WHAT VIDEO GAMES HAVE TO TEACH US ABOUT LEARNING AND LITERACY

Revised and Updated Edition

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INTRODUCTION: 36 WAYS TO LEARN A VIDEO GAME

VIDEO GAMES AND LEARNING

I WANT TO TALK ABOUT VIDEO GAMES—YES, EVEN VIOLENT VIDEO games—and say some positive things about them. I am mainly concerned with games in which the player takes on the role of a virtual character moving through an elaborate world, solving problems, or in which the player builds and maintains complex entities like armies, cities, or even whole civilizations. There are, of course, other types of video games. By "video games" I mean games played on game platforms (such as the Sony PlayStation 2 or 3, the Nintendo GameCube or Wii, and Microsoft's Xbox or Xbox 360, or various handheld devices) and games played on computers.

I was born in 1948. So, for heaven's sake, what I am doing playing video games and, worse yet, writing about them? The answer is this: When my now 11-year-old (Sam) was very young, I used to sit next to him as he played video games, starting with *Winnie the Pooh* and moving on to *Freddy Fish*, *Pajama Sam*, and *Spy Fox*. I was intrigued. One day I decided I wanted to help him play *Pajama Sam in No Need to Hide When It's Dark Outside*. The superhero "Pajama Sam" must solve problems in the Land of Darkness in order to meet Darkness and tame him, so that players can learn they no longer need to be afraid of the dark. A typical problem in the

game is deciding how to convince a talking wooden boat that wood floats, so that the boat, which is afraid of water, can feel free to go "boating" on the water and take Pajama Sam where he needs to go. I decided to play through the game by myself so I could "coach" Sam as he played. (Now he charges me a dollar any time I attempt to "coach" him when he is playing a video game—he calls it "bossing him around" and "telling him what to do when he can figure it out for himself.")

When I played the game I was quite surprised to find out that it was fairly long and pretty challenging, even for an adult. Yet a very young child was willing to put in the time and face the challenge—and enjoy it, to boot. I thought, as someone who has spent the second half of his career working in education (the first half was devoted to theoretical linguistics): "Wouldn't it be great if kids were willing to put in this much time on task on challenging material in school and enjoy it so much?"

So I decided to buy and play an adult game. ("Adult" here means the game is played by teenagers on up; video-game players tend to be anywhere between 3 years old and old age, and the average age of gamers is now around 30.) I somewhat arbitrarily picked the game *The New Adventures of the Time Machine*, a game involving adventure, problem solving, and shooting (based loosely on the book by H. G. Wells), knowing nearly nothing about video games. Little did I know what I was getting myself into. This game, like nearly all such games, takes a great many hours to play. Many good games can take 30 to 100 hours to win, even for good players. Furthermore, it was—for me—profoundly difficult.

In fact, this was my first revelation. This game—and this turned out to be true of video games more generally—requires the player to learn and think in ways at which I was not then adept. Suddenly all my baby-boomer ways of learning and thinking, for which I had heretofore received ample rewards, did not work.

My second realization came soon after, when at the end of a day in which I had played *Time Machine* for eight straight hours, I found myself at a party, with a splitting headache from too much video motion, sitting next to a 300-pound plasma physicist. I heard myself telling the physicist

that I found playing *Time Machine* a "life-enhancing experience," without even knowing what I meant by that. Fortunately, plasma physicists are extremely tolerant of human variation. (The plasma that physicists deal with is not, as he told me, a product from blood but a state of matter; when I asked him why he had not brought any to the party, he explained to me that plasma is so unstable and dangerous that if he had brought any, there would have been no party.)

Oddly enough, then, confronting a new form of learning and thinking was both frustrating and life enhancing. This was a state that I remembered from my days in graduate school and earlier in my career when I changed areas midstream. Having long routinized my ways of learning and thinking, I had forgotten this state. The experience brought home to me, forcefully, that learning should be both frustrating and life enhancing, what I will later call "pleasantly frustrating." The key is finding ways to make hard things life enhancing so that people keep going and don't fall back on learning only what is simple and easy.

My third realization followed from these other two. I eventually finished *The New Adventures of the Time Machine* and moved on to *Deus Ex*, a game I chose because it had won game of the year on many Internet game sites. *Deus Ex* is yet longer and harder than *Time Machine*. I found myself asking the following question: "How, in heaven's name, do they sell many of these games when they are so long and hard?" I soon discovered, of course, that good video games sell millions of copies.

So here we have something that is long, hard, and challenging. However, you cannot play a game if you cannot learn it. If no one plays a game, it does not sell, and the company that makes it goes broke. Of course, designers could make the games shorter and simpler. That's often what schools do with their curriculums. But gamers won't accept short or easy games. So game designers keep making long and challenging games and still manage to get them learned. How?

If you think about it, you see a Darwinian sort of thing going on here. If a game, for whatever reason, has good principles of learning built into its design—that is, if it facilitates learning in good ways—then it gets

played and can sell well, if it is otherwise a good game. Other games can build on these principles and, perhaps, do them one step better. If a game has poor learning principles built into its design, then it won't get learned or played and won't sell well. In the end, then, video games represent a process—thanks to what Marx called the "creativity of capitalism"—that leads to better and better designs for good learning and, indeed, good learning of hard and challenging things.

It would seem intriguing, then, to investigate what these principles of learning are. How are good video games designed to enhance getting themselves learned—learned well so people can play and enjoy them even when they are long and hard? What we are really looking for here is this: the theory of human learning built into good video games. This theory is built into not just the games but also gamers and the gaming community. Of course, there is an academic field devoted to studying how human beings learn best, namely the field of cognitive science (or, better put, a part of it sometimes called "the learning sciences"). So we can, then, compare the theory of learning in good video games to theories of learning in cognitive science. Who's got the best theory? Well, it turns out that the theory of learning in good video games is close to what I believe are the best theories of learning in cognitive science. And this is not because game designers read academic texts on learning.

School is a key place—though hardly the only one—where learning takes place. So, we also can ask how the theory of learning in good video games compares to how teaching and learning work in school. Here we face a mixed bag. On one hand, the theory of learning in good video games fits well, for example, with the best sorts of science instruction in schools today. Such instruction stresses strategic thinking and problem solving, often collaboratively. On the other hand, this sort of science instruction is rare and getting rarer as testing and skill-and-drill retake our schools. In turn, the theories of learning one would infer from looking at schools today often comport, as we will see, poorly with the theory of learning in good video games.

If the principles of learning in good video games *are* good, then better theories of learning are embedded in the video games many children in elementary and high school play than in the schools they attend. Furthermore, the theory of learning in good video games fits better with the modern, high-tech, global world today's children and teenagers live in than do the theories (and practices) of learning that they sometimes see in school. Today's world is very different from the world baby boomers like me grew up in and on which we have based many of our theories. Is it a wonder, then, that by high school, very often both good students and bad ones, rich ones and poor ones, don't much like school?

READING AND THINKING

Let me now say something about my previous work as a way to explicate further how I arrived here to discuss video games. I am a linguist interested in language, learning, and literacy. In two earlier books, *Social Linguistics and Literacies* and *The Social Mind*, I argued that literacy and thinking—two things that, at first sight, seem to be "mental" achievements—are in reality also and primarily social and cultural achievements (see the Bibliographic Note at the end of this chapter.) When you read, you are always reading something in some way. You are never just reading "in general." For example, you can read the Bible as history or as literature or as a self-help guide or in many other ways. So, too, with any other text, whether legal tract, comic book, essay, or novel. Different people read and interpret each type of text differently.

The argument about thinking is, in fact, the same as the argument about reading. When you think, you must think about something in some way. You are never just thinking "in general," not thinking about anything in particular. For example, you can think about people who kill themselves to set off a bomb, in pursuit of some cause they believe in, as suicide bombers, murderers, terrorists, freedom fighters, heroes, psychotics, or in

many other ways. Different people "read" the world differently just as they read different types of texts differently.

So, then, what determines how you read or think about some particular thing? What determines this is your experiences with other people who are members of various sorts of social and cultural groups, whether these are biblical scholars, radical lawyers, peace activists, family members, fellow ethnic group or church members, or whatever. These groups work, through their various social practices, to encourage people to read and think in certain ways, and not others, about certain sorts of texts and things.

Does this mean you are not "free" to read and think as you like? No—you can always align yourself with new people and new groups—there is no shortage. But it does mean you cannot read or think outside of any group whatsoever. You cannot assign private meanings to texts and things, meanings that only you are privy to and that you cannot even be sure you remember correctly from occasion to occasion as you read or think about the same thing, since as a social isolate (at least in regard to meaning) you cannot, in fact, check your memory with anyone else. The philosopher Ludwig Wittgenstein made this case long ago in his famous argument against the impossibility of "private languages." There are no "private minds" either.

Does all this mean that anything goes and nothing is true? Of course not. We humans have goals and purposes, and for some goals and purposes some groups' ways of reading and thinking work better than do others. In the world of physics, if you have pushed your stalled car until you are dripping with sweat but the car has not budged, you have done no "work" (given how physicists use this word), but in the world of "everyday" people, you have worked very hard indeed. Neither meaning is right or wrong. Each belongs to a different social world. However, if you want to do physics—for good or ill—it's best to use the word "work" the way physicists do. In that case, they are "right."

Since reading and thinking are social achievements connected to social groups, we can all read and think in different ways when we read

and think as members (or as if we were members) of different groups. I, for one, know well what it is like to read the Bible as theology, literature, or in skeptical terms, thanks to different experiences and affiliations in my life thus far. Any specific way of reading and thinking is, in fact, a way of being in the world, a way of being a certain "kind of person," a way of taking on a certain sort of identity. In that sense, each of us has multiple identities. Even a priest can read the Bible as a priest, as a literary critic, as a historian, even as a male or as an African American, though he may choose to privilege one way of reading—one identity—over another.

As a gamer now, I have come to realize that there is a new way to state my views on reading and thinking: Real life works something like a massive multiplayer game—a game like *World of WarCraft*. In such games the player can enact multiple identities (e.g., be a female night elf priest or male tauren warrior), each of which flows from the player's real-world values and desires, the skills required to enact a given character/identity, and interactions with other people/characters throughout the (virtual) world. These dynamic processes set up a place or perspective from which to think and interpret. Different characters/identities lead to different ways of looking at, feeling about, and interacting with the (virtual) world. I play as a female night elf priest, a male night elf hunter, and a male tauren shaman and I can tell you the (virtual and social) world of *World of WarCraft* looks different from each place and has to be dealt with in different ways.

As I got into playing and thinking about video games—thanks to my son Sam—I realized video games turn out to be a good way to say about learning what I have said about reading and thinking above. Like reading and thinking, learning is not general, but specific; like reading and thinking, it is not just an individual act but a social one. As for learning being specific, video games teach us that a good game teaches the player primarily how to play that game and, then, to be able to generalize to games like it. But all learning is, I would argue, learning to play "the game." For example, literary criticism and field biology are different "games" played by different rules. (They are different sorts of activities requiring different values, tools, and ways of acting and thinking; they are different domains

with different goals and different "win states.") To learn either one at any deep level requires learning to play the "game" or, at least, to appreciate the sort of "game" it is.

As for being social, gamers know fully well that to really learn to play video games one must become a "gamer," drawing on resources that reside in other gamers and their associated websites and social interactions, resources such as strategy guides ("faqs"), cheats, boards, game modifications, magazines, review sites, Local Area Network (LAN) parties, and even schoolyard trading of Pokémon secrets. Furthermore, most young people see game playing as almost entirely social, preferring to play in multiplayer settings of one sort or another (even to the point of passing the controller back and forth for single player games).

Let me tell you a little story about the social nature of gaming. I don't, in general, encourage baby boomers to rush off and play video games, since the games are often quite hard and can be frustrating for people not willing to confront their own, perhaps rigidified, learning muscles in a new setting. Nonetheless, some older people do run off to play for the first time when they hear me talk (and, indeed, there are a growing number of older gamers these days). One older adult who tried a video game after hearing one of my talks did, indeed, become seriously frustrated. Then his 21-year-old gamer stepson came into the room and asked him "What are young doing?" The man said "Trying to learn to play this damn video game." The son said "For heaven's sake, why would you do that alone?" Ah, so, here is one good learning principle built into gamers, not just games.

ABOUT THE BOOK

This book discusses 36 principles of learning (individually in each chapter and listed together in the appendix) built into good video games. However, this book has another goal as well. It seeks to use the discussion of video games to introduce the reader to three important areas of current research and to relate these areas to each other. One of these areas is work

on "situated cognition" (i.e., thinking as tied to bodies that have experiences in the world). This work argues that human learning is not just a matter of what goes on inside people's heads but is fully embedded in (situated within) a material, social, and cultural world.

Another one of these areas is the so-called New Literacy Studies, a body of work that argues that reading and writing should be viewed not only as mental achievements going on inside people's heads, but also as social and cultural practices with economic, historical, and political implications.

The third area is work on so-called connectionism, a view that stresses the ways in which human beings are powerful pattern recognizers. This body of work argues that humans don't often think at their best when they attempt to reason via logic and general abstract principles detached from experience. Rather, they think best when they reason on the basis of patterns they have picked up through their actual experiences in the world, patterns that, over time, can become generalized but that are still rooted in specific areas of embodied experience.

None of these three areas—work on situated cognition, New Literacy Studies, and a pattern-recognition view of the mind—represents a viewpoint that is universally agreed on. Furthermore, my "introduction" to these areas, via video games, is highly selective. People who know little about these areas will pick up only the big picture. People who know a lot about them will quickly realize that I am developing my own perspectives in each of these areas, while many other perspectives exist as well. Nonetheless, I believe that these three areas capture central truths about the human mind and human learning and that these truths are well represented in the ways in which good video games are learned and played.

These truths are often less well represented in today's schools. And this book is about schools as well. It is a plea to build schooling on better principles of learning. If we have to learn these principles from video games, and not from a field with as boring a name as cognitive science, then so be it.

VIOLENCE AND GENDER

Let me end this introduction with a few short points. First, while I talk a good deal about actual video games, I really intend to be discussing the *potential* of video games. The games get better and more sophisticated all the time and at a rapid pace. Much of what I have to say here will simply get "truer" as the games get yet better. This is my consolation for the fact that any games I mention will be, for some players, out of date, replaced by newer ones by the time anyone reads this book.

Second, I am aware that many readers will not have played—or will not currently be playing—video games, especially the type I discuss. I will try to be as clear and explicit as I can about the games, so that all readers can form a picture of what I am talking about. Readers who want to further explore the many types of video games, see images from them, and even download demonstrations can log on to a wide array of Internet sites devoted to video games.

Third, I am not, in this book, meaning to imply that I think "old" baby boomers like me need to run out and start playing video games. Nonetheless, we can learn a lot from those young people who play games, if only we take them and their games seriously. And, indeed, I am always struck by how many people, even some of the liberal advocates of multiculturalism, readily decry and seek to override people's cultures when these cultures are popular peer-based ones centered around things like video games. Let it be said, too, having mentioned multiculturalism, that people of every ethnic group and social class play video games and more and more girls and women are playing every day (e.g., the majority of the players of *The Sims*—the best selling video game of all time—are girls and women).

Finally, there is this: Two issues have taken up the vast majority of writing about video games: violence and gender (e.g., whether and how much girls play, whether and in what ways video games depict women poorly). Neither of these issues is focused on in this book, both because they are well discussed elsewhere and because they would require more space than I can devote to them here and still fairly cover issues germane to learning.

However, a short version of my views on the violence and gender issues is as follows, starting with violence: Under contrived laboratory conditions, people who play, say, a game like *Castle Wolfenstein*, will, afterward, blast a competitor in a button-pushing task with a noise blast .21 seconds longer than someone who played *Myst*. Additionally, it is pretty clear that video games can make young boys, in particular, aroused for a short period of time after play, an effect that seems to follow from pretend-play as superheroes as well, if the many schools that ban superhero shirts are any guide. Finally, despite some claims to the contrary, the fact of the matter is that the effect size of video-game play on aggression is smaller than the effect size for television, thereby rendering the claim that there is something special about the interactivity of games as a source of aggression suspect. None of this is to say that future research won't discover other additional information, pro or con.

None of the current research even remotely suggests video games lead to real-life violence in any predicable way. As a good many people already know, since it has been pointed out by conservative politicians and policy makers as a sign of the effectiveness of their social policies, there has been a pronounced decrease in violent crime since the earlier 1990s, the very time when violent video games were introduced, for example, *Mortal Kombat*, *Doom*, and *Quake*. Even more to the point, if playing violent video games leads to a statistical increase in violence we should see a rise in violent crime, say, after QuakeCon each year, an event which draws thousands of gamers to play violent games. So far no one has found any such thing. On the other hand, some researchers have argued that video games have beneficial effects in regard to violence: for example, that teens use violent games as a way to manage feelings of anger or as an outlet for feelings of a lack of control.

In my view, the issue of violence in video games is overblown (especially in a world where real people are regularly killing real people in wars across the world that we watch on television). Debates over violence in

video games are one more way in which we seek to talk about technology doing things to people rather than talking about the implications of people's overall social and economic contexts. Having said that, I don't advocate having young children play M-rated games and I most certainly advocate that parents should know what their children are doing and engage in ongoing discussions with them, discussions in which they seek not just to teach their children but to learn from them as well.

Furthermore, there are many categories of very sophisticated video games—simulations and some strategy games—that do not involve any or much violence at all. Nonetheless, I base some of my arguments about learning in this book on shooter games, precisely because they are the "hardest" case. It's pretty clear that a simulation game (like *SimCity* or *Civilization*) involves important learning principles, if only because many scientists themselves use such simulation techniques. However, it is easier to miss and dismiss the learning principles in other sorts of games. But learning principles are very much there, nonetheless.

Some people have the idea that video games are somehow more potent than movies or books because the player does things in the virtual world via his or her avatar. This is akin, I suppose, to the claim that because I have planted lots of corn in *Harvest Moon* I will run out and plant corn in my back yard—in reality we have as little real corn from *Harvest Moon* as we have real killings from *Grand Theft Auto* (which is not to rule out the rare case of either—given enough time, even low probability events occur—though, of course, by definition, rarely).

But here, to my mind, is the crux of the matter: Movies, books, television, or video games—that is, technologies—do not have any effects, good or bad, all by themselves. The question as to whether video games (or computers, or television, or what have you) are good for you (or children) or bad for you (or children) all by themselves is actually meaningless. Technologies have effects—and different ones—only as they are situated within specific contexts. So we always have to ask how the technology was used and in what context it was being used. For example, we have known for some time that television is good for children's cognitive

growth if they are watching it in a reflective state of mind, for example, because an adult is interacting with them and discussing what they are watching with them. If the child is just passively consuming television, then it is not necessarily of any great use. It is also clear that children raised in a culture of violence or abuse may consume media—not to mention their real-world interactions—as fodder for their anger and confusion. In these cases, we would hope, of course, that policy makers would speak to the real-world culture of violence or abuse and not just the virtual images the child sees.

Now, on to depictions of gender: I have no doubt that video games, like most other popular cultural forms, overstress young, buxom, and beautiful women in their content. Furthermore, with several major exceptions (e.g., Lara Croft in the *Tomb Raider* games or the magnificent Samus Aran in the *Metroid* games), these woman are often not the main characters in the games. However, things are changing, though, admittedly, too slowly. Many role-playing games allow players to design their own character and the range of choices as to things like body type (and skin color) are expanding. There are more and stronger women characters in games (e.g., *Half-Life 2*). Nonetheless, games, of course, reflect the culture we live in—a culture we can change.

As for girls and women playing games: they are quickly catching up with the boys and men, though they sometimes prefer different games (e.g., *The Sims*). Nevertheless, there are whole Internet sites devoted to women who play the sorts of shooter games more commonly associated with males. There is growing evidence that today a great many young girls play video games, but sometimes give them up by middle school, the same time they tend to give up science and math as "unfeminine." This is something we should worry about, since video games and modifying video games ("modding") appears to be one route boys use to get into information technology (IT) skills and careers. I was recently talking to a sixth-grade class in an urban area about their interest in games and what they thought about games and learning. All the girls in the class were avid and eloquent gamers. At the end, I told the class that people often said to me

that "girls didn't play video games." One girl stood up, indignant, and demanded to know who had told me that.

BIBLIOGRAPHICAL NOTE

In order not to clutter the text with references, I will not insert references directly into the text but will instead give citations to the literature in a bibliographical note at the end of each chapter.

Poole 2000 and Herz 1996 are good analyses of the design of video games and their role in our culture. Kent 2001 is an entertaining history of video games. Greenfield 1984 and Loftus and Loftus 1983 are good early discussions of the role of learning and thinking in video games. King 2002, prepared for a museum exhibit on video games, contains a wide array of interesting articles on all aspects of the games. Raessens and Goldstein 2005 is a good compilation of articles on game studies, dealing with a wide array of issues. See Juul 2005 for an insightful theoretical overview of games studies. Salen and Zimmerman 2003 is a classic on game design that is accessible to anyone interested in the nature of games in general and the role of design as a form of shaping human interactions with rules, technology, and other people. Salen and Zimmerman 2005 is an excellent reader connected to their game design book. Koster (2004) is a insightful and entertaining discussion of game design, learning, and fun.

Pinker 1999 is a good, basic introduction to cognitive science. For more on cognitive science, especially as it applies to schools and learning, see Bransford, Brown, and Cocking 1999; Bruer 1993; Gardner 1991; Pelligrino, Chudowksy, and Glaser 2001; and Sawyer 2006. These sources discuss work on situated cognition, as well as a number of other areas. For additional work on situated cognition, see Brooks 2002; Brown, Collins, and Dugid 1989; Clark 1997; Gee 1992, 2004; Hawkins 2004; Lave 1988; Lave and Wenger 1991; Rogoff 1990; and Tomasello 1999.

For a discussion of good, conceptually based science instruction in schools, see Bruer 1993; Cognition and Technology Group at Vanderbilt 1997; and diSessa 2000. For introductions to the New Literacy Studies, see Barton 1994; Gee 1996; and Street 1995. For work on connectionism and the human mind as a pattern recognizer, see Clark 1989, 1993; Gee 1992; Margolis 1987, 1993; and Rumelhart, McClelland, and the PDP Research Group 1986.

For laboratory experiments on violence and video games, see, for example, Anderson and Bushman 2001; Anderson and Dill 2000. On the effect size for games versus television, as well as the decrease in violence since the 1990s, see Sherry 2006. On teens using games as a way to manage their feelings, see Kestenbaum and Weinstein 1985. For media effects as relative to contexts of use, including my remarks about television, see Greenfield 1984 and Sternheimer 2003. For games, girls, and women, see, for example, Hayes 2007 and Kafai, Heeter, Denner, and Sun 2007.

2

SEMIOTIC DOMAINS: IS PLAYING VIDEO GAMES A "WASTE OF TIME"?

LITERACY AND SEMIOTIC DOMAINS

WHEN PEOPLE LEARN TO PLAY VIDEO GAMES, THEY ARE LEARNING A NEW *literacy*. Of course, this is not how the word "literacy" is normally used. Traditionally, literacy is the ability to read and write. So why should we think of literacy more broadly?

There are two reasons: First, language is not the only important communicational system. Images, symbols, graphs, diagrams, artifacts, and many other visual symbols are significant, more so today than ever. Furthermore, words and images are very often juxtaposed and integrated. In newspaper and magazines, as well as in textbooks, images take up more and more space alongside words. In fact, in many modern textbooks images not only take up more space, they carry meanings that are independent of the words in the text. If you can't read the images, you will not be able to recover their meanings from the words in the text alone—for example, a technical diagram covering cell division in a biology textbook will contain information not fully explicated in the words of the text itself.

In such *multimodal* texts (texts that mix words and images), then, the images often communicate different things from the words. Further, the combination of the two modes communicates things that neither of

the modes does separately. And, indeed, multimodality goes far beyond images and words to include sounds, music, movement, and bodily sensations. Video gaming, as we will see throughout this book, is a multimodal literacy *par excellence*.

Second, even print literacy is multiple. There are many different ways of reading and writing. We don't read or write newspapers, legal tracts, essays, poetry, rap songs, and so on through a nearly endless list, in the same way. Each of these domains has its own rules and requirements. The legal literacy needed for reading law books is not the same as the literacy needed for reading physics texts or superhero comic books. And, indeed, we should not be too quick to dismiss the latter form of literacy. Many a superhero comic is replete with post-Freudian irony of a sort that would make a modern literary critic's heart beat fast and confuse any otherwise normal adult.

Once we see this multiplicity of literacy, we realize that when we think about reading and writing, we must think beyond print. Reading and writing in any domain, whether it is law, rap songs, academic essays, superhero comics, or whatever, are not just ways of decoding print, they are also caught up with ways of doing things, thinking about things, valuing things, and interacting with other people—that is, they are caught up with different sorts of social practices. Literacy in any domain is actually not worth much if one knows nothing about the social practices of which that literacy is but a part. So, for example, legal language and literacy are married to legal practices; gaming language and literacy (words, images, movements, and sounds) are married to gaming practices, to gaming as an activity in the world; and rap as music, language, and literacy are married to hip hop practices and values.

Because literacy requires more than being able to "decode" (words or images for instance) and because it requires people to be able to participate in—or at least understand—certain sorts of social practices, we need to focus on not just "codes" or "representations" (like language, equations, images, and so forth) but the domains in which these codes or representations are used, as well. We need to think in terms of what I will call *semiotic domains*. "Semiotic" here just means "signs." It is merely a fancy way of saying that we want to talk about how things take on meaning, things like images, sounds, gestures, movements, graphs, diagrams, equations, objects, and even humans like babies, midwives, and mothers (all of which have had different meanings in different cultures and at different points in history). It is not just words that have meanings. Words and all these other things are all signs (symbols, representations, whatever term you want to use) that "stand for" (take on) different meanings in different situations, contexts, practices, cultures, and historical periods. For example, the image of a cross means Christ (or Christ's death) in the context of Christian social practices and it means the four points of the compass (north, south, west, and east) in the context of other social practices (e.g., in some African religions). Or to take another example, childbirth in the eighteenth century in the United States was seen as a natural event meant to occur at home among friends and family. Later as modern medicine and hospitals arose, it came to be seen as a medical event meant to occur in a hospital among doctors and nurses, though today many people want to view it again as a natural home-based event.

Some readers of the first edition of this book were bothered by the word "semiotic" as a piece of jargon. If it bothers you, just translate "semiotic domain" into something like "an area or set of activities where people think, act, and value in certain ways"—an area like video gaming, bird watching, physics, anime, or many other such "domains," acknowledging that there are distinctive sub-types of all these bigger domains as well (e.g., real-time strategy gaming).

By a semiotic domain I mean any set of practices that recruits one or more modalities (e.g., oral or written language, images, equations, symbols, sounds, gestures, graphs, artifacts, etc.) to communicate distinctive types of meanings. Here are more examples of semiotic domains: cellular biology, postmodern literary criticism, first-person-shooter video games, high-fashion advertisements, Roman Catholic theology, modernist painting, midwifery, rap music, wine connoisseurship—through a nearly endless, motley, and ever-changing list.

If we think first in terms of semiotic domains and not in terms of reading and writing as traditionally conceived, we can say that people are (or are not) literate (partially or fully) in a domain if they can recognize (the equivalent of "reading") and/or produce (the equivalent of "writing") meanings in the domain. We can reserve the term "print literate" for talking about people who can read and/or write a language like English or Russian, though here, still, we will want to insist that there are different ways to read and write connected to different social practices. Thus, the rap artist who can understand and compose rap songs but not read print or musical notation is literate (can give and take meanings) in the semiotic domain of rap music, but not print or music notation literate in that domain.

In the modern world, print literacy is not enough. People need to be literate in a great variety of different semiotic domains. If these domains involve print, people often need the print bits, of course. However, the vast majority of domains involve semiotic (symbolic, representational) resources besides print and some don't involve print as a resource at all. Furthermore, and more important, people need to be able to learn to be literate in new semiotic domains throughout their lives. If our modern, global, high-tech, and science-driven world does anything, it certainly gives rise to new semiotic domains and transforms old ones at an ever faster rate.

This book deals with video games as a semiotic domain, actually as a family of related but different domains, since there are different types or genres of video games (e.g., first-person shooter games, fantasy role-playing games, real-time strategy games, simulation games, etc.). People can be literate, or not, in one or more of these video-game semiotic domains. However, in talking about learning and literacy in regard to video games, I hope, as well, to develop a perspective on learning, literacy, and semiotic domains that applies more generally beyond video games.

However, if we want to take video games seriously as a family of semiotic domains in which one can learn to be literate, we face an immediate problem. Many people who don't play video games, especially older

people, are sure to say that playing video games is "a waste of time." In the next section, I sketch out one version of what I think this claim often amounts to, using a specific example involving a six-year-old child.

LEARNING AND THE PROBLEM OF CONTENT

To spell out what I think the claim that playing video games is a waste of time often means, I need first to tell you about a game a six-year-old boy was playing, a game called "*Pikmin*." *Pikmin* is a game for the Nintendo GameCube. It is rated "E," which means that it is a game acceptable for all ages (a sequel, *Pikmin 2*, came out in 2004).

In *Pikmin*, the player takes on the role of Captain Olimar, a small (he's about the size of an American quarter), bald, big-eared, bulbous-nosed spaceman who crashes into an unfamiliar planet when a comet hits his spaceship. Captain Olimar (i.e., the player) must collect the spaceship's lost parts, scattered throughout the planet, while relying on his spacesuit to protect him from the planet's poisonous atmosphere. The player must carefully monitor the damage done to Captain Olimar's suit and repair it when needed. To make matters more complicated, the spacesuit's life support will fail after 30 days, so the captain (the player) must find all the missing parts in 30 days (each day is 15 minutes of game-time play). Thus the game is a race against time and represents the rare case of a game that one can play to the end and still "lose."

However, Captain Olimar gets help. Soon after arriving on the strange planet, he comes upon native life that is willing to aid him. Sprouts dispensed from a large onionlike creature yield tiny (they're even smaller than Captain Olimar) cute creatures that Olimar names "Pikmin" after a carrot from his home planet. These little creatures appear to be quite taken with Olimar and follow his directions without question. Captain Olimar learns to raise Pikmin of three different colors (red, yellow, and blue), each of which has different skills. He learns, as well, to train them so that each Pikmin, regardless of color, can grow through three different ever-stronger forms: Pikmin sprout a leaf, a bud, or a flower from their heads.

Captain Olimar's colorful Pikmin follow him as his army, and he uses them to attack dangerous creatures, tear down stone walls, build bridges, and explore a great many areas of the strange planet in search of the missing parts to his spaceship. While Captain Olimar can replace killed Pikmin from remaining Pikmin, he must, however, ensure that at no point do all his Pikmin perish—an event called, by the game and by the child player, "an extinction event."

It was quite a sight to watch a six-year-old, as Captain Olimar, lead a multicolored army of little Pikmin to fight, build, grow more Pikmin, and explore a strange landscape, all the while solving multiple problems to discover and get to the locations of the spaceship's missing parts. The child then ordered his Pikmin to carry the heavy parts back to the ship. When this child's grandfather watched him play the game for several hours, the grandfather made the following remark: "While it may be good for his hand-eye coordination, it's a waste of time, because there isn't any content he's learning." I call this *the problem of content.*

The problem of content is, I believe, based on common attitudes about schooling, learning, and knowledge. The idea is this: Important knowledge (now usually gained in school) is content in the sense of information related to intellectual domains or academic disciplines like physics, history, art, or literature. Activities that are entertaining, but that themselves do not involve such learning, are just "meaningless play." Of course, video games fall into this category.

The problem with the content view is that an academic discipline (or any other semiotic domain, for that matter) is not primarily content, in the sense of facts and principles. It is primarily a lived and historically changing set of distinctive social practices. It is in these social practices that "content" is generated, debated, and transformed via distinctive ways of thinking, talking, valuing, acting, and, often, writing and reading.

Consider, for a moment, basketball as a domain. No one would want to treat basketball as "content" apart from the game itself. Imagine a textbook that contained all the facts and rules about basketball read by

students who never played or watched the game. How well do you think they would understand this textbook? How motivated to understand it do you think they would be? But we do this sort of thing all the time in school with areas like math and science.

There is, however, an alternative way to think about learning and knowing. I turn to this viewpoint in the following sections. Under this alternative perspective it will become clear that playing video games is not necessarily "a waste of time," though it will be a while until I can return to that claim and contradict it directly.

AN ALTERNATIVE PERSPECTIVE ON LEARNING AND KNOWING

The alternative perspective starts with the claim that there really is no such thing as learning "in general." We always learn *something*. And that something is always connected, in some way, to some semiotic domain or other.

Therefore, if we are concerned with whether something is worth learning or not, whether it is a waste of time or not—video games or anything else—we should start with questions like the following: What semiotic domain is being entered through this learning? Is it a valuable domain or not? In what sense? Is the learner learning simply to understand ("read") parts of the domain or also to participate more fully in the domain by learning to produce ("write") meanings in the domain? And we need to keep in mind that in the modern world, there are a great many more potentially important semiotic domains than just those that show up in typical schools.

Once we learn to start with such questions, we find that it is often tricky to determine what semiotic domain is being entered when someone is learning something. For example, consider college freshmen who have taken their first college-level physics class, passed it with good grades, and can write down Newton's laws of motion. What domain have they entered? It will not do to say "physics" and leave the matter at that, though the content view would take this position.

Lots of studies have shown that many such students, students who can write down Newton's laws of motion, if asked the simple question "How many forces are acting on a coin that has been thrown up into the air?" get the answer wrong (despite the fact that the answer can actually be deduced from Newton's laws). Leaving aside friction, they claim that two forces are operating on the coin, gravity and "impetus," the force the hand has transferred to the coin. Gravity exists as a force and, according to Newton's laws, is the sole force acting on the coin when it is in the air (aside from air friction). Impetus, in the sense above, does not exist, though Aristotle thought it did and people in their everyday lives tend to view force and motion in such terms.

So these students have entered the semiotic domain of physics as passive *content* but not as something in terms of which they can actually see and operate on their world in new ways. These students cannot produce meanings in physics or understand them in producerlike ways. They have not learned to experience the world in a new way.

When we learn a new semiotic domain in a more active way, not as passive content, three things happen:

1. We learn to experience (see, feel, and operate on) the world in new ways.
2. Since semiotic domains usually are shared by groups of people who carry them on as distinctive social practices, we gain the potential to join this social group, to become affiliated with such kinds of people (even though we may never see all of them, or any of them, face to face).
3. We gain resources that prepare us for future learning and problem solving in the domain and in related domains.

These three things, then, are involved in active learning: *experiencing* the world in new ways, forming new *affiliations*, and *preparation* for future learning.

This is "active learning." However, such learning is not yet what I call "critical learning." For learning to be critical as well as active, one additional feature is needed. The learner needs to learn not only how to understand and produce meanings in a particular semiotic domain but, in addition, needs to learn how to think about the domain at a "meta" level as a complex system of interrelated parts. The learner also needs to learn how to innovate in the domain—how to produce meanings that, while recognizable to experts in the domain, are seen as somehow novel or unpredictable.

To get at what all this really means, though, I need to discuss semiotic domains a bit more. This will allow me to clarify what I mean by critical learning.

MORE ON SEMIOTIC DOMAINS: SITUATED MEANINGS

Words, symbols, images, and artifacts have meanings that are specific to particular semiotic domains and particular situations (contexts). They do not just have general meanings.

I was once a cannery worker; later I became an academic. I used the word "work" in both cases, but the word meant different things in each case. In my cannery life, it meant something like laboring for eight straight hours in order to survive and get home to lead my "real" life. In my academic life, it means something like chosen efforts I put into thinking, reading, writing, and teaching as part and parcel of my vocation, efforts not clocked by an eight-hour workday. In the domain of human romantic relationships, the word "work" means something else altogether; for example, in a sentence like "Relationships take work." A word like "work" can even take on different meanings within a single domain, like the cannery, academics, or romantic relationships, meanings that vary according to different situations or contexts in the domain.

Meaning is both situation (context) and domain specific. Thus, even in a single domain, the meaning of a word varies across different situations. Let me give an example of what I am talking about by taking up again the example of the word "work." In semiotic domains connected to academics, the word "work" takes on a range of possible situated meanings different from the range possible in other semiotic domains (e.g., romance, the cannery, acting, etc.).

In one situation I might say of a fellow academic, "Her work has been very influential" and by "work" mean the ideas developed in her research. In another situation I might say the same thing, but now in regard to a particular committee she has chaired, and by "work" mean her political efforts within her discipline or institution. To understand the word "work" in these cases, you need to ask yourself what you take the situation to be (e.g., talk about contributions to knowledge or about disciplinary or institutional political affairs) and what semiotic domain is at stake (here academics, not the cannery or a movie set).

The same thing is true in all domains. Even in the rigorous semiotic domain of physics, one must give different specific meanings to the word "light," for instance, in different situations (contexts). So even in physics, when someone uses the word "light," we need to know whether they are talking about waves or particles, lasers or colors, or something else (perhaps they are talking about the general theory of electromagnetism). Of course, "light" takes on quite different meanings in other domains, for example in religion (e.g., "bathed in the Lord's light") or theater (e.g., "lighting effects").

Why I am belaboring this point? For two reasons: first, to make clear that understanding meanings is an active affair in which we have to reflect (however unconsciously) on both the situation (context) and the domain we are in. We "situate" the meaning in the given context and domain, I will say. And, second, because I want to argue that learning in any semiotic domain crucially involves learning how to situate (build) meanings for that domain in the sorts of situations the domain involves. That is precisely why real learning is always an active and new way of experiencing the world.

MORE ON SEMIOTIC DOMAINS: INTERNAL AND EXTERNAL VIEWS

There are two different ways to look at semiotic domains: internally and externally. Any domain can be viewed internally as a type of content or externally in terms of people engaged in a set of social practices. For example, first-person shooter games are a semiotic domain, and they contain a particular type of content. For instance, as part of their typical content, such games involve moving through a virtual world in a first-person perspective (you see only what you are holding and move and feel as if you yourself are holding it) and using weapons to battle enemies. Of course, such games involve a good deal more content as well. Thus we can talk about the typical sorts of content we find in first-person shooter games. This is to view the semiotic domain internally.

On the other hand, people actually play first-person shooter games as a practice in the world, sometimes alone and sometimes with other people on the Internet or when they connect several game platforms or computers together. They may also talk to other players about such games and read magazines and Internet sites devoted to them. They are aware that certain people are more adept at playing such games than are others. They are also aware that people who are into such games take on a certain identity, at least when they are involved with those games. For example, it is unlikely that people into first-person shooter games are going to object to violence in video games, though they may have strong views about how that violence ought to function in games.

I will call the group of people associated with a given semiotic domain—in this case, first-person shooter gamers—an *affinity group.* People in an affinity group can recognize others as more or less "insiders" to the group. They may not see many people in the group face to face, but when they interact with someone on the Internet or read something about the domain, they can recognize certain ways of thinking, acting, interacting, valuing, and believing as more or less typical of people who are into the semiotic domain. Thus we can talk about the typical ways of thinking,

acting, interacting, valuing, and believing, as well as the typical sorts of social practices associated with a given semiotic domain. This is to view the domain externally.

What I have said about viewing first-person shooter games internally or externally applies to any semiotic domain. For example, it applies to academic disciplines and sub-disciplines like physics or particle physics. We can take an internal view of a discipline in terms of its content (facts, theories, and principles) or an external view in terms of its social practices and the ways in which people interact within the field.

Do the internal and external aspects of a semiotic domain have anything to do with each other? Of course, if we are talking about academic disciplines as semiotic domains, most academics would like to think that the answer to this question is no. But the answer is, in fact, yes. Content, the internal part of a semiotic domain, gets made in history by real people and their social interactions. They build that content in certain ways because of the people they are (socially, historically, culturally), the beliefs and values they share, and their shared ways of talking, interacting, and viewing the world. That content comes to define one of their important identities in the world. As these identities develop through further social interactions, they come to affect the ongoing development and transformation of the content of the semiotic domain in yet new ways. In turn, that new content helps further develop and transform those identities. The relationship between the internal and external is reciprocal.

MORE ON SEMIOTIC DOMAINS: DESIGN GRAMMARS

Semiotic domains have what I call *design grammars*. Each domain has an internal and an external design grammar. By an internal design grammar, I mean the principles and patterns in terms of which one can recognize what is and what is not acceptable or typical content in a semiotic domain. By an external design grammar, I mean the principles and patterns in terms of which one can recognize what is and what is not an acceptable or typical social practice and identity in regard to the affinity group associated with a semiotic domain.

Do you know what counts as a modernist piece of architecture? If you do, then you know, consciously or unconsciously, the internal design grammar of the semiotic domain of modernist architecture (as a field of interest).

If all you know is a list of all the modernist buildings ever built, then you don't know the internal design grammar of the domain. Why? Because if you know the design grammar—that is, the underlying principles and patterns that determine what counts and what doesn't count as a piece of modernist architecture—you can make judgments about buildings you have never seen before or even ones never actually built, but only modeled in cardboard. If all you have is a list, you can't make any judgments about anything that isn't on your list.

Do you know what counts as thinking, acting, interacting, and valuing like someone who is into modernist architecture? Can you recognize the sorts of identities such people take on when they are in their domain? Can you recognize what counts as valued social practices to the members of the affinity group associated with modernist architecture and what counts as behaving appropriately in these social practices? If the answer to these questions is "yes," then you know, consciously or unconsciously, the external design grammar of the semiotic domain.

Of course, the internal and external grammars of a domain change through time. For example, it was once common for linguists to study issues germane to the translation of the Bible, for example, into Native American languages, as a core part of their academic work and identity as linguists. They hoped to facilitate the work of Christian missionaries, and they saw no conflict between doing linguistics and serving their religious purposes at the same time. Other linguists, not involved in Bible translation, did not necessarily dispute this at the time and often did not withhold professional respect from such religious linguists. The external grammar of the domain (and this was certainly influenced by the wider

culture at the time) allowed a connection between linguistic work as science and religious commitments as an overt part of that work. The internal grammar of the domain—its content—involved lots of direct research on issues germane to translation and the "modernization" of "non-modern" people.

Today most linguists would be skeptical of any connection between linguistic work and religion. They would not see translating the Bible into languages connected to cultures without the Bible, to facilitate the work of missionaries, as a central part of any branch of linguistics. Today the external design grammar of the field does not as readily allow for a connection between work as a linguist and religion, for identities as a linguist that are formed around this connection or for social practices germane to it. At the same time, the sorts of linguistic content that was most relevant to translation and conversion is no longer prominent in linguistics (the internal grammar).

So why I am being so perverse as to use the term "design grammar" for these matters? Because I want us to think about the fact that for any semiotic domain, whether it is first-person shooter games, architecture, or linguistics, that domain, internally and externally, was and is designed by someone. But who, for example, was/is this someone who designed the semiotic domains of first-person shooter games?

Obviously real game designers and producers determine what counts as recognizable content (in terms of story, images, and game play) for first-person shooter games by actually making such games. Over time, as they apply certain principles, patterns, and procedures to the construction of such games, the content of first-person shooter games comes to have a recognizable shape such that people not only say things like "Oh, yeah, that's a first-person shooter game" or "No, that's not a first-person shooter" but also "Oh, yeah, that's a typical first-person shooter game" or "Oh, no, that's a groundbreaking first-person shooter game." Fans, through activities like modding (modifying the game design using software that comes with the game) also help determine aspects of the internal grammar (content) of first-person shooters.

Yet these designers and producers are only a few of the people who produce the external grammar of first-person shooter games. People who play, review, and discuss such games, as well as those who design and produce them, shape the external design grammar of the semiotic domain of first-person shooter games through their ongoing social interactions. It is their ongoing social interactions that determine the principles and patterns through which people in the domain can recognize and judge the thinking, talking, reading, writing, acting, interacting, valuing, and believing characteristic of people who are in the affinity group associated with first-person shooter games.

And, of course, the acts of people helping to design the domain externally as a set of social practices and identities rebound on the acts of those helping to design the domain internally as content, since that content must "please" the members of the affinity group associated with the domain as well as recruit newcomers to the domain. At the same time, the acts of those helping to design the domain internally in terms of content rebound on the acts of those helping to design the domain externally as a set of social practices and identities, since that content shapes and transforms those practices and identities. It is crucial, then, to see that the internal and external grammars of semiotic domains interrelate with each other, mutually supporting and transforming each other.

BACK TO *PIKMIN*: CRITICAL LEARNING

If learning is to be active, it must involve experiencing the world in new ways. Active learning in a domain also involves not just learning here and now but preparation for future learning within the domain and within related domains, as well.

However, as I said earlier, critical learning involves yet another step. For active learning, the learner must, at least unconsciously, understand and operate within the internal and external design grammars of the semiotic domain he or she is learning. But for critical learning, the learner must be able consciously to attend to, reflect on, critique, and manipulate

those design grammars at a metalevel. That is, the learner must see and appreciate the semiotic domain as a *design space*, internally as a system of interrelated elements making up the possible content of the domain and externally as ways of thinking, acting, interacting, and valuing that constitute the identities of those people who are members of the affinity group associated with the domain.

Let me return to the child playing *Pikmin* for a specific example of what I mean. What does it take just to play a game as an active learner? To do this the player must understand and produce situated meanings in the semiotic domain that this game, and games like it, constitutes. Elements in the content of *Pikmin*—for example, a yellow Pikmin—do not have just one general meaning or a single significance in the game world. Learners must learn to situate different meanings for such elements within different specific situations within the domain.

For example, when a player is faced with a rock wall, his yellow Pikmin (who can throw bomb rocks) take on the situated meaning *the type of Pikmin who can use bombs* (unlike red and blue Pikmin), since a good strategy for destroying walls in the game is to have yellow Pikmin throw bombs at them. However, when attacking a fat, sleeping, dangerous spotted creature (a Spotty Bulborb) found throughout the first levels of the game, the yellow Pikmin take on the situated meaning *the sorts of Pikmin who can be thrown farther than other sorts of Pikmin*, since a good strategy when fighting big creatures like these is to have Captain Olimar tell the red Pikmin to run up and attack from the rear, while he throws the yellow Pikmin onto their backs to attack from up top.

Additionally, players need to know what patterns or combinations of elements the game's internal design grammar allows. They need to know, given the situated meanings they have given to each element in the pattern or combination, what the whole pattern or combination means in a situated way useful for action.

For example, the internal design grammar of *Pikmin* allows the player to bring together (by moving Captain Olimar and his Pikmin) the combination of Pikmin, a rock wall, and a small tin can containing little

rock bombs. Of course, the game did not need to allow this pattern or combination to be able to occur; its design grammar could have been built differently. Even given that the design grammar does allow this combination, players still have to build a situated meaning for this combination out of the situated meanings they have given to each element in the combination.

If this is a point in the game where the player needs to get past a wall, and given the fact that he or she can build a situated meaning for yellow Pikmin like *the type of Pikmin that can throw bombs*, the player can build a situated meaning for this combination, something like: *Equip the yellow Pikmin with the rock bombs and have them use the bombs to blow up the wall.*

Here is another example from *Pikmin* of a combination of elements allowable by the internal design grammar of the game. The player often finds a Spotty Bulborb—a creature with big teeth and jaws suitable for swallowing Pikmin whole—sleeping peacefully in a fairly exposed space. So the design grammar of the domain allows the combination: Spotty Bulborb, sleeping, in exposed area. Depending on what situation the player takes him- or herself to be in, this combination can be assigned several different situated meanings. For instance, it could be taken to mean: *Attack the Spotty Bulborb carefully from the rear before it wakes up*; or it could be taken to mean: *Sneak quietly by the Spotty Bulborb to get where you want to go without trouble*. Nothing stops the player from assigning the combination a more unexpected situated meaning, perhaps something like: *Wake the Spotty Bulborb up so you can get a more exciting (and fair?) fight.*

Since the child can successfully break down rock walls and attack Spotty Bulborbs, he can understand ("read") and produce ("write") appropriate situated meanings for elements and combinations of elements in the domain (game). But all of this is "just" playing the game in a proactive way—that is, using situated meanings and the design grammar of the game to understand and produce appropriate meanings and actions. Of course, one could just ritualize one's response to the game and try pretty much the same strategy in every situation, but this would not be a proactive way to play and learn.

All these meanings and actions are a product of what I have called active learning, but they are not yet critical learning that leverages the design grammar at a metalevel in a reflective way that can lead to critique, novel meanings, or transformation of the domain. However, the child is learning to do this as well—that is, his process of learning the game is not only active, it is increasingly critical.

When the child had recovered 5 of the spaceship's 30 missing parts, he was able to search in a new area called the Forest's Navel. This area had a much harsher and more dangerous-looking landscape than the previous areas the child had been in. It had different dangerous creatures, including a number of closely grouped creatures that breathed fire. And the background music had changed considerably. Since the player has already found five parts, the game assumes that he is now more adept than when he began the game; thus, the landscape and creatures get harder to deal with, offering a bigger challenge. At the same time, these changes in features communicate a new mood, changing the tone of the game from a cute fairy tale to a somewhat darker struggle for survival.

The child was able to think about and comment on these changes. He said that the music was now "scary" and the landscape much harsher-looking than the ones he had previously been in. He knew that this signaled that things were going to get harder. Furthermore, he was aware that the changes signaled that he needed to rethink some of his strategies as well his relationship to the game. He was even able to comment on the fact that the earlier parts of the game made it appear more appropriate for a child his age than did the Forest Navel area and considered whether the game was now "too scary" or not. He decided on a strategy of exploring the new area only a little bit at a time, avoiding the fire-breathing creatures, and returning to old areas with the new resources (e.g., blue Pikmin) he got in the Forest Navel area to find more parts in these old areas more quickly and easily (remember, the player has only 30 game days to get all the parts and so wants to get some of them quickly and easily).

What we are dealing with here is talking and thinking about the (internal) design of the game, about the game as a complex system of interrelated parts meant to engage and even manipulate the player in certain ways. This is metalevel thinking, thinking about the game as a system and a designed space. Such thinking can open up critique of the game. It can also lead to novel moves and strategies, sometimes ones that the game makers never anticipated. This is what I mean by critical learning and thinking. Of course, the six-year-old is only beginning the process of critical learning in regard to *Pikmin* and other video games, but he is well begun.

The child is learning to think reflectively about the internal design grammar (the grammar of content) of *Pikmin* and games like it. As he interacts with others, he will have opportunities to reflect on the external design grammar (the grammar of social practices and identities) too. For example, he has already learned that he can search the Internet for helpful tips about playing the game, including what are called Easter Eggs (little surprises players can find in a game if they know where and how to look for them). He considers these tips part of playing the game. On the other hand, he characterizes advice from adults about how to play the game as "bossing him around" and claims he can "do his own thinking."

These are early moments in the child's induction into the affinity groups associated with video-game playing, their characteristic social practices, and the sorts of identities people take on within these groups and practices. If he is to engage with these external aspects of game playing critically, he will need to reflect in an overt way on the patterns and possibilities he does and does not find in these social practices and identities. Doing this is to reflect on the external design grammar of the domain. Today this child is 11 and actively keeps a website up devoted to a favorite game (*Naruto*), creating faqs and contests for fellow fans who visit the site. He visits and actively interacts on boards devoted to *Naruto*. He is very much part of the affinity group associated with *Naruto* and, more generally, anime games, films, and books. He now has many more opportunities to think critically about the external design grammar—the social and interactional organization—associated with *Naruto* and games (and anime) like it.

Critical learning, as I am defining it here, involves learning to think of semiotic domains as design spaces that manipulate (if I can use this term without necessary negative connotations) us in certain ways and that we can manipulate in certain ways. Then there is the crucial matter of learning how these design spaces relate to each other and to other sorts of semiotic domains, some more closely related to video games as semiotic domains, some less closely related. That is, the child can learn how to think about, and act on, semiotic domains as a larger design space composed of clusters (families) of more or less closely related semiotic domains.

So, then, why do I call learning and thinking at a metalevel about semiotic domains (alone and in relation to each other) as design spaces *critical* learning and thinking? For this reason: Semiotic domains are human cultural and historical creations that are designed to engage and manipulate people in certain ways. They attempt through their content and social practices to recruit people to think, act, interact, value, and feel in certain specific ways.

Let me make this discussion more concrete. A game like *Pikmin* recruits from our six-year-old a complex identity composed of various related traits. The game encourages him to think of himself as an active problem solver, one who persists in trying to solve problems even after making mistakes, one who, in fact, does not see mistakes as errors but as opportunities for reflection and learning. It encourages him to be the sort of problem solver who, rather than ritualizing the solutions to problems, leaves himself open to undoing former mastery and finding new ways to solve new problems in new situations.

At the same time, the boy is encouraged to see himself as solving problems from the perspective of a particular fantasy creature (Captain Olimar) and his faithful helpers (the Pikmin) and, thus, to get outside his "real" identity and play with the notions of perspectives and identities themselves. He is also encouraged to focus on the problem-solving and fantasy aspects of his new identity and not, say, his worries about killing (virtual) "living" creatures, however odd they may be, though he can choose to avoid killing some of the creatures by running from them or sneaking around them. The learner, in this case, gets to customize the identity the game offers him to a certain extent—this, in fact, is an important feature of good video games.

The identity that *Pikmin* invites the player to take on relates in a variety of ways to other identities he takes on in other domains. I believe, for example, that the identity *Pikmin* recruits relates rather well to the sort of identity a learner is called on to assume in the best active science learning in schools and other sites. Such learning—just like Pikmin—encourages exploration, hypothesis testing, risk taking, persistence past failure, and seeing "mistakes" as new opportunities for progress and learning.

If this is true, then our six-year-old is privileged in this respect over children who do not have the opportunity to play such games (in an active and critical way). An issue of social justice is at stake here in regard to the distribution of, and access to, this identity, whether through video games or science. We can note, as well, that the boy is using the video game to practice this identity, for many hours, at an early age, outside of science instruction in school, which may take up very little of the school day. Other children may get to practice this identity only during the limited amount of time their school devotes to active and critical learning in science—the sort that lets children do science rather than memorize lists of facts—which often is no time at all.

VIDEO GAMES: A WASTE OF TIME?

I have now discussed a perspective on learning that stresses active and critical learning within specific semiotic domains. So, let me now return to the grandfather's remark that playing video games is a waste of time because the child is learning no "content."

If children (and adults) are playing video games in such a way as to learn actively and critically, then they are:

1. Learning to experience (see and act on) the world in a new way.
2. Gaining the potential to join and collaborate with a new affinity group.

3. Developing resources for future learning and problem solving in the semiotic domains to which the game is related.
4. Learning how to think about semiotic domains as design spaces that engage and manipulate people in certain ways and, in turn, help create certain relationships in society among people and groups of people, some of which have important implications for social justice.

These, of course, are just the four things one learns when engaging actively and critically with any new semiotic domain. So the questions in regard to any specific semiotic domain become: Are these good or valuable ways to experience the world? Is this a good or valuable affinity group to join? Are these resources for future learning applicable to other good and valued semiotic domains? Is this domain leading the learner to reflect on design spaces (and the concomitant identities they help create), and their intricate relationships to each other, in ways that potentially can lead to critique, innovation, and good or valued thinking and acting in society?

The answers to these questions will vary along a variety of parameters. But they show that a great deal more is at stake than "content" in the grandfather's sense. This book offers a positive answer to these questions in regard to a good many (certainly not all) video games, as long as people are playing them in ways that involve active and critical learning.

What ensures that a person plays video games in a way that involves active and critical learning and thinking? Nothing, of course, can ensure such a thing. Obviously, people differ in a variety of ways, including how much they are willing to challenge themselves, and they play video games for a great variety of different purposes. But two things help to lead to active and critical learning in playing video games.

One is the internal design of the game itself. Good games—and the games get better in this respect all the time—are crafted in ways that encourage and facilitate active and critical learning and thinking (which is not to say that every player will take up this offer). The other is the people around the learner, other players and nonplayers. If these people encourage reflective metatalk, thinking, and actions in regard to the design of the game, of video games more generally, and of other semiotic domains and their complex interrelationships, then this, too, can encourage and facilitate active and critical learning and thinking (though, again, the offer may not be taken up). And, indeed, the affinity groups connected to video games do often encourage metareflective thinking about design, as a look at Internet game sites will readily attest.

There is another important issue here that bears on deciding whether a given semiotic domain—like video games—is valuable or not: Semiotic domains in society are connected to other semiotic domains in a myriad of complex ways. One of these is that knowledge of a given domain can be a good precursor for learning another one, because mastering the meaning-making skills in, and taking on the identity associated with, the precursor domain facilitates learning in the other domain. Facilitation can also happen because being (or having been) a member of the affinity group associated with the precursor domain facilitates becoming a member of the affinity group associated with the other domain, because the values, norms, goals, or practices of the precursor group resemble in some ways the other group's values, norms, goals, or practices.

Let me give a concrete example of such connections. In the larger semiotic domain of video games, first- and third-person shooter games are a well-defined subdomain. However, such games often have elements that are similar to features found in arcade games, games (like *Space Invaders*, *Pacman*, and *Frogger*) that involve a good deal of fast hand-eye coordination. (In fact, one of the original first-person shooter games, a game that helped start the genre—*Wolfenstein 3D*—operates very much like an arcade game.) Thus, someone who has mastered the domain of arcade games has mastered a precursor domain for shooter games, though such games now contain many other elements, as well.

On the other hand, fantasy role-playing games are another well-defined subdomain. People who have earlier played and mastered the *Dungeons and Dragons* semiotic domain (as make-believe play or with books and cards) are advantaged when they play fantasy role-playing

games, since such games developed out of *Dungeons and Dragons*, though they now contain a good many additional elements.

Both the shooter domain and the fantasy role-playing domain have other precursor domains, and they share some precursor domains (e.g., make-believe play wherein one is willing to take on different identities). Some of these video-game (sub)domains may well serve as precursor domains for other semiotic domains. For example, it may well be that the popular (sub)domain of simulation games (so-called god games, like *SimCity*, *The Sims*, *Railroad Tycoon*, and *Civilization*) could be, for some children, a precursor domain for those sciences that heavily trade in computer-based simulations as a method of inquiry (e.g., some types of biology and cognitive science).

In interviews my research team and I have conducted with video-game players, we have found a number of young people who have used the domain of video games as a fruitful precursor domain for mastering other semiotic domains tied to computers and related technologies. Indeed, several of these young people have subsequently gone on to college and majored in computer science or related areas.

So we can ask: Can various subdomains in the larger domain of video-game playing serve as precursor domains facilitating later learning in and out of school? I believe that the sorts of active and critical learning about design—and the type of problem-solving identities—that a game like *Pikmin* can involve may well relate to later learning in domains like science, at least when we are talking about teaching and learning science as an active process of inquiry and not the memorization of passive facts.

I am convinced that playing video games actively and critically is not "a waste of time." And people playing video games are indeed (*pace* the six-year-old's grandfather) learning "content," albeit usually not the passive content of school-based facts. (Though many games, such as *Civilization*, do contain a good number of facts.) The content of video games, when they are played actively and critically, is something like this: *They situate meaning in a multimodal space through embodied experiences to solve problems and reflect on the intricacies of the design of imagined worlds and the design of both real and imagined social relationships and identities in the modern world.* That's not at all that bad—and people get wildly entertained to boot. No wonder it is hard for today's schools to compete.

LEARNING PRINCIPLES

The discussion in this chapter suggests a variety of learning principles that are built into good video games, like *Pikmin*, as will the discussion in each of the following chapters. Some of the learning principles suggested in this chapter are a bit more general than are those in later chapters. Here I bring together these principles to start a list that will continue in subsequent chapters.

I state only five very basic principles, since quite a number of other principles that are implicated in the earlier discussion will be discussed in greater detail later. The order of the principles is not important. Some of the principles overlap and, in actuality, reflect different aspects of much the same general theme. Furthermore, these principles are not claims about all and any video games played in any old fashion. Rather, they are claims about the potential of good video games played in environments that encourage overt reflection. (While good video games do indeed encourage overt reflection, this feature can be greatly enhanced by the presence of others, both players and viewers.)

I state each principle in a way that is intended to be equally relevant to learning in video games and learning in content areas in classrooms.

1. **Active, Critical Learning Principle**
   All aspects of the learning environment (including the ways in which the semiotic domain is designed and presented) are set up to encourage active and critical, not passive, learning.
2. **Design Principle**
   Learning about and coming to appreciate design and design principles is core to the learning experience.

3. **Semiotic Principle**
   Learning about and coming to appreciate interrelations within and across multiple sign systems (images, words, actions, symbols, artifacts, etc.) as a complex system is core to the learning experience.
4. **Semiotic Domains Principle**
   Learning involves mastering, at some level, semiotic domains, and being able to participate, at some level, in the affinity group or groups connected to them.
5. **Metalevel Thinking About Semiotic Domains Principle**
   Learning involves active and critical thinking about the relationships of the semiotic domain being learned to other semiotic domains.

BIBLIOGRAPHICAL NOTE

See Kress 1985, 1996, and Kress and van Leeuwen 1996, 2001 for insightful discussions on reading images and multimodal texts, that is, texts that mix words and images. For work on literacy as multiple—that is, multiple literacies—see the citations to the New Literacy Studies at the end of chapter 1 as well as Cope and Kalantzis 2000, Gee 2007a, Heath 1983, Scollon and Scollon 1981, and Street 1984. On the complexity of the language and meanings in comic books, see the sidebars on comics in Jenkins (2006).

The discussion of physics students who know Newton's laws of motion but cannot apply them to a specific situation is taken from Chi, Feltovich, and Glaser 1981. For further discussion, see Gardner 1991 and Mayer 1992.

On semiotics and content learning, see Kress 2003; Kress, Jewitt, Ogborn, and Tsatsarelis 2001; Kress and van Leeuwen 2001; Lemke 1990; and Ogborn, Kress, Martins, and McGillicuddy 1996. On the notion of affiliation and affinity groups, see Beck 1992, 1994; Gee 2004; Rifkin 2000; and Taylor 1994. For the idea of preparation for future learning, see Bransford and Schwartz 1999, a very important and illuminating paper for anyone interested in learning. On the notion of design and design grammars, see New London Group 1996, a "manifesto" written by an international group of scholars (a group of which I was a member) working in the area of language and literacy studies.

My notion of critical learning combines work on situated cognition (see bibliographic note for chapter 4), especially work on metacognition—see, for example Bereiter and Scardamalia 1989; Bruer 1993 (pp. 67–99); Pellegrino, Chudowsky, and Glaser 2001; Schon 1987; with Paulo Freire's 1995 work on critical thinking and literacy as "reading the world" and not just "reading the word."

3

LEARNING AND IDENTITY: WHAT DOES IT MEAN TO BE A HALF-ELF?

ARCANUM: LEARNING AND IDENTITY

THE LAST CHAPTER ARGUED THAT SEMIOTIC DOMAINS REQUIRE PEOPLE new to them to take on and play with new identities. I discussed the identity as an exploratory problem solver that the game *Pikmin* encouraged a six-year-old to take on. All learning in all semiotic domains requires taking on a new identity and forming bridges from one's old identities to the new one.

For example, children in a science classroom engaged in real inquiry, and not just passive learning, must be willing to take on an identity as a certain type of scientific thinker, problem solver, and doer. The children must see and make connections between this new identity and other identities they have already formed. Certainly children will be at a disadvantage if they have one or more identities that do not fit with, are opposed to, or are threatened by the identity recruited in the science classroom (e.g., an identity as someone who is bad at learning technical matters, as someone who dislikes school, or as someone from a family that is not "into" science or school, not to mention cases like creationist Christians in biology classes).

This chapter uses learning to play video games as a crucial example of how identities work in learning. Video games recruit identities and encourage identity work and reflection on identities in clear and powerful ways. If schools worked in similar ways, learning in school would be more successful and powerful because it would become the active and critical learning discussed in the last chapter. To make the discussion concrete, I base it on one particular video game, a fantasy role-playing game called *Arcanum: Of Steamworks and Magick Obscura* (some other deep role-playing games, among many, that would have worked as well are: *The Elder Scrolls III: Morrowind* and its sequel *Elder Scrolls IV: Oblivion* or *Gothic 2* and its sequel *Gothic 3*).

I first discuss this game and the sorts of identity work it recruits. Then I turn to learning in school, making comparisons and contrasts with learning in *Arcanum* and games like it. Finally, I continue the list of learning principles that are embedded in good video games, principles that are important for powerful learning in any domain. Let us turn to *Arcanum*.

Arcanum takes place in a massive world called Arcanum, a world made up of a great many countries and towns. Once upon a time magic ("magick") held sway throughout Arcanum. But now technology has arrived, and Arcanum has become a place of both ancient runes and industrial steamworks, a land where magic and machines coexist in a tension-filled and uneasy balance. A variety of races—humans, elves, gnomes, dwarves, orcs, and ogres (as well as half-elves, half-orcs, and half-ogres, each of which have one human parent)—cohabit this world, each orienting to the conflicts between magic and technology in different ways.

Before you start playing *Arcanum*, you must construct your character. Each race and gender has different natural characteristics. For example, I chose to be a female half-elf, whom I named "Bead Bead." Half-elves, like all other races, have their own unique degrees of strength, constitution, dexterity, beauty, intelligence, willpower, perception, and charisma. Each of these traits will affect how your character—that is, *you*—carries out dialogue and action in the world of Arcanum and how other characters in the world respond to you (e.g., if you are not strong enough to fight in a given situation, you better be intelligent enough to think your way out of the problem, or beautiful or charismatic enough to get others to want to help you).

You can also initially choose from a wide variety of unique backgrounds—things that happened in your character's past. For example, your character might have been a rich debutante who developed strong social skills in her youth suitable now for recruiting help from others or might have been a child of a hero, a parent who has given you extra-special skills with a sword, but whose reputation for goodness you must now live up to, and so on through many other choices.

When the game starts you get five "points" that you can choose to distribute, in any way you wish, to your character, thereby changing his or her "natural" state. For example, Bead Bead, as a female half-elf, had a natural strength of seven, but I used one of my five points to make her stronger. As the game progresses and you gain more worldly experience, you gain yet more points to distribute, thereby allowing your character to develop in certain ways and not others.

You can distribute these initial and subsequent points to your character's primary traits, such as strength, dexterity, intelligence, and so forth, but you can also use them to build up a wide variety of other skills, such as ability with a bow and arrow, skill with picking locks, or persuasive skills; ability to cast a wide variety of magic spells or to build a wide variety of technological apparatuses, including weapons; or the ability to heal better or get less fatigued as your character engages in effortful tasks. You can choose to have a character primarily oriented to magic or technology or some mixture of the two.

During game play you talk and interact with a great many other characters in the world of Arcanum. Your actions gain you a reputation as good or evil. Various other characters will join you or not, depending on their own alignments as good or evil and also depending on things like your persuasiveness, beauty, and charisma. Throughout the game, you can get gold and buy clothing, armor, and equipment for yourself and any of your followers, who may run off with your purchases and leave you if you don't

please them. For example, one of my followers, a rather self-righteous human, kept threatening to leave me if I continued to attempt to pick people's pockets. Rather than quit picking pockets (though I did lay off a bit, at least when he was looking), I reassured him by giving money to poor street beggars, something of which he approved.

Your adventures in Arcanum start with a catastrophe. Your character is a passenger on the *Zephyr*, a large blimp. Two quite odd flying vessels appear and attack the *Zephyr*, destroying themselves in the process. The *Zephyr* bursts into flame and smashes into the ground. Only your character and a dying old man survive the crash. The old man musters just enough strength to give you an engraved ring along with a cryptic message. He pleads with you to take his ring and bring it to "the boy," telling you that a great evil is coming back to destroy everything. After assuring you that the boy "will know what to do," he dies. You are left as the sole survivor of the crash, though you soon meet a mysterious follower of one of Arcanum's religions, a man named Virgil, who, if you wish, will come with you and help you (though you still have to make the major decisions for yourself).

Thus, your quest begins. The game involves not only the main quest of carrying out the dead man's wishes, a quest that eventually leads to a great many subquests that are part of the main quest, but it also has lots of side quests, given to you by characters you meet throughout Arcanum, which you can choose to do or ignore. (Though you can gain experience and, thus, more experience points to distribute to your character if you do them.) By the time you finish, your character is very different from the characters other players have built, and the game you have played is very different from what it would have been had you built your character differently initially and throughout the game.

THREE IDENTITIES: VIRTUAL, REAL, AND PROJECTIVE

A game like *Arcanum* involves playing with identities in very interesting and important ways. When one plays *Arcanum*, and role-playing games like it, three different identities are at stake. All three are aspects of the following relationship: A real person (here James Paul Gee) as a virtual character (here Bead Bead). All three operate together, at once, as a larger whole.

First, there is a *virtual* identity: one's identity as a virtual character in the virtual world of Arcanum—in my case the half-elf Bead Bead. I will represent this identity as "James Paul Gee as *Bead Bead*," where Bead Bead is italicized to indicate that, in this identity, the stress is on the virtual character Bead Bead acting in the virtual world of Arcanum (though I am "playing/developing" her).

In the virtual world of Arcanum, given the sort of creature Bead Bead is (a female half-elf) and how I have developed her thus far, there are, at any point, things she can do and things she cannot do. For example, at a certain place in the game, Bead Bead wants to persuade a town meeting to fund the building of a monument to please the town's mayor. To do this, she needs to be intelligent and persuasive. Half-elves are, by nature, pretty intelligent, and I had built up Bead Bead to be persuasive during the game (i.e., given her points in this area). Thus, she was able to pull off the task at the town meeting (something I very much doubt a Half-orc could have done, though half-orcs have other talents). These traits (her intelligence and persuasive skills) and her accomplishment at the town meeting—for which she received ample praise—are part of my virtual identity as Bead Bead.

The successes and failures of the virtual being Bead Bead (me in my virtual identity) are a delicious blend of my doing and not my doing. After all, I made Bead Bead and developed her, so I deserve—partly, at least—praise for her successes and blame for her failures. Yet Bead Bead is who she is—a female half-elf—and must move through the world of Arcanum and be formed, in part, by it, a world I did not create. Thus I am, in this sense, not responsible for her successes or her failures. I suppose this is how many a parent feels about his or her child, save that in this case, I (James Paul Gee) am my own child (Bead Bead).

A second identity that is at stake in playing a game like *Arcanum* is a *real-world identity*: namely, my own identity as "James Paul Gee," a nonvirtual

person playing a computer game. I will represent this identity as "*James Paul Gee* as Bead Bead," where James Paul Gee is italicized to indicate that, in this identity, the stress is on the real-world character James Paul Gee playing *Arcanum* as a game in real time (though Bead Bead is the tool through which I operate the game).

Of course, in the real world I have a good many different nonvirtual identities. I am a professor, a linguist, an Anglo American, a middle-age male baby boomer, a parent, an avid reader, a middle-class person initially raised outside the middle class, a former devout Catholic, a lover of movies, and so on through a great many other identities (most of which need not be mentioned here). Of course, these identities become relevant only as they affect and are filtered through my identity as a video-game player playing *Arcanum*. And, indeed, any one of my real-world identities can be so engaged whenever I am playing *Arcanum*. Which of these identities, for instance, was at play—positively or negatively—when I got such joy at having Bead Bead pick rich people's pockets? When I chose to be a female half-elf in the first place? When I chose to use my points to make her as strong and good as a male at melee fighting with a sword?

A third identity that is at stake in playing a game like *Arcanum* is what I will call a *projective identity*, playing on two senses of the word "project," meaning both "to project one's values and desires onto the virtual character" (Bead Bead, in this case) and "seeing the virtual character as one's own project in the making, a creature whom I imbue with a certain trajectory through time defined by my aspirations for what I want that character to be and become (within the limitations of her capacities, of course, and within the resources the game designer has given me)." This is the hardest identity to describe but the most important one for understanding the power of games like *Arcanum*. I will represent this identity as "James Paul Gee *as* Bead Bead," where the word "as" is italicized to indicate that, in this identity, the stress is on the interface between—the interactions between—the real-world person and the virtual character.

A game like *Arcanum* allows me, the player, certain degrees of freedom (choices) in forming my virtual character and developing her throughout the game. In my projective identity I worry about what sort of "person" I want her to be, what type of history I want her to have had by the time I am done playing the game. I want this person and history to reflect my values, though I have to think reflectively and critically about them, since I have never had to project a half-elf onto the world before. But this person and history also reflect what I have learned from playing the game and being Bead Bead in the land of Arcanum. A good role-playing video game makes me think new thoughts about what I value and what I do not.

I, the real-world person, James Paul Gee, a creature with multiple identities, must face the fact that I am fixed in certain ways. Though I am, like all human beings, ever changing, at the moment I am who I am (I wish I had more hair, but I don't; I wish I was thinner, but I am not; I wish I was a better game player, but I am not). At least for the moment, I must live with my limitations. Bead Bead, my virtual alter ego, is a creature who is, at any moment in the game, also fixed in certain ways—she is skilled in certain areas, not others (e.g., while she was pretty good at picking pockets, she was lousy at picking locks). At least for the given moment in the game, I/she must live with her limitations.

The kind of person I want Bead Bead to be, the kind of history I want her to have, the kind of person and history I am trying to build in and through her is what I mean by a projective identity. Since these aspirations are *my* desires for Bead Bead, the projective identity is both mine and hers, and it is a space in which I can transcend both her limitations and my own.

To see more clearly what I mean by a projective identity and how it differs from the virtual identity of being Bead Bead and the real-world identity of being James Paul Gee (however myriad a thing that is), consider that each of the three identities I am talking about can fail (or, for that matter, succeed) in different sorts of ways.

The virtual character Bead Bead (my alter-ego) can fail to defeat another character in battle because, as a half-elf, at that point in the game, she just is not strong enough to win. This is a limitation I have to live with if I want to be Bead Bead. Of course, I can meditate—in my role as Bead

Bead—on my inability to get what I need or want at a certain point because I am physically too powerless to get it.

The real-world person (James Paul Gee) can fail to use the game controls in an effective way, thereby causing Bead Bead to lose a fight against a weaker creature she could have otherwise beaten; he can fail to save the game at a good time and place (e.g., saving in the middle of a battle that cannot be won is a bad move); he can fail to find his (Bead Bead's) way in a maze because he has poor spatial abilities (a trait Bead Bead therefore inherits). He can even realize that his former Catholic inhibitions will not let Bead Bead take up a madam's offer of a free trip to her (female) brothel. (This is just an example: There is such a brothel in Arcanum, but my former Catholic inhibitions, very real in the real world, did not, in fact, deny Bead Bead a well-deserved night of forbidden pleasure, though, it turns out, she fainted in the middle of things.)

These are limitations in the real-world me as a game player (an identity intersected by a good many other identities), limitations I have to live with if I want to play and eventually get better at games. One sort of limitation video games certainly bring up to real-world baby boomers like me is that they do not reward—in fact, they punish—some of my most cherished ways of learning and thinking (e.g., being too quick to want to get to a goal without engaging in sufficient prior nonlinear exploration).

The projective identity of Bead Bead as a project (mine) in the making can fail because I (the real-world James Paul Gee) have caused Bead Bead (the virtual me) to do something in the game that the character I want Bead Bead to be would not or should not do. For example, on my first try at the game, early on I had Bead Bead sell the ring the old man had given her. This is not a mistake at playing the game (thus not a failure of the real me to play the game properly). It's a move allowed by the internal design grammar of the game and one for which I would have suffered no bad consequences in the game world. It is also not something that Half-Elves can't do or are, for that matter, necessarily too principled or ungreedy to want to do. Thus it is not necessarily a violation of Bead Bead as a virtual identity.

However, the act just seemed *wrong* for the creature I wanted Bead Bead to be (or to have become, however partially, by the end of the game). I felt when I (Bead Bead) had sold the ring that I was forming a history for Bead Bead that was not the one she should have. I wanted her to be a creature who acted more intelligently and more cautiously, a creature who could eventually look back on the history of her acts without regret. I felt I had "let her down" and started the game all over again. Thus, in my projective identity—Bead Bead as my project—I am attributing feelings and motives to Bead Bead that go beyond the confines of the game world and enter the realm of a world of my own creation.

It is not uncommon, even when young people are playing first-person shooter games featuring a superhuman hero (like Master Chief in *Halo*)—a character that, unlike Bead Bead, they usually cannot choose or develop but must take as is—that they will redo a given fight scene because they feel they have "let their character down." They want to pull off the victory more spectacularly, as befits a superhero. They feel responsible to and for the character. They are projecting an identity as to who the character ought to be and what the trajectory of his or her acts in the virtual world ought, at the end of the day, to look like.

Likewise, while some young people will let a superhero first-person shooter character kill "civilians" and not just enemies, a good many others will not, since they feel that it just isn't fitting for such a superperson—that is, the person they are projecting into the world—to do such a thing. In fact, I once had remorse when I let/made Bead Bead kill a pesky chicken, an action for which she was also suitably castigated by the self-righteous follower I mentioned earlier. Players are projecting an identity onto their virtual character based both on their own values and on what the game has taught them about what such a character should or might be and become.

This tripartite play of identities (a virtual identity, a real-world identity, and a projective identity) in the relationship "player as virtual character" is quite powerful. It transcends identification with characters in novels or movies, for instance, because it is both *active* (the player actively does things)

and *reflexive*, in the sense that once the player has made some choices about the virtual character, the virtual character is now developed in a way that sets certain parameters about what the player can now do. The virtual character redounds back on the player and affects his or her future actions.

As a player, I was proud of Bead Bead at the end of the game in a way in which I have never been proud of a character in a novel or movie, however much I had identified with him or her. I can identify with the pride characters in a novel or movie must or should feel, given what they have done or how far they have come. But my satisfaction with Bead Bead is tinged with pride (it could have been regret had things turned out differently), at various levels, in and with myself. This feeling is not (just) selfish. In a sense, it is also selfless, since it is pride at things that have transcended—taken me outside of—my real-world self (selves), if I am playing the game reflectively.

IDENTITY AND LEARNING

The theme of this book is that good video games reflect, in their design, good principles of learning. We turn directly to some of these principles in the next section and in following chapters. Now I want to discuss how and why the sort of play with identities at work in *Arcanum* is relevant to learning outside video games.

A game like *Arcanum* is powerfully caught up in the act of playing with identities. However, all deep learning—that is, active, critical learning—is inextricably caught up with identity in a variety of ways. People cannot learn in a deep way within a semiotic domain if they are not willing to commit themselves fully to the learning in terms of time, effort, and active engagement. Such a commitment requires that they are willing to see themselves in terms of a new identity, that is, to see themselves as the *kind of person* who can learn, use, and value the new semiotic domain. In turn, they need to believe that, if they are successful learners in the domain, they will be valued and accepted by others committed to that domain—that is, by people in the affinity group associated with the domain.

It has been argued that some poor urban African American children and teenagers resist learning literacy in school because they see school-based literacy as "white," as associated with people who disregard them and others like them. They don't believe that a society that they view as racist will ever allow them to gain a good job, status, and power, even if they do succeed at school-based literacy. Thus they will not envisage themselves in the new identity that success in school requires—that is, as the "kind of person" who learns, values, and uses such school-based literacy and gets valued and respected for doing so. Without such an identity commitment, no deep learning can occur. The students will not invest the time, effort, and committed engagement that active, critical learning requires. In fact, they resist learning in school in order to privilege another identity that such learning would put at risk.

The tripartite play of identities that a game like *Arcanum* recruits is at the root of active and critical learning in many other semiotic domains, including learning content actively and critically in school. Let's take good school science learning as an example.

First, let's consider *virtual identities*. In a good science classroom, a virtual identity is at stake. Learners need to be able to engage in words, interactions, and actions that allow them to take on the identity of a "scientist." But what does this mean? There are many different sciences and types of scientists. The teacher must put into motion, in the classroom, a set of values, beliefs, and ways with words, deeds, and interactions that represent, for the teacher and the students, what it means to be a particular kind of scientist in that classroom. Doing this means taking up a specific viewpoint on a specific branch of science as a set of cognitive and social practices. Of course, the students are not "real" scientists and are not going to become real scientists any time soon. What is being created here is fully akin to a virtual identity ("student as *scientist*").

As I did with Bead Bead in *Arcanum*, learners in a science classroom should see the virtual identity (being a particular type of scientist) as partly fixed by the history and workings of the (scientific) semiotic domain being learned and partly open to some choices (compatible, of course, with the

domain) that they themselves get to make about this virtual identity. For example, in one fourth-grade classroom in which I have worked, the children did experiments on fast-growing plants, mentored, in part, by the scientist who actually invented such plants (a man with strong views about how scientists ought to think, value, and act) as well as by their teacher (a teacher with strong views about how she wants her students to think, value, and act when they are learning science). In this classroom, the children were expected to act, interact, and use language in ways that were recognizable, in terms of the norms set up in this classroom, as scientists doing science. However, the children could also choose a particular style of carrying out their virtual identities as scientists.

For example, the children chose what questions they wanted to ask and what sort of experiments they wanted to carry out to help answer those questions. Some worked in closer collaborations with other children than others did. Some studied texts more thoroughly before experimentation, some more thoroughly afterward. Some experimented to check on the results of previous experiments they found suspicious; others chose to try something for the first time. Some used African American Vernacular English phonology, some did not, though they all used the lexicon and syntax of scientific language about plants when they needed to, which was an important norm in the classroom.

Second, let's consider *real-world identities*. In good science classrooms, the learners' real-world identities are involved ("*learner* as scientist"). All learners in a science classroom bring to that room their real-world identities. As was the case with me playing *Arcanum*, each learner has multiple real-world identities: A given child might be middle-class, male, African American, a Pokémon fanatic, adept at rap music, and have a good many other identities as well. But, too, like me playing *Arcanum*, where these multiple identities are all filtered through my identity as a game player, the multiple real-world identities of learners in a science classroom are filtered through their real-world identities as a learner, a school learner, and a school science learner learning science here and now.

If a child brings to science learning a real-world identity as a learner, a school learner, or a school science learner who is already damaged—and a good many children do—then this identity needs to be repaired before any active, critical learning can occur here and now. Imagine how successful you would be learning to play *Arcanum* if you started with the assumption that you are a failure at learning to play video games and role-playing games in particular. This, in fact, is what has happened to me when I tried to learn real-time strategy games (e.g., *Age of Empires*, *Star Wars: Galactic Battlegrounds*, or *WarCraft III*). I am intimidated by anything that is a race against time and so have, until recently, been pretty much a failure at playing real-time strategy games well and with enjoyment. Some repair work needed to be done and was, in fact, done by the wonderful game *Rise of Nations*, a game that is designed to allow even "damaged" real-time strategy players to learn and learn well.

Furthermore, if children cannot or will not make bridges between one or more of their real-world identities and the virtual identity at stake in the classroom (here, a particular type of scientist)—or if teachers or others destroy or don't help build such bridges—then, once again, learning is imperiled. Children who, for instance, see themselves as members of families that are adept at technical learning have an advantage, since they can build a powerful bridge between one of their real-world identities ("people like us learn technical stuff well—it's no big deal") and the virtual identity at stake in the science classroom ("scientists in the sort of semiotic domain being created in this classroom do not fear or put off technical learning"). If a child cannot or will not build such bridges, then, again, repair works needs to be done.

But how can such repair work be done? It is no easy matter. In fact, often this is what good teaching, especially in socially and culturally diverse classrooms, amounts to. However, good repair work is just a more intense version of good teaching and learning for all types of students, including those who have no need of any particular repair work.

Such teaching and learning is, in my view, a matter of three things:

1. The learner must be enticed to *try*, even if he or she already has good grounds to be afraid to try.
2. The learner must be enticed to *put in lots of effort* even if he or she begins with little motivation to do so.
3. The learner must *achieve some meaningful success* when he or she has expended this effort.

There are three principles here because people will not put in effort if they are not even willing to try in a domain; success without effort is not rewarding; and effort with little success is equally unrewarding.

These three things seem pretty basic. Nonetheless, they are left out of most of the current debates about education, which tend not to engage with issues about the identities learners bring to school and how these identities relate to motivation and effort (or their lack) in relation to specific sorts of pedagogies.

Video games are particularly good at these three things, at least for some types of learners. For instance, when I started playing video games, I certainly brought a fearful and damaged identity as a game player to the task. I had never been good at such things in the past, and my identical twin brother always beat me when we played very early video games. And I felt too old now to have any success. Furthermore, initially I could not conceive of which of my multiple real-world identities could possibly serve as a bridge to the sorts of virtual worlds, identities, and situations video games set up (e.g., blasting aliens—I've always liked aliens).

What enticed me to try in the first place, then? Well, I watched my son play video games, starting with *Winnie the Pooh*, moving on to *Pajama Sam*, *Freddy Fish*, *Putt-Putt*, and *Spy Fox*. I played some of the games myself ("just to help him"). I tried a more adult game, one I picked "randomly" at the store, the little-known game *The New Adventures of the Time Machine*. Of course, its tie to literature (H. G. Wells's book *The Time Machine*) piqued my interest and made playing a video game seem more acceptable, in terms of some of my real-world identities. My engagement with games through my child taught me there was some level at which I could enter this semiotic domain in which I could achieve enough initial success to keep on practicing and getting better. To repair damaged learners in any domain, there must be some such story, though the stories will be as various as the learners.

Even more important, I learned that video games create what the psychologist Eric Erickson has called a *psychosocial moratorium*—that is, a learning space in which the learner can take risks where real-world consequences are lowered. After all, you can save the game and start back at the save point when you fail. Often you can customize the game to a level of difficulty you can cope with initially. And, of course, you can choose the game you want to play. Although you have to put out a good deal of effort to play any good video game, there is a relatively low cost of failure and high reward for success. None of this is to say that it does not bother or even frustrate players when they die or do not play part of a game well. It does indeed. Of course they care about how well they do—but the cost of caring is not prohibitive, as it so often is in school.

What made me, once I was enticed to try, willing to put in lots of effort and practice with video games? When you have chosen a video game well, the virtual world it allows you to live in is quite compelling. I found the virtual world of *The New Adventures of the Time Machine* simply amazing. I particularly liked how, when a certain wave of light went through the world, all adult characters in the game changed to their child selves and all children changed to their adult selves, so that sometimes the virtual character you are playing, Brendan Wales, is a boy, sometimes a man. What makes a game compelling to me might not make it so to you. Indeed, what made a game compelling to me when I started to play is not what makes a game compelling to me now. But if the virtual world and virtual identity at stake in learning is not compelling to the learner, at some level, then little deep learning is liable to occur, in part because the learner is going to be unwilling to put in the effort and practice demanded for mastering the domain.

What made *The New Adventures of the Time Machine* compelling to me was initially the way in which I could bridge some of my real-world identities to the virtual character I played in the game and the virtual world in which he/I moved. For example, there were the ties to literature (books); academics (Wales is a scientist); problem solving (another tie, at least initially, to my academic identity); a medieval but futuristic world (I once lived for real in the medieval world, though we don't need to pursue the matter further here); and fantasy worlds (I have always been a willing escapee from reality, which is why I have always loved movies and have nothing against ivory towers).

Once these ties had drawn me into the game and made me put in lots of effort, it would have been disappointing in the extreme to experience no success. However, at the same time, it would have been equally disappointing to get the sorts of rewards that much better players get. This would have made me believe the domain was not very deep and rich. So how does one build in success for effort, success that is earned, not given away, but nonetheless ensured, given the effort?

Good computer games are designed so that they adjust to different levels of play and reward each sort of player, if the player is putting in effort, with some appropriate degree of success. For example, in a shooter game, after much exploration, I may uncover a spiffy rifle that I am just thrilled with, since it is so much better than the crowbar I have been using to fend off enemies, while you, much better at the game than I, may have found a tank.

Of course, video games offer players a feeling of achievement in a number of different ways. First of all, they operate according to a very powerful learning principle, a principle we can call the "amplification of input principle." When systems operate according to this principle, they give, for a little input, a lot of output. (Driving a car is a good example: You press a little pedal and off you zoom.) In a video game, you press some buttons in the real world and a whole interactive virtual world comes to life. Amplification of input is highly motivating for learning.

By the way, in the real world, science often operates by the amplification of input principle. In a chemistry experiment, you mix a few chemicals and make a major discovery, cure cancer, or blow up the lab. Think, too, of the monk Mendel and his peas: He putters (in the right way) in the garden and unlocks the key to the origins and development of species on earth. Think even of Newton's laws of motion: Such simple and elegant principles cover so much ground and give so much insight into so many things that one is simply amazed. None of this is to say that great effort is not required. Mendel worked for years (and, by the way, failed his exam to become a high school biology teacher, which was why he was stuck in the garden). It is just to say that there is something very satisfying when what one actually does seems so small compared to what one gets. It's like a miracle.

Video games also offer other rewards than the powerfully amplified outputs they give. When I was enticed to put in effort on *The New Adventures of the Time Machine*, new compelling elements quickly arose, beyond those connected to my real-world identities and the amplification of input I experienced. I discovered that this game, like many other good video games, encourages new ways of learning and thinking for an old baby boomer like me. I discovered new powers in myself. I felt the dawning of a new identity growing, one to be added to my other real-world identities. Of course this is true of all good learning—we gain a new valued identity that gives us new powers; it's the final hook where the repair work is finally done.

This discussion suggests that good science instruction—or good instruction in any content area—must accomplish the same three goals. The learner must be enticed to try. This is done through building bridges to his or her real-world identities and by creating a psychosocial moratorium.

The learner must be enticed to put in lots of effort. This is done by making the virtual world and virtual identity (e.g., being/doing a particular type of scientists in the classroom) at stake in the learning compelling to the learner on his or her own terms. The learner needs to be sucked in.

And, finally, this effort must issue in success at an appropriate level, customized to the learner's stage of development in the semiotic domain being learned. Success for effort at different levels needs to be built in, letting learners know all the while that there will be yet greater successes for yet greater effort. Amplification of input needs to be designed into the teaching and learning. And to ensure the deepest sort of success, the virtual world needs to be built in such a way that learners discover new powers and feel the dawning of new valued identities.

Let us return to *projective identities* ("the learner *as* scientist"). If learners are to take on projective identities in the science classroom, they must come to project their own values and desires onto the virtual identity of "being a scientist of a certain sort" in this classroom. They also must come to see this virtual identity as their own project in the making, an identity they take on that entails a certain trajectory through time defined by their own values, desires, choices, goals, and actions. This is what creates ownership.

When learners take on a projective identity, they want the scientist they are "playing" to be a certain sort of person and to have had a certain sort of history in the learning trajectory of this classroom. They have aspirations for this scientist, just as I had aspirations for Bead Bead when I played *Arcanum*. Perhaps they want their scientist to have had a history of having been persistent, resilient in the face of failure, collaborative, risk taking, skeptical, and creative. They want their scientist to become this sort of person, whether or not they are themselves anything like this in their "everyday" lives. In good science learning, learners are not just role-playing being a scientist of a certain sort (their virtual identity). They are also proactively building that virtual person as a certain kind of person with a certain kind of history. They are projecting their own hopes and desires onto that person.

The learner's hopes, values, and aspirations for the "character" (the virtual scientist)—and the project the learner makes of that character, the history he or she builds for that character—have their source not just in the learner's real-world identities, though they most certainly partially have their source there as the learner reflects on his or her values, desires, aspirations, and goals. They also have their source in what the learner is learning about the virtual identity and the virtual world (what it means to be a scientist in this classroom). Remember that the projective identity is the interface between one's real-world identities and the virtual identity (e.g., between the real me and the virtual Bead Bead). The projective identity is the space in which the learner can transcend the limitations both of the virtual identity and the learner's own real-world identity.

If learners in classrooms carry learning so far as to take on a projective identity, something magical happens. The learner comes to know that he or she has the *capacity*, at some level, to take on the virtual identity as a real-world identity. However much I might want to, I myself, in the real world, have no capacity to become the sort of female half-elf I wanted and built Bead Bead to be (though I can still adopt some of her persona). But learners in a good science classroom come to feel what it is like to have the capacity to actually be the sort of scientist (and person) they have wanted and built their "character" in the classroom to be.

Learners do not, of course, have to realize this capacity in actuality and become scientists. They don't even have to feel they could become particularly good scientists—after all, in the projective identity you also learn about your own limitations. Often it is enough that they have sensed new powers in themselves. They will, possibly for a lifetime, be able to empathize with, affiliate with, learn more about, and even critique science as a valued but vulnerable human enterprise.

This is why it is important for teachers to pick the semiotic domains they will teach—and the particular virtual identities and worlds they will create in their classrooms—carefully. If children are learning deeply, they will learn, through their projective identities, new values and new ways of being in the world based on the powerful juxtaposition of their real-world identities ("So, that's what I really feel, think, and value") and the virtual identity at stake in the learning ("So, these are the ways of feeling, thinking, and valuing open to a scientist"). This juxtaposition is the ground on which their projective work is done. ("So, I want, for this time and place, to have been *this* type of scientist and person and not *that* type.")

The discussion has suggested more learning principles that are built into good video games. In this section, I bring these together to continue the list started in chapter 2. After listing principles we have already discussed, I discuss a few others that are related to them:

6. **"Psychosocial Moratorium" Principle**
   Learners can take risks in a space where real-world consequences are lowered.
7. **Committed Learning Principle**
   Learners participate in an extended engagement (lots of effort and practice) as an extension of their real-world identities in relation to a virtual identity to which they feel some commitment and a virtual world that they find compelling.
8. **Identity Principle**
   Learning involves taking on and playing with identities in such a way that the learner has real choices (in developing the virtual identity) and ample opportunity to meditate on the relationship between new identities and old ones. There is a tripartite play of identities as learners relate, and reflect on, their multiple real-world identities, a virtual identity, and a projective identity.
9. **Self-Knowledge Principle**
   The virtual world is constructed in such a way that learners learn not only about the domain but about themselves and their current and potential capacities.
10. **Amplification of Input Principle**
    For a little input, learners get a lot of output.
11. **Achievement Principle**
    For learners of all levels of skill there are intrinsic rewards from the beginning, customized to each learner's level, effort, and growing mastery and signaling the learner's ongoing achievements.

Because good video games are built in such a way that they operate by these learning principles, several other principles also come into play. One thing that designers of video games realize, but that many schools seem not to, is that learning for human beings is in large part *a practice effect.* Humans need to practice what they are learning a good deal before they master it. Furthermore, they tend to lose a good deal of their learning—including school learning—when they cease to practice the skills associated with this learning in their daily lives. This is why it is easy to discover many adults who are no longer very good with school-based science, math, and literacy because they do not, in their work or home lives, practice these on a regular basis.

The fact that human learning is a practice effect can create a good deal of difficulty for learning in school. Children cannot learn in a deep way if they have no opportunities to practice what they are learning. They cannot learn deeply only by being told things outside the context of embodied actions. Yet at the same time, children must be motivated to engage in a good deal of practice if they are to master what is to be learned. However, if this practice is boring, they will resist it.

Good video games involve the player in a compelling world of action and interaction, a world to which the learner has made an identity commitment, in the sense of engaging in the sort of play with identities we have discussed. Thanks to this fact, the player practices a myriad of skills, over and over again, relevant to playing the game, often without realizing that he or she is engaging in such extended practice sessions. For example, the six-year-old we discussed in the last chapter had grouped and regrouped his Pikmin a thousand times. And I practiced, in the midst of battle, switching Bead Bead to a magic spell and away from her sword in a timely fashion a good many times. The player's sights are set on his or her aspirations and goals in the virtual world of the game, not on the level of practicing skills outside meaningful, goal-driven contexts.

Educators often bemoan the fact that video games are compelling and school is not. They say that children must learn to practice skills ("skill and drill") outside of meaningful contexts and outside their own

goals: It's too bad, but that's just the way school and, indeed, life *is*, they claim. Unfortunately, if human learning works best in a certain way, given the sorts of biological creatures we are, then it is not going to work well in another way just because educators, policymakers, and politicians want it to.

The fact is that there are some children who learn well in skill-and-drill contexts. However, in my experience, these children *do* find this sort of instruction meaningful and compelling, usually because they trust that it will lead them to accomplish their goals and have success later in life. In turn, they believe this thanks to their trust in various authority figures around them (family and teachers) who have told them this. Other children have no such trust. Nor do I.

In any case, I have already made my own position clear: Passive learning—rather than active, critical learning—will not lead to much power and empowerment in the contemporary world, however much it may suit one for a low-level service job. Mastering literacy or math as a set of routinized procedures without being able to use these procedures proactively within activities that one understands and for the accomplishment of one's own goals will not lead to learners who can learn quickly and well as they face new semiotic domains throughout their lives.

The achievement principle above (principle 11) tells us that good video games reward all players who put in effort, but reward players at different skill levels differently. But there is more to this matter: Good video games give players better and deeper rewards as they continue to learn new things as they play (or replay) the game. This means that, in a good video game, the distinction between learner and master is vague (at whatever level of mastery one thinks one has arrived). If players have just routinized their behaviors (i.e., if they operate on "automatic pilot" and keep reacting to problems in the same now well-practiced way), a level of the game will be reached at which the game will realize this and disreward these behaviors. This fact forces players to think about the routinized mastery they have achieved and to undo this routinization to achieve a new and higher level of skill. This higher level of skill will itself, thanks to the large amount of practice that video games allow, become routinized (automatic) as the player perfects it, only to be undone later in the game, or in the same game played a second time at a higher level of difficulty, or in a new game.

Several educators have argued that this cycle of automatization of skills through practice, rethinking this automatization when faced with new conditions in order to learn new skills and transform old ones, and then perfecting these new skills through further practice that once again leads to automatization is the very foundation of intelligent practice in the world. Automatization is good and necessary if one is to engage in fluent and masterful practice. However, it gets in the way of new learning if it does not change and adapt in the face of novel conditions and new opportunities to learn, which requires the learner to bring back to conscious awareness skills that have become unconscious and taken for granted and to think anew about these skills and how they relate to specific sorts of problems. A cycle of automatization, adaptation, new learning, and new automatization is a sine qua non of learning for those who want to survive as active thinkers in a fast-changing world that requires the mastery of ever newer semiotic domains. Video games are quite adept at creating and sustaining this cycle.

Finally, all the design features discussed so far work to ensure that a good video game operates within the learner's "regime of competence." By this I mean that the game often operates within, but at the outer edge of, the learner's resources, so that at many points the game is felt as challenging but not "undoable." If learning always operates well within the learner's resources, then all that happens is that the learner's behaviors get more and more routinized, as the learner continues to experience success by doing the same things. This is good, as we have seen, for learning and practicing fluent and masterful performance (which is, indeed, necessary), but it is not good for developing newer and higher skills. However, if learning operates outside one's resources, the learner is simply frustrated and gives up.

While good video games offer players ample opportunity to practice and even automatize their skills at various levels, they also always build in many opportunities for learners to operate at the outer edge of their

regime of competence, thereby causing them to rethink their routinized mastery and move, within the game and within themselves, to a new level. Indeed, for many learners it is these times, when they are operating at the edge of their regime of competence, when learning is most exciting and rewarding. Sadly in school, many so-called advantaged learners rarely get to operate at the edge of their regime of competence as they coast along in a curriculum that makes few real demands on them. At the same time, less advantaged learners are repeatedly asked to operate outside their regime of competence.

Additional learning principles follow. These are principles found in good video games, but ones that are also hallmarks of deep (active and critical) learning beyond video games, as well.

12. **Practice Principle**
    Learners get lots and lots of practice in a context where the practice is not boring (i.e., in a virtual world that is compelling to learners on their own terms and where the learners experience ongoing success). They spend lots of time on task.
13. **Ongoing Learning Principle**
    The distinction between learner and master is vague, since learners, thanks to the operation of the "regime of competence" principle listed next, must, at higher and higher levels, undo their routinized mastery to adapt to new or changed conditions. There are cycles of new learning, automatization, undoing automatization, and new, reorganized automatization.
14. **"Regime of Competence" Principle**
    The learner gets ample opportunity to operate within, but at the outer edge of, his or her resources, so that at those points things are felt as challenging but not "undoable."

BIBLIOGRAPHICAL NOTE

There is a massive amount of work on socially situated identities and how they are changing in the modern world. For work compatible with my approach in this chapter, see Alvermann, Moon, and Hagood 1999; Bauman 2000; Beck, Giddens, and Lash 1994; Castells 1996; Foucault 1980; Gee, Hull, and Lankshear 1996; Giddens 1991, 1992; Hacking 1995, 1998; Martin 1995; Mishler 2000; Rifkin 2000; Sternberg and Grigorenko 1999; Taylor 1989, 1992, 1994. For an early but brilliant work on socially situated identities, specially relevant to science, see Fleck 1979, originally 1935.

For a discussion of the advantages of many middle- and upper-middle-class students in our schools and the disadvantages of many minority and lower socioeconomic students, see Finn 1999; Gee 2004, 2007a; Heath 1983; Miller 1995; Varenne and McDermott 1998.

For Erikson's notion of a psychosocial moratorium, see Erikson 1968. Several of the learning principles in this chapter relate closely to principles developed in current accounts of efficacious learning in cognitive science; see, for example, Bransford, Brown, and Cocking 1999; Pellegrino, Chudowsky, and Glaser 2001; Sawyer 2006. Several of the principles fit very well with Bereiter and Scardamelia's 1989 important discussion of learning and expertise. The importance of gaining and undoing automatization, and its connection to the ongoing learning principle, is well discussed in Bereiter and Scardamelia's book. The practice principle is discussed in sociocultural terms in Scribner and Cole's famous 1981 study. The regime of competence is discussed in diSessa 2000 and is related to Vygotsky's well-known notion of the zone of proximal development; see Vygotsky 1978. DiSessa 2000 also discusses amplification of input and contains an extended and important discussion of committed learning.