combined real/imaginary space, inside a hybrid, that it becomes possible to *feel* as if the player were hitting the snow, as if the model or simulated space has managed to exceed the boundaries that govern its operations.

What would happen if the landscape were to change dynamically in response to additional variables such as weather and other unforeseen natural events? Would the sense of realism increase even further? What would happen if the animated character were to rebel against the player and reject his or her style of play? All of this is possible inside these worlds—only possible, that is, if the world does not obey conventional rules of space and time.

Computer games typically control individual characters according to scripts that are written at design time. As a result, a character's behavior is limited in its ability to respond to unanticipated run-time contexts. Combinations of generative and reactive planning algorithms provide the means for creating customized, novel behavior that changes each time a game is played (Amant and Young 2001, 18).

This type of customization and flexibility may finally alter the bridge between the real and the virtual, collapsing both of them into another, perhaps different space where the virtual "feels" like a more personal visualization of desire, pleasure, and need (Vilhjálmsson 1997).

"Hacking" the Game

Computer games and the excitement they generate are a partial response to the need to actualize the collective human engagement with technology in general and with image-worlds in particular. They are also a response to the complexity of the hybridized spaces that human-technology relations create. There are tensions among gamers and creators, and an increasing desire among users to control more fully every aspect of the games they play. An entire subculture has arisen devoted to transforming the look and feel of computer games through "hacking" and "patching" in order to overcome the organization of the game as well as the coding.

In a crucial article that appeared in the journal *Interactions*, Mitchell Resnick, Amy Bruckman, and Fred Martin argued for a constructionist approach to computer technologies that builds in the capacity to create computer-driven objects and programs that connect to the user's personal and intellectual interests. One example this research produced was the LEGO game *Mindstorms* that allows children to build robots with tiny chips in them. The robots can be programmed in a very simple way on a computer. The toy has been a major success for the LEGO Company. It takes the conventional relationships that novices have with computers and creates an immediate and easy level of access. The virtual space represented by the screen of a computer suddenly moves from a flat world to a three-dimensional and sculptural one. The creators of *Mindstorms* put it this way: "Developers of design-oriented learning environments can not 'program' learning experiences directly. The challenge, instead, is to create frameworks from which strong connections—and rich learning experiences—are likely to emerge" (Bruckman, Martin and Resnick 1996, 47).

Anne-Marie Schleiner (2001) comments on this phenomenon in relation to computer games in the following way with particular reference to Lara Croft and the *Tomb Raider* games:

The Internet provides the techno-culture researcher with a visible mapping of desire, digital evidence of an internationally shared lust for the Nude Raider patch. A Web search for Nude Raider produces innumerable fan sites requesting the Nude Raider patch and displaying Nude Raider screen shots (1,072,226 hits from one search with the Excite search engine). An older version of the official Tomb Raider homepage itself even contained a link to the Nude Raider patch. Nude Raider strips Lara Croft's already scant clothing to reveal polygonal tits and ass as she fights her way up the game levels, operating within the bounds of gender-subject configurations: Lara as fetish object of the male gaze. Not all game patches so explicitly echo or reinforce a particular feature of the original game—in the case of Nude Raider, an exaggeration of Lara's synthetic erotic appeal. A concentrated Web search on almost any shooter produces a stratum of alternate and more subversive game scenarios in the form of game plug-ins and patches offered freely from fans' personal websites. Some game companies, like Bungie, developers of Marathon, and Id Software, developers of Doom and Quake, have even capitalized on this widespread hacking by packaging software with their games that makes it easier to manipulate and create new game scenarios. (P. 225)

Schleiner's own artistic work explores the transformation of the attributes of computer and video games. She is part of a large and growing community that is confronting the seeming "solidity" of programming languages in the same vein and with the same intensity as hackers (Cassell and Jenkins 1998). It is significant that the movement to alter games is so widespread that creators of games often face a crisis about how to program and protect their intellectual property.

It may be, however, that the issue is far broader than just individual games. The underlying motivation to hack a game comes from the same culture and history that helped in the development of computers in the 1950s (Johnson 1997). Thousands of players have formed guilds and communities devoting themselves not only to playing but also to understanding the games they love from a variety of narrative and technical perspectives. For example, downloadable "cheat mods" are patches that permit, if not encourage, players to make the games work to their advantage. Unlike patches, which may alter the look and feel of characters, mods change the programming. Since they are often so private, mods can give some players a major edge over their competitors. Ironically, these interventions are what the early inventors of computer technology envisaged for their machines (Shurkin 1996). Application program interfaces are part and parcel of games like *Quake* and *Half-Life*, and they permit profound changes in the organization and dynamics of the games (Amant and Young 2001).

The video and computer game industry has been developing more sophisticated models of interactivity to allow players to fully explore the closeness they have established with screen-based experiences. But the connections between interactivity and technology have been with consumers since popular culture became a part of everyday life in the nineteenth century. The futurists, for example, argued for the destruction of conventional theater in the 1920s as a way of overcoming the distance between spectator and stage:

As Futurism became popular, it afforded artists an opportunity to create environments for the public eye. The location of the café-cabaret proved to be a logical solution because it had established itself as an open avenue for the inventive sensibility. The artists Vladimir Tatlin, Alexander Rodchenko, Giacomo Balla, and Leo Van Doesburg produced café-cabaret environments between the years 1917 and 1926. Visual arenas were created to coincide with the theatrical and musical experiments that took place in the café. In 1921 Balla created a visual environment in the Bal Tic Tac in Rome, Italy. Acoustics, lighting, and visual effects interacted with and influenced each other. Projections of dancers upon the walls of the café created a display of colors, lines, and planes. Van Doesburg, in collaboration with Jean Arp and Sophie Tauber-Arp, created murals at the Café L'Aubette, a café-cabaret cinema in Strasbourg, Germany, between 1926 and 1928. Doesburg's goal was to break up the symmetry of the interior architecture by creating passages of color that seemingly flowed within the spaces of the entrance, foyer, staircase, and room for dancing. (Gallagher 2000)

The desire to produce interactive environments accelerated in the 1960s and found its fullest expression in the use of cybernetic concepts and ideas from research into artificial intelligence. There is a wonderful story to be told here in the movement from performance art to happenings, installations, and the advent of sophisticated imaging devices. More sophisticated information storage technologies like PlayStation 2 have been wrapped into gaming culture in order to facilitate playing, but PlayStation 2 can also be used for artistic purposes. Among the artists who have explored these levels of interaction to the fullest are David Roekby, Stelarc, and Perry Hoberman. As Rokeby (1996) says:

Interactive artists are engaged in changing the relationship between artists and their media, and between artworks and their audience. These changes tend to increase the extent of the audience's role in the artwork, loosening the authority of the author or creator. Rather than creating finished works, the interactive artist creates relationships. The ability to represent relationships in a functional way adds significantly to the expressive palette available to artists. The power of this expression is multiplied by the fact that the interactors themselves become referents of the work. The works are somewhat akin to portraits, reflecting back aspects of the interactors, transformed so as to express the artist's point.

The gaming community has contributed to the development and growth of a new medium that responds and even acts on what Rokeby is saying (Daubner 1998). In some respects gaming has provided the foundation for the shift into digital and virtual environments. Many of the claims for "virtuality" are in essence claims about the breadth, the infinite ability that people have to use their imaginations to bring them into contact with any number of different phenomena. All these elements are about the expansion of the traditional ground for "play" in Western culture. The difference is that a great deal of power is now being attributed to the technology of play. The implications of this cultural choice need to be explored in the context of the shared dialogue that individuals have developed with these nonhumans and the new hybrid spaces that have been created.

HAL's Legacy: 2001's Computer as Dream and Reality (Stork 1997b) devoted itself to examining whether the human characteristics of the HAL computer were or are possible. Generally, most of the writers in the book came to the conclusion that HAL was ahead of its time and unlikely in the future. Interestingly, the book was written by scientists who were genuinely interested in the cultural assumptions that went into the creation of HAL as a character in the film *2001: A Space Odyssey*. As I mentioned earlier in this book, even though the chess computer Deep Blue appears to confirm the worst cultural fears about technology, it remains extremely limited when compared to the full range of knowledge and emotions that make up human consciousness. Yet, there remains a sense that intelligence can be programmed into computers. As Roger Schank (1997) suggests: "To tackle the question of whether a machine like HAL could exist, we need to ask how such a machine would acquire knowledge. The answer must be that the machine would need to be endowed with sufficient intelligence to understand any experience it confronted" (183).

It is not a question of programming computers to be like humans. It is a matter of understanding that humans share a similar ground with computers that now precludes the possibility of existing without them. Another entry point into this discussion is through the aesthetic choices made about the interfaces that both separate and invite users into the digital world. When players talk about the *look* of a program, in this case a game, what are they talking about? It would be useful to develop some taxonomies of the "look" of digital games as well as digital environments. As three-dimensional Internet games become more popular and more practical, the interfaces become more complex. And the claims made for those interfaces raise general expectations for the experiences that the games offer and for the intelligence of the machines being used.

For example, the *Ultima 2* online game is described as a "Persistent State World." This is a world that players "cohabit" with thousands of other people, "simultaneously." According to the *Ultima 2* Web site, "It's persistent in that the world exists independent of your presence, and in that your actions can permanently shape the world" (*Ultima 2* 2002a). The role-playing possibilities of the game are extended into something far more complex. Fantasy becomes the basis for an extension of the body into the protected spaces of the screen. But this is also about the shared ground upon which fantasy can develop. It is about the prostheses that Western culture has used to enhance and strengthen imaginary spaces for play and interaction. In this sense, conventional notions of aesthetics used for analogue media may not be that easily transferable to the digital area, challenging what is meant by interactivity.

Building New Worlds

The links between the computer and the television screen are very suggestive of an aesthetic that is struggling to redefine flatness and three-dimensionality. Part of the struggle is located in the creation of "worlds"—the idea that worlds can be constructed by programming that introduces a whole host of variables into screen-based experiences. Yet it seems clear that games are about a creative mix of worlds and otherworldliness. Games are about gaps, and gaps are about finding a place for the player to affect the experiences he or she has. They are about role playing and imaginary projections of self into interfaces that have enough power to absorb a variety of needs and desires. In other words, they are about using the power of fantasy to allow players to see into their motivations and to hear their desires through the avatars that are generated in the screen environment (Vilhjálmsson 1997).

Games are about substitution, displacement, and the extraordinary need gamers have to reinvigorate ancient mythic stories and tales. I think there is more than a passing relationship between the medium of the computer and the desire to create complex fantasies within its screens. I would even posit that what is described as hypermedia is about the joy that comes from virtual travel, a phenomenon that has its roots in literature, art, and the relationship humans have always had with technology. (This argument might encourage critics and analysts to look at the origins of writing, storytelling, and the mapping of technology onto human bodies and into human fantasies from a different perspective.)

What does it mean to suggest that players inhabit the screen? Is the bridge among fantasy, screen, and reality such a flimsy one? Or have gamers understood that the distinction itself has never been as useful as their culture and society would like them to believe? From the very beginning of the cinema, for example, screens were used as vehicles to draw audiences into other worlds. The fascination, the sheer excitement of discovering the range, depth, and infinite storytelling capacity of the cinema has not only sustained an industry, it has transformed screens into vehicles of excitement, entertainment, and learning.

The contrasting popular cultural complaint has been that viewers are victims of this process—the common argument, for example, that violent games produce violent children. I believe this point of view to be fundamentally incorrect although I am fascinated by the way it resonates as an explanation for many social ills and how it leads to all sorts of conclusions about the "value" of games, if not of the value of popular culture itself. The arguments about violence are weak in large measure because there is no way of specifying *exactly* which part of a story or a set of images has a particular effect or whether the cumulative impact of images can be measured.

Within all of this, the power to control what happens on screens, to change and transform the aesthetic of screen-based experiences has more often than not been made possible by the attentiveness of creators and producers to the needs of their audiences. Western culture has built up a vast inventory of what works and what doesn't. In this respect, gamers are and have been interacting with computer games using a vast repertoire of already existing abilities and knowledge. The tone, design, and direction of computer games have been set by a host of cultural assumptions driven by the audiences that use them.

It is nevertheless important to understand that players cannot change the aesthetic of individual games unless they become the authors of the code that organizes the game's orientation, direction, and content. The movement here is along a trajectory of participation at the level of the game itself to influencing the design and appearance of the game in its next version. By now, there are many generations of games; the surprise is that there has not been even more inventiveness, more new interfaces, and more new ideas about the worlds that are generated (Schleiner 1998). Perhaps these are limitations that cannot be overcome unless screen interfaces change. The biggest challenge facing gaming companies is that they need to create more complex operating systems (game engines) for the games, which may work against transparency and simplicity. There needs to be a synergistic relationship among code, game, interface, player, and design.

Ironically, ever larger screens still remain enclosed by frames, and this may preclude the simple movement from game experience to total virtual enclosure. Perhaps this desire for the immersive experience is not as much about mastery as it is about the very character of the technology itself. In other words, the technology (and not necessarily what it does) may be the real attractor here. Immersion makes an assumption about human experience that is verified by reference to the technology itself. At the same time, flight simulators, for example, come as close to the "real" thing as is possible. American corporations now spend over $10 billion a year on three-dimensional design for a whole host of military and nonmilitary applications. Most areas of product design use digital tools to achieve their goals. *Ultima 2 Online* promotes itself as one of the most "amazing" immersive experiences in the game world, and this is largely based on assumptions about immersion. Immersion is a trope for the experiences of virtual space. Those experiences are framed by interfaces, which means that highly mediated and organized *metaphors* for seeing facilitate and encourage users to feel as if they are inside images. Ultimately, these virtual environments can only be visualized through representations, and the experiences can only be validated if participants have the will to do so. In other words, virtual spaces have no ontological foundation, and claims that suggest participants are capable of entering into virtual spaces are more than likely claims about the strength of interfaces than they are about human experience. This would even apply to the use of tele-immersive tools for medical purposes. The ability of doctors to engage with these tools will be largely dependent on the ability they have to learn how to use the interfaces that link them to patients in remote locations. The notion of presence, so crucial to games as well, is about a mental act of will to try and overcome the lack of immediacy. This requires imagination as much as it requires "presence." The confusion here is how to distinguish among the use of the tools, experience, and interpretation. Virtual spaces are, by themselves, not the medium of communications. Rather, virtual spaces are the context within which a variety of image and sound-based media operate. And participants, in ways that cannot be extrapolated from the technologies, will determine the effectiveness of those operations.

Unlike the cinema, which borrowed freely from photography, theatre, opera, music, and other traditions and media, computer games have evolved as a result of their interaction with the history of games and various forms of cultural expression. The games have been designed using categories that have links into the history of stories but not into the artistic traditions for the creation of those stories.

Many of the traditions being drawn upon are essentially linked to the capacities of the technology, which is perhaps why so many games try to generate role-playing situations and simulations. So when the creators of *Ultima 2* suggest that gamers can become a "master craftsman" or a "monster" or an "expert weapon smith," they are suggesting that gamers can learn to accommodate the fantasy process by reveling in their actualization of it, as well as in the immersive space that *Ultima* has created for participants.

The technology disappears so that participants can also disappear into their imaginaries. The embedded chip may well be within humans as well as outside of them, which ironically was a recurring theme of the television show *The X-Files* over a number of seasons. An important feature of *Ultima Online* is found in the many contacts people make with each other outside of the game context through conventions and other public events. This further extends the boundaries of the virtual from one context into another.

I regard the period of aesthetic experimentation in video and computer games to be in its early phase. This phase has been characterized by the incorporation of traditional styles, narrative structures, and themes into the particular look and feel of simulated gaming spaces. At the same time, an understanding of the particularities of space and time that characterize the way the games and their participants orient themselves within the screen environment is still being developed. Some of what is now going on could be described as reverse engineering. A computer animator creates an artificial world of fish in a pool. He programs them to act like real fish by first filming fish in their natural habitat. He creates his graphics by developing the drawings from the originals and then regenerating three-dimensional models with richly endowed computer-based colors. He then lets the digital fish play in their digital pool and films their behavior for a fishing game.

"A virtual world is an Internet community where thousands of players simultaneously live out fantasy lives in an everchanging virtual environment.

ORIGIN created the virtual world game genre in 1997 with the launch of Ultima Online, which has sold over 1 million copies to date.

Four years after its launch, *Ultima Online* still is growing and has more than 225,000 active players who spend an average of between 10–20 hours per week immersed in the land of Britannia and the virtual world of Ultima Online" (*Ultima 2* 2002b).

As Dimitri Terzopoulos (1998) puts it: "Rather than being a graphical model puppeteer, the computer animator has a job more analogous to that of an underwater nature cinematographer. Immersed in the virtual marine world, the animator strategically positions one or more virtual cameras to capture interesting film footage of the behaviors of the artificial fish" (71). The increasingly complex mediations here suggest that the creative process of producing virtual spaces has moved beyond artifice into new kinds of physical and mental environments with radically different ways of using time and dramatically new ways of envisioning the role of sight and the human body.

For example, how do participants deal with the normal sensations of space in a snowboarding game that puts them face to face with a screen large enough for them to "locate" their experiences on a mountain? The speed of descent increases with each shift of their bodies, but clearly there is neither a descent nor real speed being reached here. An argument can be made that the space being entered is an inner one, located, if that is the word, within a highly contingent imaginary sphere. This brings the body of the "player" into close contact with emotions that are linked to the "descent" even if the boundaries of the experience are ultimately of a hypothetical nature.

Here is a wonderful irony. Most games of this sort reside in a theoretical world in which a variety of hypothetical possibilities are continuously tested. The excitement and adrenaline come from the process of testing many of the inner states that are suppressed when people are on the mountain itself, as well as learning the new sensations of space and time that come with telesnowboarding.

On the mountain, the testing must be approached with great care or the player will lose his or her concentration and take a tumble. The beauty of playing at snowboarding, in an emporium devoted to virtual games or at home with a large screen and rap songs blasting over the sound system, is that players can simultaneously focus on all the elements of being within and outside the experience. This is one of the reasons why a player's sense of space is transformed. In order to really play this type of game, the participant must learn its rules and the expectations that have been built into its structure. Telepresence is about the creation of new aesthetic forms driven by photorealism and efforts to link human physical movement with responsive screen environments. In other words, telepresence is not an easy process in which to enter, nor is it foreign to other strategies that have been developed to play within any number of imaginary and real spaces.

Depending on one's perspective, these imaginary places are often miniature models of hypothetical worlds that players are asked to inhabit. The jump from presence to telepresence may be the only way to sustain the hypothetical relationship that players develop with the gaming environment. Telepresence is about playing with contingency, about the joy of testing and challenging oneself as if everything and nothing were at stake.

From an aesthetic point of view, the graphical interfaces that are designed to contain these worlds must increasingly be created according to their own rules and must allow players a smooth transition from one state of mind to another. I watched a young boy lie down on a virtual hang gliding machine at a games emporium and loudly gasp at the vista presented to him. He transited with great speed from the real to the virtual. The key word is *transit*, which means that no one could, by observation alone, fully understand how he had prepared himself for the experience or what he went through. Presumably, he had a sophisticated enough Nintendo machine to have already accepted the process of modeling, and the jump to hang gliding was merely one of many steps that he had already made in his exploration of virtual spaces and simulation.

A game is just a representational data structure with thousands of variables built into it. This structure makes it possible for certain "events," for the actual modeling, to take place. But how does that structure make it "feel" as if the screen were a useful and exciting place to create and sustain the intense relationships of a game? Can new ideas appear within this structure if the information at the core of the game is carefully organized to represent a particular design and form? These are crucial questions that require further research into the ways computer games have evolved and the synergies that have been created between images and playing.

Three-dimensional screen worlds are built on a two-dimensional foundation. The markers within those worlds must be clearly understood in order for participants to wend their way through the spatial architecture. Those markers are oriented toward simulated experiences, but what does the word *simulation* actually suggest in the context of a game? Does it imply a direct relationship between the events of the game and the world of the player? I think not.

Simulation is about a world that has a measure of autonomy built into its very grammar, but that autonomy is illusory. In simulated environments the programming can make it possible for independent choices to be made by players or users. Players use their senses in so many different ways that part of the challenge is to integrate the intensity of playing with enough self-awareness to maintain some control. This suggests that the ability to use visual signs and cues is as much about the intersections of popular culture and simulation as it is about already existing "bodies" of knowledge. As the body is transformed into digital characters capable of doing anything within the limits of the screen and within the limits of the interface, players experience a rush of power (as in the game *Grand Theft Auto 3*).

The process of getting into the games is related to the amount of time it takes to train oneself in all of the characteristics of the simulation. Perhaps this is what permits, if not encourages, the ease of movement from physical presence to telepresence. One has to be careful because simulation seems to suggest a loss of self, or a loss of control over what one defines as real to oneself. Clearly, the feelings associated with simulation are powerful. But they are limited by the interfaces and by the fact that there are always mediators among experience, fantasy, and simulation.

Could it be that the games reflect the cultural move from sensate experiences to mediated screen-based relationships? Could it be that the structure of these experiences has legitimated the ways telepresence is now accepted as an experience worth having? It may be the case that a generation that grows up with avatars, intelligent agents, and substitute worlds will lose interest in the distinctions that I am drawing here.

The flatness of the screen encourages the transposition of the games into arcades and the production of as many related toys, figurines, magazines, and texts as possible. (Books about *Myst* and *Riven* have sold hundreds of thousands of copies.) The exigencies here are not only market-driven, but the electronic pets, Playdiums, IMAX rides, and so on, are symptomatic expressions of the need to somehow bring screen experiences to another level that actualizes the physical traces of sensation even as these processes loop back again into the virtual. There could be no better evidence of the unity of these experiences than the virtual emporia I have been discussing and the increasing presence of large screen-based entertainment centers in the home.

From an analytical point of view, this once again highlights the gradual manner in which a variety of mediations support a structure that includes many levels of the real mixed in with artifice. The artifice is permanent scaffolding for buildings that will never be completed. Players don't like it when characters are killed off and can't return, because players want to keep constructing and reconstructing the scaffolding. It may be that this restructuring is actually the physical underpining for interactive processes.

Gamers discuss the interaction of the physical, visible, sensate, and screen in a holistic manner, which suggests that they are talking about a coevolutionary process. The games evolve as players collaborate with them. Such interactions generate increasingly complex levels of play. The various components of a game, from setting the scene (exposition), facing a variety of crises, encountering obstacles and overcoming them, resolving problems and then completing the game by outwitting its structural constraints (coding), are all about the use of surrogacy to gain control over virtual environments.

All the dimensions of interaction, experience, and reconstruction that I have described and analyzed in this chapter are part of an unfolding world for which there are only temporary maps. For cultures that have been attuned to permanence and the need to preserve artifacts and experiences, this fluidity poses many challenges. Computer games are pointing toward a new process of engagement with image-worlds. At the same time, as part of the living archeological process that I mentioned earlier, all the layers of previous forms and experiences remain in place. This is as confusing as it is enticing. It could also be the site for reenvisioning the relationships humans have with the technologies they are creating and using. Crucially, computer games signal how important vantage point is, because without some perspective on subjectivity and identity, image-worlds make it appear as if players are not at the center of game experiences. The mediations among images, experiences, and players suggest a struggle with what intelligence means in digital environments. The concluding chapter of this book examines the implications of "reanimating" the world inside hybrid image spaces.