3

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

ARCANUM: LEARNING AND IDENTITY

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

For example, a child in a science classroom engaged in real inquiry, and not passive learning, must be willing to take on an identity as a certain type of scientific thinker, problem solver, and doer. The child must see and make connections between this new identity and other identities he or she has already formed. Certainly the child will be at a disadvantage if he or she has 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., his or her 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, an example that illuminates how active and critical learning works in any semiotic domain, including in school. 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 sorts of 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*.

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, then, 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 7, 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 treat 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 follow and help you.

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 sub-quests that are part of the main quest. 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 would 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 are aspects of the relationship: "A real person (here James Paul Gee) as a virtual character (here Bead Bead)." They operate all 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)." 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, 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 mediate on what it feels like—in my role as Bead Bead—to be unable 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 game for the Xbox)—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 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 (or, 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 with playing with identities. However, all deep learning—that is, active, critical learning—is inextricably caught up with identity in a variety of different 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-based literacy requires—that is, as the "kind of person" who learns, values, and uses such 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 personally committed engagement that active, critical learning requires. In fact, they resist learning in school in the name of another identity that they see such learning as putting 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 his or her 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 this 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 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 Ameri-

can, a Pokemon 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 intimated by anything that is a race against time, and so, thus far, I have been a failure at playing real-time strategy games well and with enjoyment. Some repair work needs to be done.

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 be-
   gins 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 reward-
ing; 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 cer-
tainly 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 the 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 bridge to the sorts
of virtual worlds and identities 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 do-
main 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 psychol-
ogist 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, 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 turn 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 class-room). 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 magic happens—a magic that cannot take place in quite the same way when playing a video game. 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 do, 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 be the sort of scientist (and person) they have wanted and built their "charac-ter" 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 particu-larly 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, affil-iate with, learn more about, and even critique science as a valued but vulner-able 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 has been done. ("So, I want, for this time and place, to have been *this* type of scientist and person and not *that* type.")

WHAT VIDEO GAMES HAVE TO TEACH US ABOUT LEARNING AND LITERACY

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