

From *Digital Game-Based Learning* (McGraw-Hill, 2001)*by Marc Prensky**Chapter 5*

Fun, Play and Games: What Makes Games Engaging

Children are into the games body and soul.

-C. Everett Koop, former Surgeon General

When I watch children playing video games at home or in the arcades, I am impressed with the energy and enthusiasm they devote to the task. ... Why can't we get the same devotion to school lessons as people naturally apply to the things that interest them?

-Donald Norman, CEO, Unext

You go for it. All the stops are out. Caution is to the wind and you're battling with everything you have. That's the real fun of the game.

-Dan Dierdorf

Computer and videogames are potentially the most engaging pastime in the history of mankind. This is due, in my view, to a combination of twelve elements:

1. Games are a form of **fun**. That gives us *enjoyment and pleasure*.
2. Games are form of **play**. That gives us *intense and passionate involvement*.
3. Games have **rules**. That gives us *structure*.
4. Games have **goals**. That gives us *motivation*.
5. Games are **interactive**. That gives us *doing*.
6. Games are **adaptive**. That gives us *flow*.
7. Games have **outcomes and feedback**. That gives us *learning*.
8. Games have **win states**. That gives us *ego gratification*.
9. Games have **conflict/competition/challenge/opposition**. That gives us *adrenaline*.
10. Games have **problem solving**. That sparks our *creativity*.
11. Games have **interaction**. That gives us *social groups*.
12. Games have **representation and story**. That gives us *emotion*.

Nothing else provides all of these. Books and movies, which perhaps come closest, have many of these characteristics, but they are not interactive, and are typically experienced alone. Games, at their best, are highly social, highly interactive experiences.

In this chapter I will look at each of these elements to see how it contributes to the unbelievable engagement of the best games. Of course not all games have all of these elements and not all games are great. But when they do and are, watch out!

1. Fun : the great motivator

People rarely succeed unless they have fun in what they are doing.
-Dale Carnegie

What *is* fun, anyway?

Microsoft's Encarta World English Dictionary (2000) defines "fun" as

1. **amusement:** a time or feeling of enjoyment or amusement *Just for fun, we wore silly hats.*
2. **something amusing:** something such as an activity that provides enjoyment or amusement *Skiing is fun for the whole family.*
3. **mockery:** playful joking, often at the expense of another *What's said in fun can still hurt.*

It goes on to define a separate phrase, "fun and games"

1. activity, difficulty, or trouble (*informal*) (*used ironically*) *A broken sprinkler in the stockroom overnight gave us some fun and games in the morning.*
 2. carefree amusement (*informal*)
- make fun of somebody or something** to make somebody or something appear ridiculous
- poke fun at somebody or something** to mock or ridicule somebody or something

The venerable OED (Oxford English Dictionary) defines fun as:

1. A cheat or trick; a hoax, a practical joke
2. a. Diversion amusement, sport; also boisterous jocularly or gaily, drollery. Also, a source or cause of amusement or pleasure.
 - b. *to make fun of, poke fun at* (a person, etc): to ridicule. *For or in fun:* as a joke, sportatively, not seriously. *(he, it is) good, great fun:* a source of much amusement. *Like fun:* energetically, very quickly, vigorously. *What fun!:* how very amusing 1 *for the fun of the thing:* for amusement; to have fun with: to enjoy (a process); spec. to have sexual intercourse.

c. Exciting goings on. Also *fun and games*, freq. Used ironically; spec. amatory play. Colloq.

Right away there is a major duality: On the one hand fun is amusement, but on the other hand it is ridicule, or a cheat or trick, or even sexual. Of course no executive wants his or her training to be “ridiculous” “sexual” or even just “amusing.”

But there is yet a further division, one that is far more relevant and important. Note carefully that the above definitions tend to lump “enjoyment” and “amusement” into the same category. This, I am sure, is wrong, at least in terms of the modern use of the word “fun”, and is what leads us to confusion and conflict.

For while *amusement* may, in fact, be frivolous, *enjoyment* and *pleasure* are certainly not. We enjoy and take pleasure from many of the most serious things in life – our families, our passions, our work. The enjoyment, pleasure or “fun”, we derive from these activities is the principle source of what makes us return to do them again and again — and there is increased “fun” from the fact that the more we do them the better we get, the easier they become, and the more goals we can achieve.

Fun in this positive sense is not passive, and can include real exertion, as in sports or other competitions. In fact the learning crowd at the MIT Media Lab are fond of calling their type of learning “hard fun.”

So the real issue is that the same simple word “fun” can connote both enjoyment and pleasure (good), *and* amusement and/or ridicule (bad). This dichotomy, which we will see over and over again, lies at the root of resistance by business people and educators to new learning approaches based on any connection to fun (and, by extension, to play and games). In some respects it’s only a matter of semantics, but with important consequences. Proponents of “fun learning” relate fun to enjoyment and pleasure. Opponents relate fun to amusement and ridicule. They use the same word but don’t speak the same language.

You might think this would be obvious enough not to belabor the point, but when a business executive or CEO purchasing training says, as they often do, “I don’t *want* my training to be fun!” it is important to understand that he or she is (hopefully) telling us only that they don’t want it to be frivolous, not that we should take the enjoyment out.

Some, like game designer Noah Falstein go even farther, associating fun with survival “It is my belief,” he says, “the main purpose of ‘fun activities’ is to practice useful survival skills.”¹

However, there is another factor. Many people relate training and learning not to fun — in any sense — but rather to its opposite, pain. This is well expressed by Benjamin Franklin’s aphorism: “The things which hurt, instruct.” Thiagi (aka Sivasailam Thiagarajan), the great proponent of game-based learning in companies, says “I think

people *want* learning to be painful. If you look universally at every language, every culture has the equivalent of “no pain, no gain” as a proverb. I think it’s partly due to the survival need of human beings that usually suffering results in learning. Unfortunately, human beings took the *converse* of that also to be true, that is to say if you don’t suffer you’re not going to learn.”² In this view, learning *can’t* be fun in the same way that pain is not fun.

Of course there is no theoretical or practical reason why this converse — that learning must be painful to be effective — should be true. In fact it is patently *not* true. People, starting as babies, learn all the time without suffering. Sure it hurts to touch a hot stove and get the painful lesson not to do it again, but does it hurt to say “dada” and get a huge smile, hug and kiss as a reward? So while we do learn from pain, learning doesn’t *have* to be painful. These ideas are learning shackles that certainly have no relevance for today’s learners, and that we, as trainers and educators should all throw away.

To make matters worse, there is a strong religious tradition involved here as well. Remember the story of Adam and Eve? How happy they were before they ate the fruit of *which* tree? In this extreme biblical view, the cause of man’s suffering is knowledge. *All* learning is painful, knowledge is sin, and learning is merely a form of suffering. It is worth remembering that for literally thousands of years the church controlled schools and learning. Many of its precepts live on in the minds of educators. While religious thought has many positive things to offer us, the link between knowledge and evil, fun and sin is not one of them. It is certainly time to throw these learning shackles away as well.

An additional concept with religious overtones that may inhibit a positive relationship between fun and learning is what some have referred to as the “Madonna/whore” complex, whereby people do not want to mix the “pure” with the “unholy.” J.C. Herz in *Joystick Nation* cites this as a reason why the computer and the television are unlikely ever to merge — the computer is “serious” and the TV “a plaything,” “whose first duty is to amuse us.”³ Anyone who sees “learning” as serious, and “fun” as frivolous or sinful is experiencing this quasi-religious double standard.

An interesting fact about fun is that, that at least as far as Johan Huizenga could see in his major work *Homo Ludens*, there is not an exact equivalent of the word fun in any language besides English.⁴ Maybe we do have something special going on.

As I said earlier, people at the MIT Media Lab are fond of using the term “hard fun.” In his landmark book *Being Digital*, Nicolas Negroponte, director of the Media Lab, explains how the term originated. In 1989, at a big Media Lab news conference in which kids demonstrated their LEGO/Logo work, one eight-year-old was asked by a reporter whether it was “not just all fun and games.” (*See?*) He replied “Yes, this is fun, but it’s *hard fun*.”⁵

Fun and Learning

*People with the notion that learning cannot and should not be fun
are clearly in an archaic mode.*

-Mark Bieler, former head of HR, Bankers Trust Company

So what *is* the relationship between fun and learning? Does having fun help or hurt? Let us look at what some researchers have to say on the subject:

“Enjoyment and fun as part of the learning process are important when learning new tools since the learner is relaxed and motivated and therefore more willing to learn.”⁶

"The role that fun plays with regard to intrinsic motivation in education is twofold. First, intrinsic motivation promotes the desire for recurrence of the experience... Secondly, fun can motivate learners to engage themselves in activities with which they have little or no previous experience."⁷

"In simple terms a brain enjoying itself is functioning more efficiently."⁸

"When we enjoy learning, we learn better"⁹

Fun has also been shown by Datillo & Kleiber, 1993; Hastie, 1994; Middleton, Littlefield & Lehrer, 1992, to increase motivation for learners.¹⁰

It appears then that the principal roles of fun in the learning process are to create *relaxation* and *motivation*. Relaxation enables a learner to take things in more easily, and motivation enables them to put forth effort without resentment.

Next on our journey to understanding the power of games, let us consider *play*.

2. Play: The universal teacher

Play is our brain's favorite way of learning things.

-Diane Ackerman, *Deep Play*

While fun, despite its dualistic nature, is a relatively simple idea — a state of being — play is a much more complex phenomenon. There is relatively little written on fun, but the phenomenon of play has been studied and written about extensively. There are a number of classic books on play, including Johan Huizinga's *Homo Ludens*,¹¹ and Roger Callois' *L'Homme et les jeux* (translated as *Man, Play and Games*)¹², both of which relate play to anthropological and sociological concerns.

So what *is* play?

The OED, which allots “fun” less than a page, devotes over 10 of its tiny-print pages to defining play, with 39 numbered definitions, each with many subcategories. With such a wide variety of meanings, ranging from sword fighting to staged representation to an activity of children to sexual intercourse, it is no wonder there is sometimes controversy and misunderstanding over the meaning and value of play.

In the case of play, though, the dictionary is less useful to us, since what we are concerned about here is not *all* the many ways the word is used, but a particular activity that we all pretty much recognize. So let us turn instead to the theorists.

Johan Huizenga, in his book *Homo Ludens*, characterizes play as a free activity standing quite consciously outside of “ordinary” life as being “not serious.” Play, he says, absorbs the player “intensely and utterly.” It has fixed rules and order, does not have any material interest or profit, and, encourages the formation of social groupings.¹³ Roger Callois, in *Man, Play and Games*, defines play as an activity which is not obligatory, has its own space and time, is uncertain in its outcomes, creates no material wealth, is governed by rules, and has elements of make-believe and unreality.¹⁴

Out of these definitions of play a couple of factors merit emphasis in our context.

- Play is something one *chooses* to do.
- Play is *intensely and utterly absorbing*.
- Play *promotes the formation of social groupings*.

Play and Learning

Play is the original way of learning things.

-Danny Hillis

Some people assume that because children do it play is therefore trivial and unimportant. In fact, in the view of many scientists, quite the opposite is true. Play has a deep biological, evolutionarily important, function, which has to do specifically with learning. It is “one of the cultural universals, something every single culture does.” says Danny Hillis, founder of Thinking Machines and a former Disney Fellow. “Of course this has to do with learning.”¹⁵ “Play is our brain’s favorite way of learning things,” writes Diane Ackerman in her book *Deep Play*.¹⁶ “Children are expected to play because we recognize (perhaps unconsciously) the fundamental utility of games as an educational tool,” adds Chris Crawford, noted game designer.¹⁷ And Robert Fagan, a child psychologist, defines play as “optimal generic learning by experimentation in a relaxed field.”¹⁸

Proponents of play as enhancing *children’s* learning have much evidence to cite. Many point to young animals such as bear or lion cubs learning to fight and hunt by nipping at each other, and by sneaking up and pouncing on butterflies. Alison Gopnick, author of *The Scientist in the Crib*, cites the extended human childhood, longer than any other

animal's, when the child's needs are taken care of so they can be free to play, explore and learn.¹⁹ Other evidence includes children's fascination with many forms of learning play, including the alphabet song and counting rhymes. Children's TV shows such as *Sesame Street* and *Blues Clues* have created strong evidence of the value of combining learning and play. Research into children's learning by MIT's Media Lab (see below) and its many offshoots, such as Edit Harel's company MaMaMedia, supports this view as well.

Play and Work

Great adults are driven to [play] too.

-Danny Hillis

But what about adults – the workers we are supposed to train? Do adults play? Is there any value in it for them? And what is play's relationship to “work”?

Of course adults play – they play with their children, they play games, they play in many of the senses of the above definitions. But unlike children, adults also have a “serious,” “work,” or “real life” side that is often construed to be in conflict with, or even the opposite from, play. The definitions cited above define play as “outside of ordinary life,” not serious,” and “unproductive.” Some authors attribute this work/play distinction to industrialization or to social-class distinctions. We speak of executives who “work hard and play hard.” But are play and work really that separate?

Certainly not for the most creative adults, including musicians, actors and scientists. Musicians “play” for a living — it's the fun part of what they do. Actors, too, play for a living. (It is interesting to observe that musicians and actors “practice” first, and then “play” as the end product. Doctors and lawyers on the other hand, study first, and their end product is called “practicing.”

Many scientists think of much of their work as play, often linking the idea of play with high creativity. “I've been really lucky” says Danny Hillis, “that I've had a chance to work with...people like Marvin Minsky, Claude Shannon, Jonas Salk, Richard Feynman. The thing that all those people have in common is that even as adults they have an extreme sense of play.”²⁰ Alan Kay, the well-known pioneer of and visionary of Xerox PARC, Apple, and now Disney, recalls “hours of play” at Xerox. “Play did not interrupt work,” he says, it just provided another venue for thinking. People often have more brainstorming on the jogging path than at their desks.”²¹ And Einstein, of course wiser than all, is reputed to have commented: “If A is a success in life, A equals x plus y plus z. X is work, y is play, and z is keeping your mouth shut.”²²

According to Professors William H. Starbuck and Jane Webster, “Work and play have always been overlapping categories.”²³ Many people become very involved with and derive great pleasure from “work” activities, and “play” activities may create results of

lasting value. One modern concept they use to unite the two is the notion of “playful work,” work that is both productive *and* pleasant and involving.

In business, work and play mix regularly, starting at the highest executive levels. Deals get done on the golf course. Business have been bought and sold on bets. At Harvard Business School my fellow students played daily games of “who gets called on bingo” and would shoot the person talking with water guns while the teacher is looking the other way during the classes. They would, I have no doubt, do so as eagerly again 20 years later, many as multimillionaires. Many of the most successful adults, in business or in the professions, will tell you that they think of their work as “playing,” and that that is a big factor in their success.

Michael Schrage, in his book *Serious Play*, describes how many businesses are using a form of play to create “models” that are extremely useful in helping businesses prepare for the future.²⁴ War gaming is another form of play that has been used successfully in business, and executives often get into this form of “play” quite completely. In one instance, for particular a business war game the president ordered all his top lieutenants to dress in camouflage gear and created an olive drab painted war room complete with camouflage contact paper on the computers.²⁵

That play can be a valuable part of the learning and training process is not, of course, a new revelation. The best trainers and teachers have *always* tried and succeeded in making learning fun and playful. This is probably, in fact, a big part of *why* we think of them as the best teachers.

Yet one thing that often happens in companies is that as you go lower and lower into the depths of an organization, seriousness of purpose somehow gets translated into seriousness of demeanor. Playfulness gets excluded, and this is often reflected in training. Outside observers of business can often see what the insiders can’t or won’t. Nicholas Negroponte, head of the MIT Media Lab is quoted in *Inside Technology Training* magazine as saying “Sometimes I want to tell people who are in the training business to lighten up, that your customer will appropriate the knowledge much more quickly if playing is at the root of what you are doing.”²⁶

Negroponte should know. The renowned Media Lab he directs at MIT has created a whole research division, funded by Sony, Lego, Nintendo and other major corporations, to investigate play and learning. With the decidedly non-playful name of The “Epistemology and Learning Group” — epistemology is the branch of philosophy that investigates the origin, nature, methods and limits of human knowing — the group is led by two well-known researchers in the field of learning and play, Seymour Papert and Mitchel Resnick, who have brought us terms like “hard fun,” and “lifelong kindergarten.” The group mixes learning, play and work, through what they call “constructivist” learning, largely derived from the work of Piaget. Kids learn to create their own knowledge by playing, experimenting and constructing with certain kinds of physical objects, such as Lego blocks and necklace beads with built in computer chips. While the group’s research focuses exclusively on children’s learning, many of their play-oriented

“constructivist” ideas are being extended to adults through computer games such as *Roller Coaster Tycoon*. It is worth noting that the children they began working with in the 1980s are fast becoming today’s corporate workers.

Just adding the labels “work” and “play” to something can affect our whole attitude, Thiagi reports in his fun newsletter *The Thiagi Games Letter*. In a word association survey he conducted, he found that the words most typically associated with work are pressure, boredom, deadlines, chores, office, salary, drudgery, nine-to-five, overtime and goals. The words strongly associated with play are fun, enjoyment, game, laughter, choice, spontaneous, relaxation. People enjoy difficult tasks more when presented as play rather than work, and their minds wander less.²⁷ What you think is what you get.

Current research in the areas of stress, anxiety, creativity, self-efficacy and neuroscience shows that more play will *improve* our learning and performance.²⁸ While “more work and less play” has been touted for a long time as the way to improve human performance — finish your work before you play— there is much evidence that the such thinking is wrong. When you are enjoying yourself and laughing, changes in the chemical balance of your blood boosts the production of neurotransmitters needed for alertness and memory.²⁹ When you feel threatened, tired and helpless you lose your ability to recall information, notice things around you ask questions and think creatively.³⁰

An academic study of play at work comes from William H. Starbuck and Jane Webster in an important paper entitled “When is Play Productive?”³ After reviewing the definitions in a number of other studies of play they boil play down to two common elements: “playful activities **elicit involvement and give pleasure.**” They then seek to discover the consequences of play at work. Starbuck and Webster found the following things, among others:

- People play at work to seek competence, stimulation, challenge, or reinforcement.
- People who perform very playful tasks enjoy what they are doing. When they judge those activities appropriate, they switch to them readily and try to continue doing them.
- They tend to concentrate more and increase their persistence.
- They become less aware of the passage of time and reluctant to change activities.
- They become so absorbed that they may neglect other things, such as long-term goals, non-playful tasks and social relations.
- Their learning is enhanced because the pleasure and involvement of playful activities induces them to expend time and effort.
- Through different forms of play they can either broaden their behavioral repertoires incrementally, discover or invent radically new behaviors, and polish their existing skills through repetitive practice.
- Playful tasks foster creativity. If the playful tasks are new ones, they will put much effort into learning them and exploring them, usually trying to control their own learning.

So the same attraction that children have to play carries on into the world of work, where people prefer and are drawn to playful tasks. In fact, as we already observed in Chapter 2, the distinction between work and play is quickly becoming moot. The Games Generation *expect* their work to also be fun and playful. In Tapscott's words, "Fun, work and play are all the same to them."³² Many high-tech startups are changing their environments to make them more playful. At i-belong, a company on Route 128 outside of Boston, there is an indoor miniature golf course. At excite @home there are winding slides to get from one level to the next (unfortunately, down only.)³³ Interestingly, while this may be news at the dot-coms, or when corporations do it, the games companies have been doing it for decades. Play has always been a big part of their environment — after all, it's what they do. The change with the growing up of the Games Generations kids is that that environment has now moved outside of the games companies and into more mainstream business.

Again, this is to a large extent the result of changing technology. Starbuck and Webster attribute much of the erosion of the distinction between play and work to the introduction of PCs into the workplace, since they are "simultaneously fun to use and serious tools."³⁴

And while some still object that play in the workplace is just escapism designed to displace or avoid work, more and more managers are realizing that making work playful reduces stress, and actually increases productivity.

3. Games : Adding the Structure

One of the most difficult tasks men can perform...is the invention of good games.
-Carl Jung

So fun — in the sense of enjoyment and pleasure — puts us in a relaxed, receptive frame of mind for learning. Play, in addition to providing pleasure, increases our involvement, which also helps us learn.

Both "fun" and "play" however, have the disadvantage of being somewhat abstract, unstructured, and hard-to-define concepts. But there exists a more formal and structured way to harness (and unleash) all the power of fun and play in the learning process — the powerful institution of *games*. Before we look specifically at how we can combine games with learning, let us examine games themselves in some detail.

Like fun and play, *game* is a word of many meanings and implications. How can we define a game? Is there any useful distinction between fun, play and games? What makes games engaging? How do we design them?

Games are a subset of both play and fun. In programming jargon they are a "child", inheriting all the characteristics of the "parents." They therefore carry both the good and

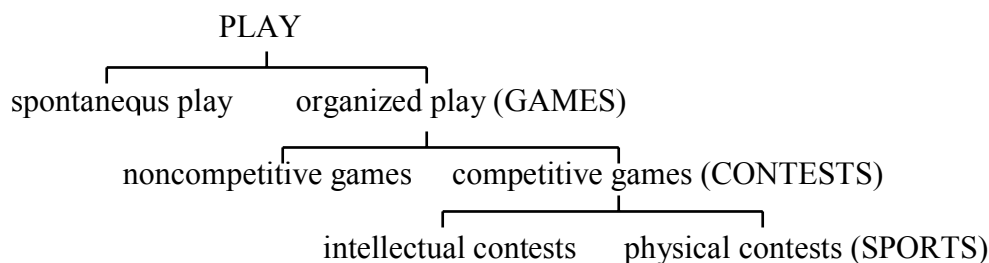
the bad of both terms. Games, as we will see, also have some special qualities, which make them particularly appropriate and well suited for learning.

So what is a game?

Like play, game, has a wide variety of meanings, some positive, some negative. On the negative side there is mocking and jesting, illegal and shady activity such as a con game, as well as the “fun and games” that we saw earlier. As noted, these can be sources of resistance to Digital Game-Based Learning — “we are not playing games here.” But much of that is semantic. What we are interested in here are the meanings that revolve around the definition of games involving rules, contest, rivalry and struggle.

What Makes a Game a Game? Six Structural Factors

The Encyclopedia Britannica provides the following diagram of the relation between play and games: ³⁵



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Our goal here is to understand why games *engage* us, drawing us in often in spite of ourselves. This powerful force stems first from the fact that they are a form of fun and play, and second from what I call the six key structural elements of games:

- 1. Rules**
- 2. Goals and Objectives**
- 3. Outcomes & Feedback**
- 4. Conflict/Competition/Challenge/Opposition**
- 5. Interaction, and**
- 6. Representation or Story.**

There are thousands, perhaps millions of different games, but all contain most, if not all, these powerful factors. Those that don't contain all the factors are still classified as games by many, but can also belong to other subclasses described below. In addition to these structural factors, there are also important design elements that add to engagement and distinguish a really good game from a poor or mediocre one.

Let us discuss these six factors in detail and show how and why they lead to such strong engagement.

Rules are what differentiate games from other kinds of play. Probably the most basic definition of a game is that it is *organized play*, that is to say rule-based. If you don't have rules you have free play, not a game. Why are rules so important to games? Rules impose limits – they force us to take specific paths to reach goals and ensure that all players take the same paths. They put us inside the game world, by letting us know what is in and out of bounds. What spoils a game is not so much the cheater, who accepts the rules but doesn't play by them (we can deal with him or her) but the nihilist, who denies them altogether. Rules make things both fair and exciting. When the Australians “bent” the rules of the America's Cup and built a huge boat in 1988, and the Americans found a way to compete with a catamaran, it was still a race — but no longer the same game.

While even small children understand some game rules (“that's not fair”), rules become increasingly more important as we grow older. The rules set the limits of what is OK and not OK, fair and not fair, in the game. By elementary school, kids know to cry “cheater” if the rules are broken. *Monopoly* and even *Trivial Pursuit* have pages of written rule sets, and by adulthood we are consulting Hoyle, hiring professional referees to enforce rules, and even holding national debates — the designated hitter, the 2 point conversion, the instant replay — over whether to change them.

In card games, board games and other non-computer games the rules are written down and generally managed by the players, in extreme cases using an “impartial” third party (e.g. a “ref”). In computer games the rules are built right into the game. It is interesting that in business one often hears talk about “changing the rules of the game” as a way of beating the competition. This has particular implication for certain games used in business, such as simulation, which may have the rules built in.

Some computer game designers, Noah Falstein points out, speak of “metagaming,” which is not just playing by the rules, but manipulating the rules and circumstances surrounding the game to your advantage. Children arguing about the specific rules of a game before they start is a kind of metagaming. Often the metagaming itself is a more satisfying way to play, and the game itself is an anticlimax. Richard Garfield, the creator of the fabulously successful *Magic: The Gathering* card game designed it with metagaming in mind, and in fact a large part of its success can be attributed to the card trading, selling, listing, and tournaments that are associated with the game itself.³⁶

Goals or Objectives also differentiate games from other types of play, as well as from other non-goal-oriented games. In some designers' eyes, if your game doesn't have a goal but is rather something that can be just played with in many ways depending on your whim, you have what they refer to as a “toy.” “Toy” in this sense is a technical term, because they use it to refer to things as complex as *Sim City* and *the Sims*, or even an airline simulator. These “goal-less simulations”, however, are generally known as games, at least by the people who market and play them. In speaking to this, Will

Wright, the designer of *Sim City* says “I’m not sure there’s a real firm distinction. I think of our models as something you can either just play with, purely kind of Zen-like, un-goal-directed or in fact you can pick a goal and turn it into a game at any time.”³⁷

In a game, achieving your goals is a big piece of what motivates you. “They are,” says Wright, “what you measure yourself against.” The goal is often stated right at the beginning of the rules: Your goal is to get the highest score, to get to the end, to beat the big boss, to capture the flag, to get the best hand, etc. Goals and objectives are important because we are goal-oriented as a species. Unlike most animals, we are capable of conceiving of a future state and of devising strategies for achieving it, and most of us enjoy the process. The rules, of course, make this harder, by limiting the strategies at our disposal. Goals push us to achieve and to win.

Outcomes and Feedback are how you measure your progress against the goals. The classic games are ones you either win or lose. “Games seem to want to have a win-lose state or at least a goal state that you can measure yourself against, says Wright. Obviously winning and losing has strong *emotional* and *ego-gratification* implications, which is a big part of the attraction of games.

Feedback comes when something in the game changes in response to what you do — it is what we mean when we say computers and computer games are *interactive*. Feedback lets us know immediately whether what we have done is positive or negative for us in the game, whether we are staying within or breaking the rules (“Tilt”), moving closer to the goal or further away (“Hot or Cold”) and how we are doing versus the competition (high score tables). Feedback can take a variety of forms, from an outside referee, to the other players, to the computer, but its main characteristic is that in almost all games it is *immediate*. I do something; I get a result. (This does not preclude a number of actions combining to produce longer-range feedback, such as an outcome, as well).

Feedback can come in the form of a numerical score, but it can also come in many other forms as well. Feedback can come graphically, like the size and condition of your cities in *Sim City* or *Age of Empires* or seeing yourself ahead in a racing game. It can also come orally, as from characters in the game who talk to you, or the wisecracking announcer in “*You Don’t Know Jack*,” In computer games it is increasingly coming to us through other senses as well, such as the tactile rumble felt in “force feedback” joysticks or other controllers when you are (figuratively or literally) on bumpy ground.

It is from the feedback in a game that *learning* takes place. Even games that are purely commercial and not at all what I call “Digital Game-Based Learning,” there is a great deal of continuous learning going on. The player is learning constantly how the game works, what the designer’s underlying model is, how to succeed, and how to get to the next level and win. Via the feedback you either get rewarded for mastering something, or you get word you have failed at something, and have to try again or seek help, until you can do it. Depending on the game, feedback can be spectacularly dramatic (crash landings, whole galaxies blowing up, or the “dead patients and big booms,” that Sharon Stansfield creates³⁸) or amusing (the Sailor in *Monkey Island* who says *No!*) or more

subtle (the music in *The Sims*) but its goal is always to enhance your experience and move you along in the game.

The art of providing feedback in a game is extremely important and complex because either too little or too much can lead quickly to frustration for the player. This leads to another important characteristic of computer games, in particular — they are *adaptive*. This means that the level of difficulty goes up or down automatically depending on what you do. This is the way computer games keep players in the “flow state.”

These first three categories — at their simplest: rules, a goal, and winning or losing — are the classic “well-accepted, thousands-of-year-old definition of a game,” according to J.C. Herz, author of *Joystick Nation*.³⁹ There are also three additional elements that are usually thought of as part of the structure of a game — or at least a computer game — by many game designers. These are conflict, interaction and representation.

Conflict/competition/challenge/opposition are the problems in a game you are trying to solve. “A computer game is nothing but a problem that we’re selling,” says Will Wright. “And basically your solving that problem is playing the game.”⁴⁰ The conflict or challenge that produced the problem to solve does not necessarily have to be against another opponent, real or AI (artificial intelligence). It can be a puzzle to solve, or anything that stands in the way of your progress (How *do* I get this Sim married off?) Conflict/competition/challenge or opposition is what gets your adrenaline and creative juices flowing, and makes you excited about playing the game. While not everyone likes head-to-head competition and some shy from conflict, most of us enjoy a challenge, particularly if we get to choose it and set its difficulty. Keeping the level of conflict/competition/challenge or opposition in synch with the player’s skills and progress is called “balancing” the game, and as we shall see is a key skill in game design.

Some argue that competition is part of our basic nature as human beings. Whether or not this is true, as game designer Eric Goldberg notes: “the people who naturally gravitate to games tend to be competitive.”⁴¹ So can there be games that are non-competitive, or even cooperative? Sure. But pretty much all games involve some kind of conflict, challenge or problem to solve, even if it is done through cooperation and teamwork. One of my favorite “cooperative” games was done on a kids’ Web site where each of four simultaneous players could control only one of the four directions (left, right, up, down) that the spaceship could move. Getting that ship to go anywhere in a reasonably direct manner was *definitely* a challenge!

An often-cited game quality is that games are safe and non-threatening because they are “only games.” Game players are thus in some sense “protected” from the dangers of the real world. While this is certainly true physically, it does not necessarily apply to players’ *emotions* while playing the game, which are very real indeed.

Interaction has two important aspects: The first is the interaction of the player and the computer, which we have discussed under feedback. The second, though, is the inherently *social* aspect of games — you do them with other people. As we saw earlier, play promotes the formation of social groupings. While you can play alone, it is much more fun to play with others. This is why in pre-computer games the category of “solitaire games”, although not insignificant, is tiny compared to games that are played with others. Despite the industry’s initial (pre-networking) focus on single player games or games against the machine (an era in which we are still involved), the tendency of *all* computer games today is to become multi-player. And while game designers do attempt, through better and better AI, to put more and more of the creator’s “mind” into computer-based opponents or collaborators in games, we are still very far from being able to create anything with the true wiles of the real human mind. Critics who see computer gaming as an isolating activity, should be aware of this. Like the Net, computer games are actually bringing people into closer social interaction — although not necessarily face-to-face.

Representation means the game is *about* something. This can be abstract or concrete, direct or indirect. Chess is about conflict. Tetris is about building and recognizing patterns. *The Age of Empires* is about the history of the art of war. Representation includes any narrative or story elements in the game. There is somewhat of a difference of opinion here among various computer game theorists. Some think representation is at the essence of what makes a game, while some think it is just the “candy” around the game. One thing that *is* happening, though, is that consumer games are becoming much more detailed in their representation, and that story and narrative are becoming a bigger part of games. This is raising a number of issues, both about narrative and games, since the integration of the two, as we shall discuss later in more detail, is neither obvious nor easy.

Representation also includes the element of fantasy, which some, like game designer Chris Crawford, place in a game’s definition. While there are a preponderance of games about a small number of types of fantasy — such as space, medieval times and “modern” war — games actually represent an enormously wide variety of subjects. When I told my classic “Business has lots of content but no engagement, games have lots of engagement but no content,” story to J.C. Herz, she took quick issue. “Games *do* have lots of content,” she countered. “It’s just not content that’s immediately useful in the “real” world.” Of course, as we shall discuss, putting content that *is* useful in the real world is what Digital Game-Based Learning is all about.

The concept of “Flow”

There is a mental state — often reported by game players, but certainly not limited to this area — of intense concentration, often to the point where previously difficult tasks become easy and whatever you are doing becomes enormously pleasurable. Most of us have experiences it in one area or another. Researchers, notably Mihaly

Csikszentmihalyi, refer to this state as “flow.”⁴² In the flow state the challenges presented and your ability to solve them are almost perfectly matched, and you often accomplish things that you didn’t think you could, along with a great deal of pleasure. There can be flow in work, sports, and even learning, such as when concepts become clear and how to solve problems obvious.

The trick with flow is to keep someone in the state. Make things too easy and player gets bored and stops. Make things too hard and they stop because they get frustrated. Well-designed games are especially good at maintaining this “flow” state in players, and game designers have developed specific techniques to do this, as we will see in a moment. In Digital Game-Based Learning, one of the biggest challenges is to keep players in the flow state in the game and in the learning simultaneously — no easy task, but enormously rewarding when successful.

Other Types of Interactivity besides Games

In order to prepare us for the design of Digital Game-Based Learning later, it is important to briefly discuss a few other categories, besides games, that make up the object world of possible computer interactions. In a “grammar” of digital interaction, these are the “nouns.” (I am indebted to J.C. Herz for introducing me to these theories.) Besides games, there are “toys,” “stories,” and “tools.” These categories can be, and often are, combined in a single work.

Toys

“Toys,” as we have already discussed, are interactions that have *neither* goals nor objectives. They are meant to be “played with” as you explore the “phase space” of whatever they are about. To people who use this terminology, *Sim City* and *The Sims* are toys. So is Microsoft Flight Simulator. A toy, according to Herz, doesn’t necessarily have rules; it’s more open ended, and its identity really has to do with the material qualities of the object. In this sense, airplane and other equipment simulators are toys, as are economic simulations if you are only playing and exploring rather than “playing to win.” Laurie Spiegel — another lute player and a brilliant composer of electronic music — created a toy called *Music Mouse* for the Macintosh when it first came out, in which by moving the mouse in various directions you can create different types of music.⁴³ I remember playing with it for hours. As Wright says, it is easy to turn a toy into a game at any moment — just add a goal. So as soon as you say: “I want to land my plane safely at JFK,” the toy has become a game. In terms of play, some people prefer toys and some games. Corey Schou tells the story of how the pilots rejected a multi-plane simulation he built for FedEx because there was no goal and therefore no competition.⁴⁴ As we shall see in Chapter 10, the military is experimenting with making some of its very expensive simulation “toys” more game-like.

Stories (Narrative)

Narrative, or story, is another kind of possible computer interaction. At its least interactive, a story is merely put onto the screen in words and/or images from start to finish, and your interaction is clicking through it. This was done for example in the “Living Books” series for children, where part of a story is given each screen and the kids can click to hear it or advance to the next page (there are “toy elements as well, in terms of things you could click on.) Non-linear hypertext can also be a kind of “story” in this sense.

Narrative has a long and important history in entertainment (and in learning as well — remember Homer.) Those who believe in the entertainment and learning power of narrative do so passionately. “I live and breathe storytelling,” says Bran Ferrin of Disney.⁴⁵ “I contend that linear narrative is the fundamental art form of humankind,” says Alex Seiden, of Industrial Light and Magic.⁴⁶ Many, especially those who come from a literary or cinema background, are convinced narrative is by far the strongest way to engage people. The *reason* it is so engaging is because it is a terrific way to stimulate our emotions “In order for it to be emotional it has to be story-based,” say Jeff Snipes of Ninth House Networks.⁴⁷ Stimulating emotion is, in fact, the “prime directive” of fiction writing, as any screenwriting book will tell you.

A big issue facing both the “narrative” people and the “games” people is how to *combine* narrative with games. Digital computers have introduced consumers of entertainment and stories to interactivity. And interactivity — getting immediate feedback to your actions — is *also* a very powerful way of engaging people. So large and varied groups of creative people are struggling hard to find ways to put narrative and interactivity together, creating “interactive stories,” which can, for example, be included in games. I use the word struggling because it isn’t at all obvious how to do this, and many attempts to date have tried and failed. When, in the first bloom of computer games, the people from Hollywood (who see themselves as the masters of narrative) tried to combine and work with the gamers of Silicon Valley (who see themselves as the masters of interactivity) the initial results were disappointing. Many referred to this as “Silliwood.”

At the heart of the issue is the fact that narrative or story has up till now always been something that is *completely controlled by the storyteller*. The “author” is uniquely in charge, feeding the story to the reader or viewer in the exact manner and pace he or she chooses. Whether the “author” of a movie is an individual or a collaboration, once the film is “in the can” the viewer, like the reader of a book, can’t change the story, except in his or her imagination.

In a digital, interactive world, however, the receiver of the narrative *wants* and *needs* to interact with and influence that story on the fly. How to make that happen while still preserving the kinds of emotional impact that good writers know how to elicit through effective structuring and organization of the material is the big question. Many of the tools they use to do this — plot twists, surprises, things coming together at certain moments — depend on the author’s, not the user’s, making the choices. A great number of highly creative people are working hard on this problem, trying to invent what

effective interactive storytelling will look like and to merge this into games in a more effective way than has been done up till now. They are trying many different approaches, from highly branching but occasionally converging decision trees, to generating story and video on the fly, to endowing characters with particular qualities and letting them interact with each other according to certain rules. Their results are highly important to digital gaming and Digital Game-Based Learning, so it's an area worth staying in touch with.

Tools

Tools are interactive programs that are used to make other things. A word processor or spreadsheet is a tool. So is a graphics program, programming language or authoring system. Tools can be included in games either as an integral part of the gameplay (the tools you use to build your theme park in *Roller Coaster Tycoon*) or as supplements (the tools you use to design your character in *EverQuest*, or to design new levels in *Quake*.)

Simulations?

Although some might expect simulations to be included as one of these “interactive noun” categories, they are really more of an action, or, in Herz’ terms, a “predicate.” “Depending on what its doing, a simulation can be a story, it can be a game, it can be a toy. If it's a role-playing simulation ultimately it's a story. If it's a simulation of trading, it's a game. If it's a sim of an airplane it's a toy. It's an analogy to a real world situation. But what that situation is can be anything,” says Herz.⁴⁸

There is more discussion of games and simulations in Chapter 8.

“Digital” Games

Games and computers are one of the great marriages out there.

-Eric Goldberg, game designer

In the preceding discussions, my focus has shifted (subtly, I hope) from games “in general” to computer games. Let me now be more explicit. What is different about playing a game on a computer? Why do so many other people, including the Games Generations, as well as many adults and even retirees, find the combination so attractive and satisfying?

The biggest difference is that computers enhance the “play experience,” which is what people want most out of games. In many non-computer games, points out Eric Goldberg, long-time game developer and CEO of Crossover Technologies,⁴⁹ a lot of the time in the game is taken up figuring out and administering (and often arguing about) the rules. One thing the computer does well is to take care of all the boring little rules and details, freeing the player to enjoy more of the game experience. The computer handles a lot of the tedium. For example, it knows automatically what moves are illegal, and won't allow you to make them. In war games, prior to the era of computers every time the competitors moved their forces a “time out” had to be called while the referees looked up

all the individual unit damage consequences in a large book of tables. Now this is done by the computer in what appears to the players to instantaneous, enabling the creation of so-called “real-time” war strategy games like *Command and Conquer*.

Why do more and more people prefer to play their games on computers? I.e., why do so many people prefer *digital* games? There are many reasons:

- Digital games take care, as I said, of the “boring stuff”
- Digital games are typically faster and more responsive.
- There are fun things that digital games can do easily that non-computer games can’t do at all, such as simulating the physics of shooting in space, or combining all the factors in flying an airplane, or considering the millions of possibilities in puzzles or strategic contests.
- Digital games are capable of more, better and far more varied graphic representation.
- Digital games can be played against real people or, if none are available, against AI (i.e. the computer). That means that multiplayer games can be played any time.
- The whole world (i.e. anyone online anywhere) is available as a potential player.
- Digital games can generate and allow huge numbers of options and scenarios.
- Digital games can deal with infinite amounts of content.
- Digital games can play at differing levels of challenge.
- Digital games can be updated instantly.
- Digital games can be customized to and by the desires of each player.
- Digital games can be modified and added to, making the player part of the creative team.

The list goes on. For all these reasons we have seen just about *every* traditional game — card, board, quiz, trivia, puzzle, etc.— move quickly to computers and the Web and be *wildly* accepted by players of all ages. Millions of people play computer chess, computer bridge, computer *Jeopardy!* and computer *Wheel of Fortune* daily, to name only a few. The classic solution for increasing traffic to your Web site is to add a game.

Game Taxonomy — Categories of Games

Is there a taxonomy of games? Can all games be broken down and classified into a limited number of specific categories?

Writing in pre-computer-game 1958, Roger Caillois, in *Man Games and Play*, divides games in to four classes: Competition, Chance, Simulation, and Movement. He then further subdivides them by their degree of agitation vs. restfulness.⁵⁰ In his 1980 book *The Art of Computer Game Design* game designer Chris Crawford identifies five major types of games: board games, card games, athletic games, children’s games, and computer games.⁵¹

Circa 2000 computer games are generally recognized as falling into one of 8 “genres,” which often overlap. They are, in alphabetical order, Action, Adventure, Fighting, Puzzle, Role Playing, Simulations, Sports, and Strategy.

Action Games began with the classic “twitch” games of the arcades and home video consoles: *Super Mario*, *Sonic the Hedgehog* et al. The category includes the old “side scroller” games, maze games (*PacMan*), platform jumping games (e.g. *Gekko*), falling things you have to shoot (*Missile Command*), car races and chases. Obviously this is the category of the shoot-em-ups like *Doom*, *Quake*, *Duke Nukem*, *Half-Life* and *Unreal Tournament*.

Adventure Games are the “find your way around the unknown world, pick up objects and solve puzzles” games. These are among the earliest of computer games; *Adventure* was played on mainframes. *Zork* is a classic of the genre. Present day adventure games include *Myst* and *Riven* on the PC and *Zelda, the Ocarina of Time* on Nintendo

Fighting Games are a lot of what you see in the lobbies of movie theaters. Two characters, drawn from a stable of hundreds, battle each other till one is wiped out. All these games are really doing is matching up two “moves” at the same time, to see which wins., But the speed is intense, and the moves are athletic, balletic and fantastical. They are typically captured by motion capture sensors on dancers and real martial arts fighters, and the goal appears to be to combine outlandish fantasy in the characters with realism of the computer graphics. The classic example: *Mortal Kombat*. Modern example: *Virtua Fighter MMMCIII*.

Puzzle games are just that. Problems to be solved, typically visual, stripped of all story pretense. The classic example: *Tetris*. Modern example: *Devil Dice*

Role Playing Games (RPG’s) are generally some form of “Dungeons and Dragons” brought to the computer screen. They are mostly mediaeval in their imagery and involve quests usually to rescue someone or something. You play a character, which has a “type” (human, orc, elf, wizard, etc) and a set of individual characteristics you assign it. You acquire equipment and experience via action and fighting. Things like spells are a big deal. The classic example: the *Ultima* series. Modern example: *EverQuest*. RPGs are most often played online with others.

Simulation Games are about flying or driving things (often military) or building worlds like *Sim City* and *The Sims*, or, increasingly, running companies (*Start-up*)

Sports Games are the one category where the content, rather than the game play is the determining factor. Most are action games where you can control one or more players at a time. Sports games are getting so photorealistic that on the latest consoles you’d almost swear you were watching real players on television. There also exist less action- and more statistics-oriented sports games like fantasy

baseball, as well as action sports games, especially in arcades, where you control the game via a realistic piece of sports equipment such as skis, a surfboard, or even — only in Japan — a rotating kayak paddle.

Strategy games are typically about being in charge of something big – an army, or an entire civilization, and making it evolve the way you want, either on your own or more often against opponents. The classic example: *Civilization*. Modern example: *Roller Coaster Tycoon*.

Computer Game Design

Game designers have a better take on the nature of learning than curriculum designers.
-Seymour Papert, MIT

Computer game designers are an extremely interesting group of people. Were you to attend the Computer Game Designers Association conference (CGDC) in San Jose each spring, you would find yourself surrounded by thousands of what might look on the surface to be “ur-geeks” – guys, mainly, in ponytails and t-shirts. If you *really* knew nothing about them, you might take them for a group of high-energy dropouts, but you would be *dead wrong*. This group might actually beat the entire Ivy League in brainpower, and includes certainly some of the most talented — if unsung — creative people of our generation.

In addressing the 2000 CGDC, Danny Hillis, the renowned creator of Thinking Machines, and at the time a Disney Fellow, said the following:

“...I really believe that this is a really important group of people. I get to talk a lot to politicians and scientists and entertainers and they all assume that they are the center of the world, and that they are making the decisions that are going to control how things come out. I actually think they are overestimating how much they are really influencing how things are coming out, and I usually give as an example people whom I think are *really* influencing the world — game designers...”⁵²

Game designers are often unknowns, even in their own industry, typically performing their magic in the shadows. In an industry that rivals the movies for revenues, their name rarely goes on boxes in the way authors' names go on books and director's names go on movie marquees. There are but a few superstar designers whose reputation is known to gamers at large: Shigeru Miyamoto of Nintendo, creator of *Mario 64* and *The Legend of Zelda: the Ocarina of Time*, Sid Meier, Creator of *Civilization*, *Railroad Tycoon* and *Alpha Centauri*, Robyn and Rand Miller, creators of *Myst* and *Riven*, Peter Molyneux, creator of *Black and White*, Richard Garriott, creator of the *Ultima* series, and Will Wright, creator of *Sim City* and *The Sims*. Forgive my omission of anyone else who should be here, but for the most part, this world-transforming force travails in anonymity.

How do *they*, the game designers, describe what they are trying to do? In December 1999, on the eve of the millennium, a number of them were interviewed by Jeff Keighley of *Game Spot*, the online affiliate of *Game Developer* magazine.⁵³ Here is what some of them had to say:

Brett Sperry of Westwood (*Half-Life*) says “I’m fascinated with the concept of fun, constantly pondering what makes one game pleasurable and another one drudgery. I’m always puzzling about how to kindle more adrenaline-filled moments outside the twitch realm. How is it possible to create extreme emotional involvement with a game? What causes a player to have a peak experience? And how can I do that without requiring that the player have the dexterity and coordination of a 15-year-old? ...Should my game have a fixed story with scripted plot points and sacrifice replayability? On the other hand, should it have lots of random elements and less compelling story elements?”

George Broussard of Apogee thinks about making “fun games... that make you want to finish them... that make you laugh, scream, and jump out of your chair when you play ... that make you call your friend on the phone and tell him he *has* to see this new game.”

Lou Castle of Westwood thinks about creating characters and phenomena that impact our worldwide culture in the same way as Lara Croft, Mario, and Pokemon.

Justin Chin of The Infinite Machine thinks about adding irony, subtle foreshadowing, restraint and good writing — “something I think we in the game industry must take to heart if we want to have compelling stories in our games.”

And Bruce Shelley of Ensemble Studios (*Age of Empires*) thinks about “problem solving...Interesting decisions in a competitive environment, that lead to a satisfying conclusion, and making virtual combat as interesting and fun as chess.”

How’s *that* for a set of challenges to spend your day on?

The Principles of Good Computer Game Design

*Computer-based training designers could learn a lot
from the people who build computer games.*

-Bob Filipczak, Training Magazine

Is game design an art or a science? This is important to us as we sit down to create Digital Game-Based Learning.

In 1997 the computer magazine *Next Generation* undertook in a special report to answer the question “What makes a good game?”⁵⁴ They were not trying, as we did before, to distinguish games structurally from any other phenomena, but rather to see if they could determine what separates the “bad from the good” in this “modern day art.” They came up with six elements “found in every successful game throughout history:”

- Good game design is ***balanced***. Balance leaves the player feeling that the game is challenging but fair, and neither too hard nor too easy at any point.
- Good game design is ***creative***. Creative here is the opposite of formulaic. Good games are not merely clones of other games, but add something original.
- Good game design is ***focused***. Focus is figuring out what is fun about *your* game and giving the player as much of it as possible, without distraction.
- Good game design has ***character***. It's a game's depth and richness. Both the character and the characters in a game, if fully developed, are what is memorable.
- Good game design has ***tension***. Every good game does it in its own way. The classic way is to make the player care about the goal of the game, and then make it hard to achieve.
- Good game design has ***energy***. This comes from things like movement, momentum and pacing. The game's energy is what keeps you playing all night or rejuvenates you after a hard day.

Other Important Digital Game Design Elements

While those six elements are important to a good game, they are, according to Noah Falstein, more the *results* experienced by a reviewer or player than the processes used to create the games. Some — though by no means all — of the more process-oriented principles and elements that designers use to create good games include (and I am indebted here to Falstein, who is a master game designer):

1. **A Clear Overall Vision.** As in any other artistic endeavor, a clear vision is key to making a good game. It is generally a good idea that one individual (designer, project leader, or producer) be the “keeper” of the vision, but the entire team must *share* the vision. This requires good and frequent communication.
2. **A Constant Focus on the Player Experience.** Since in computer games most of the creators are players as well, they often make a game that they would want to play. This is good, but they must also focus on making the game accessible to their entire audience, including new players who might find challenging what has become trivial to the designers, and not make it too hard at the start.
3. **A Strong Structure.** “Classic” game structures take many forms, from having what Crawford calls a “very bushy tree” with as much branching as possible, to what Falstein calls “convexities,” which means starting out with a small number of choices, branching out into many and funneling back into a few. Some game structures are fractal, with “convexities of convexities.” But the structure must be thought out carefully up-front.
4. **Highly adaptive.** The game must be able to be fun for a variety of players. One of the ways this is accomplished through a series of levels of increasing difficulty, so that experts can find their challenge later on in the game, while novices are challenged at the beginning. Another is to have user-controlled “difficulty levels” or “cheat codes” which provide varying levels of invulnerability or resources.

5. **Easy to learn, hard to master.** The best games are often the ones that can be learned in only a few minutes, but provide hours or even lifetimes of challenge. Will Wright's favorite game, *Go*, "has only two rules," he says, "one of which is seldom used. Yet from those two simple rules is derived this incredibly rich, complex strategy – it's much richer than chess, and the rules are far, far simpler." Think of Rubik's Cube.
6. **Stays within the "flow state."** A successful game needs to constantly walk that fine line between "not too hard" and "not too easy," and do it for a variety of players. One strategy used to accomplish this is known as "negative feedback," i.e. when you fall behind the game gets easier, as you get ahead it gets harder. In Sid Meyer's *Civilization*, for example, if a player does well and grows a civilization quickly, the cost of maintaining the civilization increases and so does the money that must be devoted to keeping the citizens happy.
7. **Provides frequent rewards, not penalties.** Rewards are an incentive to go on. Finishing a level is one reward, but there are often many small rewards, such as things to find and collect, along the way. While early on points were often subtracted for failure or bad moves, people generally do not like this. A better way is to have rewards that decrease with time, or to have players who "fail" start over from some recent milestone, rather than losing points or dying.
8. **Includes Exploration and Discovery.** While not typically a part of puzzle or sports games, players like to "explore their turf," and uncover progressively various portions of the landscape.
9. **Provides mutual assistance – thing helps solve another.** Clues to how to do one puzzle or tasks can be embedded into another one, providing "mutual assistance." In sophisticated games, these can be made to disappear when no longer needed, giving the player the illusion that less help was available than was actually the case.
10. **Has an interface that is very useful.** What is important for a successful game is *not* a simple interface, but a highly useful one. It must have a built-in learning curve so that beginning players know what to focus on and don't get confused, yet advanced players have plenty of power options and interesting ways to control the game.
11. **Includes the ability to save progress.** Most games have a "save game" button which stores all the pertinent information about the exact state of the game at the moment it is saved. The player can at any time choose "load saved game" to continue again from that point. This is pretty much of a *sine qua non*, although, says Falstein, some games are starting to lean away from that structure.

Contest # 4: What are other good game design elements? Email your entries to www.twitchspeed.com . The winner each quarter will receive something related to Digital Game-Based Learning and a mention on the site!

A particularly interesting and specific set of game design principles have been put together by Harry Gottlieb, CEO of Jellyvision, the company that created the fabulously successful trivia games *You Don't Know Jack* and *Who Wants to be a Millionaire*. Called the "Jack Principles," they reflect Gottlieb's unique approach to making computer games feel more like a TV show that you are actually in. They include techniques for maintaining pacing, creating the illusion of awareness, and maintaining the illusion of

awareness. More information about the 70+ page Jack Principles can be obtained directly from Jellyvision.⁵⁵

“Eye Candy” versus “Game Play”

Game designers often make a distinction between the way a game actually plays and the way it looks. In the early days of video and computer games, when the technology was still very new, there was not very much that could be done with graphics. So designers concentrated on making the game as exciting as possible. Even if the spaceship, for example was only a “greater than” sign, or the character only a disc with a mouth, you enjoyed the game because it provided a lot of challenge and fun.

As the display characteristics of the computers improved, however, designers began to add more and more “eye candy” to games — the eye-popping landscapes of *Myst* and *Riven*, the ultra-realistic characters of the sports games, the ultra-detailed cars and track of the driving games, and in many cases movie-like video. While this has obvious attraction to people, it also had the unfortunate consequences in many cases of both increasing costs dramatically and distracting designers from good game-play. This has been disappointing to many old-time game players.

“I think it always boils down to the interaction design, whether that’s single player or multiplayer,” says J.C. Herz “It’s always possible to make a game prettier – just add money. But the games that wind up having a real impact always have incredibly well designed rule structures, and the game play itself is well-thought-out interactions. Initially, when someone makes a breakthrough in graphics it will sell a game, because we love eye-candy, but that gee-whiz value only lasts so long.”⁵⁶

Many game designers think that we are fast approaching diminishing returns in improving graphics. After they are photorealistic, where do you go? Many of them are excited, because they believe this will mean a renewed focus on game play. And despite the raised bar on eye candy, it is still possible to make a really fun game without great graphics, as Ashley Lipson’s legal game *Objection!* illustrates. The ultimate example of the primacy of game-play over graphics is, of course, *Tetris*.

What comes out of a good game design — and a lot of hard work to actualize it — is the player’s experience. Gamers’ connection to these experiences and to their games is an extremely passionate one. Digital Game-Based Learning should evoke similarly strong passions as well.

Digital Game Preferences: Culture and Individuals

Some people, like J.C. Herz, who reviewed computer games for several years for the New York Times, are “omnivorous” in their gaming preferences. Others are very specific. Think for a moment about the games (computer or not) *you* like. Why do these games appeal to you and not others?

Games, it turns out are extremely culture and age specific. They reflect the overall culture we grew up in, the specific milieu in which we were raised, our own particular culture and ethnicity, and even our religion. Since many games are learned and played in our youth, the games we like often reflect what was going on in our environment when we were at an impressionable age, usually teenagers (e.g. boomers *and Jeopardy!*), and what we actually experienced (e.g. the sports of our particular culture and choice). Thus knowing as much as possible about your intended audience is crucial to successful game design.

Digital Games and Age

Unlike children who see it as a challenge or just natural to learn a new game, adults sometimes shy away from learning new games, because to play any game well takes effort and practice. Many of us are embarrassed not to be good at something. Today many adults over a certain age are reluctant to try the “twitch games” of their kids, particularly if anyone is watching. Yet as I found out with *Straight Shooter!*, given a little privacy to practice, they will often take to even those types of games.

I suspect our teen years are when we often become addicted to many games. There is currently a nostalgia boom going on among young professionals and others for the games of their youth. Old hand-held games from the 70’s, like *Frogger* and *Ms PacMan* are selling for sky-high prices.

Try this. Take your birth year. Go to the table and find, in the first column, the years closest to it. See if you don’t like the games listed in that year and the ones close to it more than others.

Your Birth Year	Game	Year Game Introduced
Pre 1949	Monopoly	1935
1949	Jeopardy	1964
1959	Pong	1974
1963	Space Invaders	1978
1964	Asteroids	1979
1966	Battlezone/Defender	1981
1967	Frogger/Trivial Pursuit	1982
1971	Super Mario Brothers	1986
1973	Sim City	1988
1974	Tetris	1989
1976	Sonic the Hedgehog	1991
1977	Mortal Kombat	1992
1979	Doom	1994
1981	Quake	1996
1984	Roller Coaster Tycoon/The Sims	1999

However age is no barrier to learning and playing computer games. Often when one finally realizes what a particular game is about there's a big "aha."

"I watched my 60-year old father have his "ah-ha!" moment a couple of years ago playing *Wing Commander*," says Gabe Newell of Valve software.⁵⁷ Now, he spends a lot more time playing computer games than he does watching TV. He and my half-brother spend more time playing games together, talking about games, or arguing about games than they do playing, watching, or discussing sports."

Digital Games and Violence

There's so much comedy on television. Does that cause comedy in the streets?

-Dick Cavett

Although there are, of course, many violent games, games *in themselves* are not violent. Sure, those that are get most of the press attention, especially after incidents such as what occurred at Columbine High School in Colorado. But the vast majority of digital games are *not* violent at all, and that includes many of the bestsellers: *Sim City*, *The Sims*, *Roller Coaster Tycoon*, *Tetris*, *Myst*, *Riven*. Action/Fighting games are only one genre (or two depending on how you count) of video and computer games. Adventure, Puzzle, Role Playing, Simulations, Sports, and Strategy games are all primarily non-violent (although some of them do simulate war or have "combat" – but so does Chess.)

Obviously, violent games are not the best choice, nor do I advocate them for Digital Game-Based Learning. But it is important to note that *what is at the core of even these games is not the violence but the action and the "gameplay."*

It is often possible to take an action genre and *extract* the violence and still make an exciting game, as we shall see with *Straight Shooter!* (See Chapter 9).

Digital Games and Gender

With the exception of violence, few game topics inspire so much passion as computer games and gender. The issue is whether computer games are only "boys toys" or whether females will play in equal numbers, either because there are games appealing to both sexes or because there are games that appeal directly to them. Gender is an issue very much on the minds of games makers, and certainly one we will have to keep very much in mind as we create Digital Game-Based Learning. There has been, and continues to be (and no doubt will continue to be for some time) much heated discussion and debate about computer games and gender.

Yet the truth is far from clear and is, in fact, a moving target.

One component of the issue is computer use *in general* by girls, which, while once clearly behind boys, appears to have reached parity, at least in the US. "There isn't much

of a difference between boys and girls anymore, and that's true in all age groups," says Nicholas Donatello, President of Odyssey, a research company.⁵⁸ But the kinds of sex differences that marketers and social scientists have long observed, such as boys preferring competition and girls relationships can manifest themselves on the computer as well. Both as a result of and fueling the computer-fluency of girls has been a huge rise in the number of computer games designed for girls ages 6-12.⁵⁹

So if males and females are at parity with computer use, and the number of computer games aimed at women has risen extraordinarily, we need to ask "Do girls and women play computer and video games as much as males?" and "What games do they play?" While no one disputes that *initially* video and computer games were an overwhelmingly male experience, there's plenty of evidence that girls' attitudes towards games are changing. "We're seeing far more unashamedly nerdy girls today than we saw in the 80's," says Idit Harel of MaMaMedia.⁶⁰

At a 1995 *Killer Instinct* tournament in San Francisco, 3 of the 8 winners were girls, surprising even the organizers, the PR agents for Nintendo of America. "All our research told us girls don't like these fighting games. But they had to be playing *Killer Instinct* in the arcades or they wouldn't have been that proficient," said vice president Don Varyu of Golin Harris.⁶¹ At the same time Sega and Nintendo game counselors who field thousands of calls daily from players reported that girls and young women accounted for 35-50 percent of the phone traffic, up from 90-10 in favor of boys.⁶²

And even though Mattel's *Barbie* games are by far the biggest sellers to girls,⁶³ 13-year-old Kate Crook, a semifinalist in the Blockbuster World Game championship made a point of saying that *Barbie Super Model* is "stupid." "There are plenty of girls who like fighting games and role-playing adventures," she said.⁶⁴

Many adult women are gamers as well, although not always playing the same games as men. According to J.C. Herz, *Tetris* "is more popular with women than any other game and notoriously addictive among female professionals."⁶⁵ Why? Because it appears to provide elements that females need and like. "Tetris is about coping," says Herz. "It's about imposing order on the chaos. It's not about blowing thing up it's about cleaning things up." Herz, for one, thinks that the games gender gap has disappeared, at least in the US.⁶⁶

The following can safely be said about games and gender:

- Initially, many fewer girls than boys played computer games — they were "boys toys." Many people, including the computer games makers — girls after all represent half their potential audience — have been trying to do something about this for some time.
- Few dispute that things are changing and that more women play computer games — the issues are how much and how fast.

- Many observers think the proportion of women playing computer games has changed considerably in the last several years as girls have more access to, and are more comfortable with, computers and video consoles.
- There have always been girls and women who like or love computer games. I have personally observed women playing, in a highly engaged way, a variety of video games from *Devil Dice* to *Golden Eye* to *Unreal Tournament* and loving every minute of it. One of the top game champions who travels the country challenging players is a girl.
- Some well-researched and well-funded attempts — such as Purple Moon — to make games specifically based on what are supposedly girls’ preferences, such as interaction rather than action, received positive reviews, but floundered commercially.
- An exciting game is an exciting game. While certain games like *Tetris* are reported to be played preferred by women, and others, such as shoot-em-ups, are reputed to be disliked by them, I know many women in their 20s who *love* shoot-em-ups. We used a shoot-em-up format at Bankers Trust (shooting ideas out of a cell phone) and found that the competitive-types of females at the bank were just as into it as the males.

So whether or not there is still a “games gap” is hard to say. Game *preferences* seem to be different, which clearly has implications for the design of Digital Game-Based Learning. But it’s safe to conclude that a large and steadily growing number of girls and women appear to be finding satisfying types of computer games to play. It’s also safe to say that finding *more* of these types of games is a quest that is being pursued vigorously on many fronts.

The “Language” of Digital Games

Every medium of communication has its own language — sets of meanings and shortcuts that are taken for granted by those used to the medium, but which have to be learned before it can be fully enjoyed, or even, sometimes, understood very well at all. Language has grammar: there are doers, actions, and things acted upon. Written communication adds the logic of relationships: chapters, sub chapters; forms of emphasis: bold, italics; forms of reference: quotations, footnotes; etc. Movies and TV have their own language of cuts, transitions, close-ups, blackouts to indicate the passage of time, etc. Professor Greenfield of UCLA has studied these and shown that children (or others new to the media) must gradually learn them over a period of time.⁶⁷ There are no courses for this (except in film and communications schools). People learn by doing and making inferences, and getting help from others along the way.

There is also such a language or “rhetoric” of computer games, which is shared between all players, learned by many experiences early on, and often quite opaque to non-

computer-game-players. This is part of the great generational differences that we have described in previous chapters.

Among the things that all digital game players tacitly know, do, and look for are:

- All things can and should be clicked on (actually, this is more subtle, with what is or isn't clickable often indicated by very small design elements.)
- You “build” things by clicking on an icon and dragging it to where you want it.
- You move people by selecting them and clicking where you want them to go.
- There are hidden combinations of keys that do interesting things.
- There are hidden surprises, commonly known as “Easter Eggs,” for you to find.
- There's almost always more than one way to do something.
- You may have to try something many times before it works.
- There are almost always “cheats” or ways to get around something. These codes, which at the origin were ways for programmers and testers to get further ahead in the game, are coveted and passed from player to player and even reported in magazines. Some “cheat codes” introduce funny and incongruous elements. You can, for example, create a fleet of machine-gunning 20th century Ford Cobras in your mediaeval *Age of Empires II* scenario, with predictable effect.⁶⁷
- Games can always be saved and reloaded later.
- Games are “fair.” They don't kill you off without giving you a chance and they don't require resources you cannot get (although surviving or finding the resources may not be easy).

The language of video and computer games is important because for those familiar with it certain things are extremely obvious and transparent, but for outsiders they are often hard to guess. This is *very* important, as we shall see in the next chapter, in the design of Digital Game-Based Learning.

Summary: What Makes Digital Games So Engaging?

These are the 12 characteristics that make computer games and videogames engaging for millions of people:

1. Games are a form of **fun**. That gives us *enjoyment and pleasure*.
2. Games are form of **play**. That gives us *intense and passionate involvement*.
3. Games have **rules**. That gives us *structure*.
4. Games have **goals**. That gives us *motivation*.
5. Games are **interactive**. That gives us *doing*.
6. Games are **adaptive**. That gives us *flow*.
7. Games have **outcomes and feedback**. That gives us *learning*.
8. Games have **win states**. That gives us *ego gratification*.

9. Games have **conflict/competition/challenge/opposition**. That gives us ***adrenaline***.
10. Games have **problem solving**. That sparks our ***creativity***.
11. Games have **interaction**. That gives us ***social groups***.
12. Games have **representation and story**. That gives us ***emotion***.

It is time now to see how we can use and apply this level of engagement to create something new and really worthwhile for training and education: *Digital Game-Based Learning*.

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Games are a subset of both play and fun. Games can be negatively defined as mocking or jesting, illegal and shady activity or positively defined as fun and games. Games involve rules, contest, rivalry and struggle. Example is the "Living Books"™ Series for Children. Narratives are engaging because they stimulate our emotions. Tools. Interactive programs that are used to make other things (word processor or spreadsheet). Fun, hands-on math games are a great way to make early math concepts clear and keep your students engaged. Introducing math games into the classroom is a great way to make learning fun, engaging and motivating for young learners. And the best part about starting early (kindergarten to grade 2) is that it helps your students to develop a positive attitude toward math from an early age, setting them up for a successful academic future. Here are some fun classroom math activities that will have your students begging to do more. Math Bingo. Children love playing guessing games, and when it comes to whether something is heavy or light, there can certainly be a few surprises in store for them. Gather several items and spread them across a table. Couples engaging in relationship games. These fun relationship games are not only meant for couples who have been together for a long time. Every couple can play and enjoy these games regardless of the length of the relationship. For new couples, these relationship games can act as an ice breaker to help you know your partner better. Need a new idea for a date night?