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by Marc Prensky

Chapter 1

The Digital Game-Based Learning Revolution

Fun at Last!

This generation is growing up in a revolution.
-Ryan Zacharia, 16 year-old Intenet entrepreneur

Sure they have a short attention span — for the old ways of learning!
-Edward Westhead, former Dartmouth professor

They said we could be a toy business, but we wanted to be a sex toy *business!*
-a trainee in a Wharton e-business simulation

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E3, The Electronic Entertainment Expo in Los Angeles, is a mind-boggling affair. Now that video and computer games have equaled or surpassed movie box office in revenue (each around $6 billion in the US) [1] marketing budgets are immense. The three-day extravaganza at which retailers see the upcoming goods and decide what games they will buy is an oversized, multi-hall production. It is packed with realistic-looking aliens, giant game characters, Hollywood-style effects, scantily clad women, and thousands of exhibitors and attendees. Game-style noises and lights assault your senses. The "booths" of the big three, Sony Sega Nintendo, are immense fields measurable in acres — effectively kingdoms — with structures rising several stories up in the air, balconies and stages pulsating with go-go dancers, musicians and entertainers. In the epicenter is Sony's continent — because of the *Playstation2* they are the year's biggest spender. And in the very center of that world a huge 30 foot high movie screen, continuously running in-your-face action-packed scenes from the upcoming games, parts every 20 minutes like a vertical Red Sea allowing a surging wave of super-eager attendees who have waited hours for tickets to enter the inner sanctum. Inside, amidst a storm of SurroundSound and Laser Beams, the *PlayStation2* rises onto its pedestal like a God.

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Elsewhere on the floor a slightly lesser-known games company, vying for attention in the madness, has brought in a full, two-story-tall half-pipe for stunt bikes, sponsoring shows every hour with name-brand cyclists doing competing 360's. Not far away is a full-size boxing ring with real sparring contests. Every exhibitor has a twist, an angle, a giveaway, something to draw you in. Wait — in very long lines — and you can have your picture taken with Laura Croft from *Tomb Raider*, (a real girl with real guns on a real Harley, and don't try to sit in front); or with a huge oversized Simpsons family, or with the semi-naked actual LA Lakers cheerleaders.

And everywhere, amid the sound, lights, music and dancing girls, shines the glow of thousands of the latest, largest, flat-panel computer screens with the newest, greatest, still-to-be-finished games set out like appetizers to be test-driven by attendees. Many have waiting lines several people deep, despite multiple instances.

The crowd is young, almost exclusively in their 20s and early 30s, and full of energy. They are not skeptics, but participants — possibly even addicts — eager for this year's new dose.

This is FUN!   This is the *entertainment* world. **These, ladies and gentlemen, are today's trainEES**.

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Dallas, just one week later. The American Society of Trainers and Developers (ASTD)'s annual convention. The total exhibit floor is less than one tenth the space of E3 — less than only one of its big halls. Most booths are the minimum 4 ft x 8 ft, and no booth is larger than eight or ten of the smallest ones. There is no music. No fancy lights. No noise. No lines. *Certainly* no dancing girls. The energy level is low — maybe $1/50^{th}$ of that of E3. There are maybe $1/50^{th}$ of the people as well, mostly in their 30s, 40s and 50s, meandering at glacial speeds along straight aisles from tiny booth to tiny booth. Not a single line anywhere, only slightly larger groups at the two or three booths selling training "props" — funny pointers, noisemakers, koosh balls etc. — which are the closest thing to any "fun" at the show. One single Playstastion (version 1, not 2), displays a racing videogame — totally unrelated to the product being offered — in an out-of-place and seemingly unsuccessful attempt to draw people in. Another exhibitor draws some attention with a small climbing wall and an expensive set-up of futuristic chairs and 3D electronic headsets. But when you take the trouble to sign up and wait your turn all you get is a 3D head shot of a guy standing in front of a movie screen, reading (badly) from a script. Plenty of coffee (you need it). Chocolate chip cookies. Comfortable shoes.

This is BORING!   *This* is the learning world. **These, Ladies and gentlemen, are today's trainERS**.

Exaggerated? Sure. Exceptions? Of course. Yes, there are training conferences like Online 2000 with a lot more computer equipment. But the overall picture is the same.

Today's trainers and trainees are from totally separate worlds. The biggest underlying dynamic in training and learning today is the rapid and unexpected confrontation of a corps of trainers and teachers raised in a pre-digital generation and educated in the styles of the past, with a body of learners raised in the digital world of Sesame Street, MTV, fast movies and "twitch speed" videogames.

The two groups — trainers and trainees — are *so* different in their approach, outlook, style and needs that they can hardly communicate. And the result is disaster. The trainees, which represent *fully half* of America's corporate workers (remember, the median age of a corporate worker is 36) [2] and whose numbers continue to grow daily, find today's training (and education) so incredibly boring that *they don't want — and often refuse — to do it*.

At Bankers Trust Company, where I worked for several years, workers continually signed up for "required" training classes and then just didn't show up. "Do you want me to go to training, or do my job?" they replied when questioned. This is not unusual. Ask someone to describe a corporate training class. Chances are very good you'll hear some foul language. "People *hate* training," writes Roger Schank, head of the Learning Sciences Institute at Northwestern University. And it's not only training people hate today, but practically *all* institutional learning. "The reason most kids don't like school," says Seymour Papert, "is not that the work is too hard, but that it is utterly boring.."

And online training is worse! Most designers of computer training readily admit that after some movement toward multi-media on CD-ROMs, they took an enormous step backwards when training moved online. Despite its availability over the intranet or Internet, and even though it's almost all free to users (employers pay for almost all training) completion rates are terrible, often less than 50 percent. [3] A writer in *Training* magazine says that the thing that keeps him awake at night is how to get people to finish online training. [4] Most of it is *more* than soporific. And although there is great talk of things like "learning communities" and online tutors, in fact, online training has taken away from trainees the *only* thing universally *liked* about training — *the ability to get out of the office*.

There is a terrible vicious cycle going on, to the detriment and dismay of learners — most of whom *do* want to learn — in which purchasers of corporate training are convinced that this boring style of "learning" is OK and continually acquire more of it. So that is what is made and offered by vendors, many of whom are growing like weeds and going public to amazing multiples. It is as if they have totally adopted, in twisted form, the former Apple evangelist Guy Kawasaki's new motto about just getting on with it, "Don't worry, be crappy!" [5] And this, despite the fact that they have for the most part merely replaced their

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so-called "shelfware" (unused CD-ROMs) with "forget-it-ware" (uncompleted online training)!

But don't worry, learners, it will not always be thus. For as the need for *learning that people actually want to do* becomes more and more crucial in the blur of the quickly changing business world, and as business finally confronts the fact that the generations who are the customers of E3 and love to play computer and videogames to the tune of $6 billion annually [6] are also the workers who need to be trained, the training and learning process — in companies, homes, and last but not least schools — stands at the beginning of a huge revolution.

We have heard this before. But in my view the training and learning revolution is ***not*** — despite what many preach — the shift in training delivery to the Internet, although that is important and transformational. And it's ***not*** "distance learning," although that, too, is an important part of the process. It's ***not*** just more, faster, smaller computers in corporate classrooms on desks and in laps. It's not wireless, or broadband, or just-in-time, or learning management systems, and it's ***certainly not*** computer-based training (CBT).

The ***true*** 21st century learning revolution is that learning — training *and* schooling — is finally throwing off the shackles of pain and suffering which have accompanied it for so long. Within most of our lifetimes pretty much all learning will become *truly* learner-centered and **fun** — fun for students, fun for trainers and teachers, fun for parents, supervisors administrators and executives. The huge wall which has separated learning and fun, work and play for the last few hundred years is finally beginning to tremble and will soon come tumbling down, to everyone's benefit. And while it will continue to resist for a while yet, like the Berlin Wall in the political world when it finally falls there will be a stampede to freedom.

The *reason* this will happen, and happen soon, is that *learners will demand it, to the point that management, teachers and administrators can no longer resist***.** The workers of the games generations will no longer accept, attend, or do training that is boring. So we will have to, as businesses, schools and the military are already beginning to do in places, inject fun and games into training.

And the *really* good news is that when we do it we will find — to the amazement of many (although certainly not the trainees) — that adding fun into the process will not only make learning and training much more enjoyable and compelling, but *far more effective* as well.

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This book is about the coming together of two seemingly diametrically opposed worlds: *serious learning* in schools and in businesses, and *interactive entertainment* — computer games, videogames, and, to a lesser extent, the movies.

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On the "serious" learning side today there is an enormous, multi-tens of billion dollar training budget focused on the most "serious" kinds of adult learning — how to run businesses and improve processes, how to manage people and organizations, how to wage war and maintain peace, how to manage and avoid dangers and risks, how not to violate the law. This is what is usually called "training," in both business and the military, and is a particular subset of adult learning. Training is *very* big business these days, usually estimated at over $100 billion in the US (counting the government) [7], part of a worldwide learning market of over $1 trillion [8]. Its computer-based elements, mainly online and distance learning, are growing at well over 100 percent a year. [9]

On the other side is the world of entertainment — music, television, films, and, increasingly, computer and video games, now equal to or *bigger than* the movies. Much of this entertainment is aimed at what Sony calls the "digital dream kids," but it also includes all adult entertainment from sports, to bridge and chess, to gambling. Entertainment is also a huge enterprise, also estimated in the trillions. [10]

The forces bringing these two worlds inexorably together, in Oglevy's words "like tributaries of a river" are first, *technological change and generational discontinuity* — causing learners today to be different than in the past; and second**,** *the need for training and education to catch up* to be efficient and effective.

While, as we will see, there is no consensus on exactly how people or adults learn, almost all theories recognize that it is key to have learners *engaged* in the process. And while it is sometimes possible for learning *for it's own sake* to be an engaging motivator, much of what people need to learn, particularly in a business setting, is ***not*** intrinsically motivating to most of the population. But this doesn't mean learning it can't be fun — on the contrary. ***Digital Game-Based Learning***. is precisely about fun and engagement, and the coming together of and serious learning and interactive entertainment into a newly emerging and highly exciting medium — Digital Learning Games.

Digital Game-Based Learning is already sprouting, and in some case taking firm root, in a wide variety of business and other places — in several of the world's most prestigious consulting firms, in industry leaders; in smaller firms; in service and manufacturing industries, in orientation, product training, soft skills, hard skills, marketing and strategy; in many branches and levels of the public sector, and especially in the U.S. military.

But despite some early successes**,** Digital Game-Based Learning is still a radical idea. It is based on two key premises that are still not fully accepted in the training and adult learning community. The first is that the ***learners have changed in some fundamentally important ways*** — the bulk of the people who are learning and being trained today, people who in the year 2000 are roughly under the age of 36 (the median age of the US corporate worker) [11] , are, in a very real intellectual sense, ***not the same*** as those of the past. As a result, while there is a great deal of discussion about "how people learn," there has been relatively little focus on how ***these*** people learn, with the exception of snide and generally unhelpful observations that often they do not (or at least not what some think they should).

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The second "radical" premise is that these "under-36" individuals are of a generation that when growing up *deeply experienced, for the first time in history, a radically new form of play — computer and video games —* and that this new form of entertainment has shaped their preferences and abilities and offers an enormous potential for their learning, both as children and as adults.

In *Digital Game-Based Learning* I will show how the immense changes in technology over the past 30 years, of which videogames are a major part, have dramatically — and, importantly, *discontinuously —* changed the way those people raised in this time period think, learn, and process information. Although to a surprising extent unremarked upon, the change, has been so enormous that today's younger people have, in their intellectual style and preferences, *very different minds* from their parents and, in fact, *all* preceding generations.

For those raised on traditional educational and training theory, it is important to realize that because this **is** a discontinuity, much, if not most of the data we have collected and the theories we have formulated in the past about how people think and learn may no longer apply. In fact, as anyone can observe, our whole learning system, which worked well for hundreds of years, is breaking down.   Perhaps the most important difference is that the "stuff" to be learned — information, concepts, relationships, etc. — cannot be just "told" to these people. It must be learned *by* them, through questions, discovery, construction, interaction, and, above all, fun.

Many of the generational change ideas presented here, which come from a variety of sources, have been explored and very cogently and expertly presented by others, in particular Don Tapscott in his book *Growing up Digital*. Part of my goal is to extend and build on Tapscott's work. As he points out so well, the N-generation, play and learning (as well as play and many other things, such as business) are beginning to come together and be one and the same, and that an important way this is happening is through the invention, creation, dissemination and use of digital games for learning and training — not just for children, but for adults as well

But an important element of this book, *Digital Game-Based Learning,* is that it is not only theoretical, about how the generations are different, but also practical, about how we can bridge the generations in the area of learning and training.

The second key piece of my thesis is that learning through Digital Games is a wave of the future. Here I am indebted to J.C. Herz and her wonderful book *Joystick Nation*, as well as her reviews of games in the Game Theory column she initiated and wrote for the Circuits Section of the New York Times from 1996-1999.

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It is becoming clear that one reason we are not more successful at educating our children and workforce, despite no lack of effort on our part, is *because we are working hard to educate a new generation in old ways*, using tools that have ceased to be effective.

No less an authority than the late Dr. Albert Shanker, head of both the New York City Teachers Union (UFT) and later the national teachers union (AFT) claimed, as far back as 1988, that "only 20 to 25 percent of students currently in school can learn effectively from traditional methods of teaching." [12]

And in 1999 John Chambers, CEO of Cisco Systems, stated "technology is moving too fast right now for companies' traditional hire-and-train methods to work." [13]

Anyone who is barely awake knows that today's kids, teens and young adults — Generations X, Y, and Z — don't relate well to traditional teaching methods.   "Every time I go to school I have to power down!" complains one student.   Corporate education and training are even worse.

Many blame the students. But as Colin Powell said to the 2000 Republican Convention, "Our children are not the problem, the problem is us!" We are all living through an immense technological revolution, yet mainstream education and training have done precious little to accommodate the new learning styles of those individuals raised on Sesame Street, MTV, fast action films, video games, Walkmen, Gameboys and the Internet. For a generation that *taught itself* computers, their approach is still the same old "***tell-test***" methodology as always. And despite the growing number of Web-based offerings, the dirty little secret of most Web-based training is that completion rates are appalling!

It's all so boring!

"The reason most kids don't like school is not that the work is too hard," ,says Dr. Seymour Papert, MIT Professor, "but that it is utterly boring!" [14]   Ditto, triple and quadruple for most corporate training!

Why is this so? Why is most learning — whether in schools or corporations, whether instructor-led or computer-based — so incredibly **un**engaging? And does it have to be the case? Although there are many points of view on this issue, it is my view that if we want to improve education, whether in schools, institutions or in corporate classrooms, it is incumbent upon us (and eventually upon the people from those generations) *to invent radically new ways of learning* that mesh with their new world, style and capabilities.

Digital Game-Based Learning is an important one of these ways. It is certainly not the only one, but it represents one of the first *effective and doable* means to alter the learning process in a way that appeals to, and excites, people from the "games generations."

Clifford Stoll, in his book *High Tech Heretic* says, "I may be old fashioned, but learning is hard work." [15]   Digital Game-Based Learning doesn't dispute this.   What is changing

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in the term "hard work" is not the "hard" part — no one seriously disputes that effort and energy is involved in learning. The change is in the word "work." Learning, as great teachers have known throughout the ages does not *feel* like work when you're having fun. The MIT Media Lab folks have a term for this, "hard fun," taken from the comment of a 3rd grader, searching for a way to describe the learning he had just done. [16] Digital Game-Based Learning can certainly be hard fun. But at its very best, *even the hard part goes away*, and it becomes *all* fun, a really good time from which, at the end, you have gotten better at something, through a process that Doug Crockford of LucasArts has referred to as "stealth learning." [17]

The Opportunities in the Digital Game-Based Learning Revolution

Digital Game-Based Learning is an alternative that is being used — with amazing and increasing success — in pockets and "skunk works" around our corporations, schools and institutions such as the military. From business simulators to pre-school "edutainment" titles, a new learning paradigm — learning via play — is gradually emerging:

- Pre-schoolers learn the alphabet and reading through computer games [18]
- Elementary students learn the K-6 curriculum on Playstations; scores rise 30-40% [19]
- Computer chess becomes a big part of K-12 curriculums [20]
- Typing games are among the top-selling software products [21]
- High schools students play a multiplayer online game to learn electoral politics [22]
- Financial traders use computer games to hone their skills [23]
- Policy makers play a Sim City-style game to understand the health care system [24]
- Business executives play at running simulated HR departments and oil refineries [25]
- Engineers use a consumer-style videogame to learn new CAD technology [26]
- Military trainees fight realistic battles in videogame-like simulators. [27]

Game-Based Learning**,** whose non-technology roots go deep in the past, has become with the rise of computers the learning wave of the future. It will soon cut across the entire population, from "cradle to grave." My goal is to show you

- What Digital Game-Based Learning is,
- Why it is different and better,
- Where it can be used, and
- How you can create and use it.

Not only is *Digital Game-Based Learning* a wide survey of what's happening in this exciting field and a manifesto of what can be accomplished, it's also a hands-on manual, since anyone — trainers, executives, educators, parents, *and especially you, the reader of*

this book — can begin using Digital Game-Based Learning on some level much more quickly than you might think.

Primary Learning - Not just for Review

An key point about Digital Game-Based Learning is that it is ***not*** just about using games for review and reinforcement. While that is an important and useful component, it has been going on for a long time, and is not what has really changed. What is new and different and gets people really excited, as Sarah Fister points out in an article in *Training* magazine [28], is that computer games can now be used for *primary (i.e. the only) learning* of *really hard subjects*, including people management, difficult-to-learn software, complex financial products, and intricate social interactions.

Digital Game-Based Learning can play an important role in learning material that is *not intrinsically motivating* to anyone, but which needs to be learned. We have all encountered material like this, from the multiplication tables, to typing, to vocabulary and language learning, to spelling, to rules and regulations. Stuff that is, in a word, *boring*. (And by the way, just to keep you out of trouble, the "B" word is typically not uttered in "corporatespeak." The PC term for this type of material, as I was summarily informed one day is "dry and technical.")

Despite what corporatespeak might dictate the material be called, companies in the business world are increasingly turning to Digital Game-Based Learning for:

- Material that is dry, technical and, yes, boring
- Subject matter that is really difficult
- Audiences that are hard to reach
- Difficult assessment and certification issues
- Complex process understanding
- Sophisticated "what if" analyses
- Strategy development and communication.

Let's look at two examples.

Case Study 1
The Monkey Wrench Conspiracy :
How to get 3 million engineers to learn (and like it)

In the Spring of 1998, I sat waiting one morning at 7a.m. in Fraunces Tavern, where George Washington gave his farewell address to his officers and reputedly the oldest restaurant in New York City. It is conveniently located right next door to Goldman Sachs, the investment bankers and financiers. Aside from the waiters setting up, I was the only person there at that hour, waiting for what I expected to be a routine breakfast meeting with a CEO interested in doing business with my company, games2train. At 7:

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15 in strode the man I was to meet. At a lanky six foot six, wearing a baggy, beige, unstructured suit and colorful tie, with shoulder length hair tied back in a pony tail and a big infectious smile on his face, Joe Costello was definitely not what I was expecting.

Costello, the CEO of a new company called think3, was bursting with energy — literally a man on a mission. A highly respected veteran executive in Silicon Valley, he had built Cadence Design Systems from sales of $50 million to over $1 billion. He had been tapped by Michael Milkin to be CEO of Milkin's new learning company, Knowledge Universe, and had started and quit within a week.   Now he had just signed on to lead a small company with a terrific new 3D mechanical drafting CAD (= Computer Aided Design) software product in its quest to capture the mechanical design market. "This market hasn't moved in a long time and is ripe for change", Joe told me, "and I like change." He was squeezing in his meeting with me before a (successful) request to Goldman for $25 million

Think3's product, *thinkdesign* was demonstrably better than the product that the vast majority of mechanical designers were using, known as AutoCAD. More like the rarified "high-end" CAD packages costing $15-20,000 per seat, *thinkdesign* allowed mechanical designers to work directly in 3D, instead of starting from the 2D drawings of AutoCAD. Backed by impatient venture capital money from Goldman and others, Costello's business objective was crystal clear — to convert as many of the 3 million-or-so AutoCAD users to *thinkdesign* as quickly as possible. His first major obstacle, the traditionally large difference in price between 2D and 3D products, was removed by his board's agreement to lower the price of *thinkdesign* to match the price of AutoCAD. But another, even more formidable obstacle remained, Costello knew — ease of learning.

Despite all the great advantages of 3D drafting over 2D, most mechanical design engineers were loath to make a change. CAD programs are extremely complex and traditionally have a steep learning curve. The mechanical designers — almost all male engineers between the ages of 20 and 30 — were extremely comfortable with AutoCAD, which they had been using for years, typically since engineering school. AutoCAD did the job for them — why change? Learning a new CAD system — especially a powerful one — would take a lot their time and effort. They would have to learn to draft, and even think, in a whole new way. (Hence the company name "think3"). Focus groups showed that most of these engineers were reluctant — and even dreaded — going "back to school" to learn a new product, no matter what its supposed advantages.

"Why is this?" Costello wondered "It just doesn't seem possible that it could be or had to be that complicated." After all, these were professional people, many with advanced degrees, who had spent lots of time in school. Learning was nothing new to them. As an engineer himself, and a former training manager for Cadence Design Systems (the company of which he later became CEO) Costello finally concluded that the engineers dreaded the training *precisely because it was dreadful*. Whether delivered by traditional instructor-led training ("ILT") in a classroom, or by newer computer-based training ("CBT") on the screen, learning a new CAD product consisted of someone starting from the absolute beginning, taking you through all the lessons, no matter what you already

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knew or how fast you could go. "In this first lesson you will learn about the workplane" the traditional training began. It would take hours and hours — or more likely days — before you ever got to do anything interesting or work at the skill level you were used to. There was absolutely no fun in it. It was just too boring to bother.

Costello was not willing to accept this as *his* company's training. He was convinced there had to be a better way, and set out to find it in the training marketplace. He soon became very frustrated. "We talked to lots of companies," he said. "We looked at the existing different kinds of training approaches and there was *nothing* out of the ordinary. It was basically essentially you had the old manual and instructor-led training kinds of approaches — get everybody in a classroom and bore them to death and hope that they stick around for lunch — and there were a few people who put the same boring stuff on CD ROMs A couple of those did what I call the 'dancing banana' effect which is put a few animations around the same old boring dry material that has little to do with teaching anybody to learn anything. And so none of this looked particularly exciting." That wasn't going to cut it for Costello.

As serendipity would have it, I had just created a "Doom-style" game for Bankers Trust's derivatives traders and salespeople called *Straight Shooter!* that had attracted some interest from the training press. [29] Joe read about the game and called, saying "Let's meet!"

So Joe and I began talking about training visions. After about half an hour of exchanging ideas we knew we were in synch. "I knew that that was the ticket," says Joe. "That this is the way to actually get the immersion, the excitement, the energy and get people sucked in long enough that they actually start absorbing some of the real material." We both realized happily we were on exactly the same wavelength. "Training should be as much fun as Doom," I had said to an interviewer five years earlier. [30] Joe and I decided we would make it so for think3.

> *"Your mission is simple, Moldy: infiltrate Copernicus. If you attempt to disable the anti-matter engine before it has been repaired, the antimatter will become unstable and …boom.…   Unfortunately you cannot bring any weapons with you. Your only tool is this small, lightweight computer. However this computer has been loaded with the most powerful CAD program in the universe.   It will allow you to construct whatever equipment you need…"* [31]

Joe and I saw our mission as simple. We would create a way to:

- Engage jaded engineers
- Let them have a whole lot of fun while they learned
- Get the engineers to learn to use the 3D CAD software without feeling they were "in school," or even learning.

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- Challenge serious game players while also drawing in novices and non-gamers
- Pull them all the way through to the end, and
- Be sure when they completed the game they were competent at using the software.

How would we do this? We would build a fantastic game — one the target market could resist starting or put down once they began. The learning would happen almost without their realizing it, in pursuit of beating the game. We would give them "stealth learning."

The design process began within a week, with a small team from both companies. In our initial brainstorming, we arrived at five key principles. First, we would try to be as contemporary as possible. Second, we would keep the pace of the game and the learning fast. Third, it was easier to teach a user to fix something than to create something from scratch. Fourth, the learning tasks would follow a consistent format so that they could be easily replaced or the order changed. Lastly, the learning tasks would be progressive, but not didactic.

Principle One led us to the theme of the game and the character of the main antagonist. (A future, outer space theme, with the player being a top secret agent on a mission to save the Copernicus Space station.) This allowed for lots of futuristic looking parts to be designed and repaired. We hired Dub Media, a consumer games graphics' house, to create a look that equaled that of the commercial games then on the market.

The "need for speed" of the audience dictated a fast moving game. Therefore, we chose to create a "Doom" and Quake" clone since our audience was going to be almost all male, and very familiar with this style of game. The player would run through the space station, encountering a series of tasks that had to be accomplished quickly in order to save the station, and requiring the use of the CAD software to accomplish them. We decided to make it a three level game, with lots of rooms, puzzles, evil robots to eliminate, etc, and to give the player only one hour of "game time" to get to the end. Miss this deadline, and the space station blows up spectacularly.

Our main antagonist had to be someone who broke things so the player could re-create them using the software. Gilad Atlas, a relatively junior team member, suggested "throwing a monkey wrench into the works", and the main character quickly became "Dr. Monkey Wrench." Though an alien, he would sport the taped-together eyeglasses and pocket protector that all engineers could relate to. Our learning game became *The Monkey Wrench Conspiracy*."

Fulfilling the final two principles — that the learning tasks would follow a consistent format so that they could be easily replaced or the order changed, and that the learning tasks would be progressive, but not didactic — proved far harder and more time consuming than inventing, and even making, the game. Our clients and partners at think3 were to a large extent teachers — the founder was a professor — from a very traditional background. Their idea of teaching was to start from the beginning: introduction to the interface, introduction to the workplane, simple lines and arcs, extrusions, fillets, and

work their way through the "textbook," feature by feature. We challenged them to come up instead with 30 "tasks" which, if accomplished in order, would lead the player from being able to use the easy features to being able to use the hard features of the program. They also insisted upon showing the player the "concepts" before they started on a task, so a short "concept movie" or AVI was created by think3 to introduce each task.

"Fire and Ice"

In only a matter of weeks, the models for the tasks were decided upon, the initial tasks created and the concept movies prepared.   We integrated the pieces into our first prototype and proudly presented it to Joe. He looked at it and thought for a while. "Fire and ice," he said gravely, shaking his head. "Huh?" said the rest of us. "The mix of learning and entertainment isn't working, he explained. "The game is fire — it's fun, fast and engaging. Then you hit the first learning task. Suddenly you're back in school. It's boring."

Joe was right. We needed to make the "learning" parts as exciting as the rest of the game. How could we do this? The answer, it turned out, was *urgency*. You had to be made to *want* to complete the task as quickly and efficiently as possible in order to get on with the mission. How do you create urgency? It turns out there are professionals at this — they're called Hollywood scriptwriters. So we hired one. Immediately out went the "You will now learn the following three things," and in came "Come *on* Moldy, you've got to do this or we're *doomed*." The words "objective," learn," and "know how to" were banned, replaced with imperative action verbs like "build," "get through," repair," and "rescue." The concept videos introducing tasks were cut from 3 minutes to a maximum of 30 seconds, and began with "OK Moldey, here's what you need to know to do this." Wordy instructions were cut dramatically and spiced up with integrated video clips that showed how each thing was done. Later testing revealed that most users hardly ever read the text at all.

We knew we were on to something even before the field-testing. People in the company were bringing the alpha versions home ostensibly to show to their girlfriends and spouses, but really to ask their friends for hints on how to beat the game.

The Monkey Wrench Conspiracy was released in the fall of 1998, to critical acclaim from the engineering community. It was distributed as a separate training disk — the *only* training — with the *thinkdesign* product, under the educational heading "think fast."

Costello's strategy with *Monkey Wrench* was both a learning strategy and a marketing strategy as well. He was convinced that the game could, in fact, sell the product, especially to engineering students who were still forming their tool preferences. Through the creation of a demo version — two levels instead of three — that could fit on a single disk along with a trial version of the actual *thinkdesign* product, the demo disk was bundled into sixty thousand copies of Cadence magazine, the mechanical design industry standard. The next print run was two hundred thousand.   Then another two hundred thousand, followed by translation into Japanese and other languages. A year later, there are close to a million copies of the game in print.

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Built into the disk was a request for feedback, via the Internet, from anyone who completed the game. Think3 set up a special part of their Web site — *The Monkey Wrench Zone* — and posted all the returns along with comments, along with responses to all queries from Dr. Monkey. Wrench

Some raved:
"I can't wait to play level three. The first two were so cool. Thank you once again," wrote Tim Davenport.

"Okay I am once again stuck. Yeah I can't play other games either sue me >;-) I have level 3 and I have 29 of the 31 parts. However the door is locked to get to the only part left that I can see. … How do I get through the locked door?? And will the 31st part show up after I get the 30th part?" wrote Mary Northrup. To which "Dr. Monkey Wrench" replied "The very last task is not available until after you defeat me, Dr. Monkey Wrench! In order to get by the locked door, you need to go to the bridge and look for 3 buttons on a wall. Choose wisely because 2 of those buttons are boobytraps. Muhahahha!."

How much like traditional technology training does *that* feel?

One of the most interesting postings was a letter from a father, who related the experiences of his 8-year-old son Aaron:

"A few weeks ago I received a CD containing Monkey Wrench and thinkdesign. I loaded the software on one of our PCs at home and asked my 8 year-old son Aaron if he would like to try it out. Of course, he loves video games so he jumped at the chance. …Well, we were not disappointed. Not only was the *Monkey Wrench* game a lot of fun, but the tutorial was excellent and Aaron was happy as a clam playing the game and learning how to design in 3D. …. He became so excited, about learning to design whatever he could imagine, that he told me 'this has changed my life.' 8 year-olds have a penchant for overstatement, but it was obvious that he was hooked." [32]

One reason this is interesting, says Costello, is that "people said that 'this is too hard for my people to do.' If a 3rd grader can figure it out than probably anybody can figure out how to learn 3D. We've had that experience. We've had dyed-in-the-wool 2D draftspeople who've tried 3D products before without success, pick up *Monkey Wrench*, and within 30 days they're up and going. They're making progress in learning, having fun, feeling good about themselves, and learning a new way to do things." "Customer response has been universally positive to *The Monkey Wrench Conspiracy,"* says Art Ignacio, Director of Educational Operations. "Whether it's in Japan, Italy, North America or Singapore, customers really like the idea of turning games into learning tools."

So what makes the game so successful? It is, as we shall see, the combination of the two powerful factors that make *all* good Digital Game-Based Learning a success. Those factors are the *motivation of the game*, which pulls you into the learning without your

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really realizing it, combined with a *learning methodology* that is fast, effective, and definitely *un*-school-like. "Let's face it, this is a far more inspirational and effective alternative to inches-thick manuals and tedious, text-heavy computer-based training manuals," says Costello.

For those interested in design, *The Monkey Wrench Conspiracy* is an example of what I call "loosely-linked" Digital Game-Based Learning (see Chapter 6). A templatized, task-based learning methodology makes it both easy to learn the material and easy for the makers to change the learning tasks as the underlying product evolves. The "twitch-speed" videogame part gets the player's adrenaline flowing, provides context and motivation for the tasks, and is a reward after each task has been done. What makes this format interesting is that both the tasks and the game can be updated separately. People inside and outside think3 are continually creating new learning tasks using the game format, which can be easily integrated into the game. And as technology evolves and the initial game becomes less "state-of-the-art," the same tasks can easily be integrated into a new and better game. This Digital Game-Based Learning approach is ideal for open-ended, task-based content. But, as we will see in the course of this book, Digital Game-Based Learning can take a wide variety of approaches for different goals, content, audiences and budgets. So let us examine another approach. (For more on *The Monkey Wrench Conspiracy*, see Chapter 9).

Case Study 2
In$ider: How to be sure the people who audit the books get it right (and like it!)

Remember the old saw: "What's an accountant? — an actuary with a sense of humor!"? CPAs, and auditors in particular, are not known historically for having fun. But to paraphrase Bob Dylan, as we will show in detail as the book progresses, *in these times, the* people *are a-changin'*. Today's average corporate auditor is 24 [33], and was possibly using a joystick before ever picking up a pencil. In fact, "sharpening your pencil" is a reference — much like "dialing" a telephone — that many of today's auditors, whose only sharpening is of their computer skills, might not even get.

The world of today's young accountants, like the rest of its generation, moves at "twitch speed." Changes in the ways corporations finance themselves and manage financial risks require auditors to have to learn whole new complex areas, often practically overnight. A great example is financial derivatives. Invented by, and long the exclusive province of the "rocket scientist" traders and marketers at the world's top financial firms, in the 1980s and 90's they began finding their way into more and more corporate financial structures, posing a series of difficult learning challenges.

First, people at the sellers needed to know more about these arcane and complex products, beginning with the marketers. Everybody inside companies like Bankers Trust — a derivative hot-shot in the 80's and early 90's — was eager to learn more about them. But the knowledge was scarce, and the ability to teach it even scarcer. Pulling the

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"rocket scientists" off the trading floor to teach was unthinkable — they were minting too much money for the firm. So at one point in the 90's Bankers Trust Company paid a consultant $10,000 *per day* to give one-week derivatives courses, offered several times a year to long waiting lists. Nice work if you can get it!   It did the trick — this was an audience who *wanted* to learn the stuff — but at an enormous cost.

Next came the buyers of derivatives — typically corporate treasurers and CFOs. Derivatives are risky products, which can either lead to enormous profits if you bet big and guess right (e.g. on the direction of interest rates) or to enormous losses if you guess wrong. Used properly they can reduce risk; used improperly they are wild speculation. Relatively few corporate buyers had a sophisticated understanding of the way these products worked and their risks. So sellers, like Bankers Trust, tried hard to train their clients — traders at Bankers created game-like simulations to illustrate exactly how derivatives could hedge corporate risks (see Chapter 9). Played by small groups of potential clients at corporate off-sites at fancy hotels they helped, but they only reached a small audience, and derivatives were difficult products. The lack of buyer knowledge about derivatives eventually caused enormous losses, scandals, and pain for both sides. At Bankers Trust, stock selloffs as a result of lawsuits brought by customers literally halved the market value of the bank, and was a factor that led to its eventual sale and demise. At the buyers, many financial officers lost their jobs. Finally — after eight years of study by the various regulatory agencies — in January 2000 the US government finally stepped in, making it mandatory that derivatives be disclosed in all US corporations' official financial statements in order to give a truer picture of risk. [34]   Other countries have passed similar regulations. Derivatives must now be "on the books." Uh oh! Here comes the third — and by far the biggest — derivatives learning challenge. All corporate *auditors* have to understand how derivatives work, and fast. Scramble time at the accounting firms!

Fortunately, back in 1997, Paula Young, European Leader for Learning technologies at the global accounting firm PricewaterhouseCoopers (actually then just Price Waterhouse), saw this situation coming. She knew it would be a big problem for the firm, since derivatives would be a really "hard teach" for a number of reasons. The number of people to be trained was large and decentralized, over 15,000 auditors scattered all around the globe. The subject matter was extremely complex dry and technical, and expertise within the firm was extremely scarce. Plus the time to prepare was relatively short — the regulations would be around in only a year or two.

Even more importantly, Paula realized that the auditors who were going to have to know and apply the information on derivatives were not the firm's 50-year-old partners, but the twenty-something guys and women on the firm's auditing front line. Those employees were all from the "twitch" generation, highly competitive, and fast moving. Even if expensive rocket scientists *could* be found to teach classes on derivatives, those people were unlikely to sit still long enough to get much out of them. Not to mention that the *cost* of doing it that way— 20 people in a room, x 1000 x 5 days x $5,000 per day (let's be thrifty) plus the expense of flying people around — could potentially reach over $100 million! The answer was clearly a technology-based solution, but Paula had also seen her

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share of boring online training and had no intention of doing any of what she calls the "click and fall asleep" variety.

Mulling on this problem, Paula, — a near-Londoner schooled in Wales whose academic and professional background includes communications, psychology, TV, film, and videodisc-based training — had an idea. In fact it was more than an idea it was a vision. "The light bulb went off," she says. Paula's vision was of computer games and movies, and of an engaged group of PricewaterhouseCoopers (PwC) auditors learning for hours, pulled forward by the factors that make those two entertainment media so compelling — challenges, storytelling, characters, music, "something at stake", and "inciting incidents" that you want to help resolve. In that moment of vision *In$ider,* PwC's pioneering Digital Game-Based Learning project, was born.

Paula, now the excited evangelist, eagerly took her vision to the partners — to little effect. "I just had this idea in my head," she says. "Nobody I talked to had a clue of what I was going on about at all." Yet here's the story's ending: two years later, just as the new derivatives regulations were coming into effect, hundreds of PwC auditors a day were flying through Paula's year 2030 3D world to go to work at Gyronortex, "an intergalactic mining company in the central zone," and loving the experience. The Digital Game-Based Learning application *In$ider* was a worldwide success, with 20,000 copies in print, orders coming in daily from offices from Bejing to Bermuda, and other companies —including sellers of derivatives products — considering purchasing it. This to be trained on some of the driest, most boring subject matter imaginable.

How did it happen? How did Paula convince the 50ish partners in PwC to invest close to $3 million for "entertainment?" How did she combine the entertainment with the learning? And how did she get it done? Stay tuned… (see Chapter 9).

The Promise of Digital Game-Based Learning

Here, then, is the promise of Digital Game-Based Learning:
- That motivation can finally be found for learning the subjects and content that are the most difficult to teach or train — either because they are extremely dull and dry or extremely complicated, or both, and to get people to train themselves.

- That small groups of trainers, teachers, content experts and game designers working together can create experiences that will radically improve the learning, and ultimately the competence and behavior of thousands, and potentially *millions* of learners — not only whole companies, but whole industries, whole grade-levels, even whole countries and populations, and that this will ultimately affect the market value of companies, and perhaps even nations.

- That the free market will create — through a user-evaluated process of marrying the engagement-driven, experience-centered, "fun" approach of the interactive entertainment and games world with effective techniques for teaching the

material, facts, concepts, skills, reasoning and behaviors that students and workers are required to learn — a phenomenon of highly effective learning "hits," that move through target populations at the epidemic speeds of best-selling novels, movies or games, leaving a lasting educational impact.

- That eventually any individual trainer, teacher or educator will have at his or her disposal the tools and colleagues to work with to *create* such phenomena, and that "talent will out," with successful, effective instruction no longer being confined to those a single fantastic teacher or trainer can reach in person, but to all the learners in his or her entire potential target market, worldwide. Such target markets could be all sales people, all managers, all third graders, all elementary school students, all math students, all college-level chemistry students etc.

- That, consequently, there will be training and learning brands based not just on publishers, but also on authors and designers, subjects and styles, as there are in books, movies, and games.

- That this user-driven learning phenomenon will be not only move from company to company and school to school nationally, but will be worldwide, like movies and videogames.

- That the Web, the Internet and Intranets and its successors, will not just be the conduit for boring education and training courses that people are forced to take or force themselves to suffer through, but a competitive forum — much like the games and movie businesses — where talent, creativity and the ability to hold the audience and deliver a compelling experience is what wins, where the best combination of game play, learning methodology and "eye candy" is what is being sought.

- That we will have a learning world, like the games and movies worlds of today, where there are both "classic" learning hits and exciting newcomers; where a plethora of magazines and reviewers cover what's in development and help learners choose the very best; where makers create their experiences with the goal of holding their audience and being successful in learning, and thereby making money and attracting capital; and where learners look forward to the next release as eagerly as they wait for an upcoming game, console or movie.

All this is not only possible, but it is definitely coming. Some of it is already here.

The Key Messages

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To readers of this book, here are the messages you should leave this chapter thinking about:

- If you are a <u>business executive, school administrator</u> or anyone involved in spending money to bring people — adults or kids — to a higher level of learning, there *is* a newer, better way available. While it is neither a panacea nor the only way, it behooves you to consider it seriously and invest a significant portion of your resources in this direction.

- If you are a <u>trainer or teacher</u>, your students will *not* have short attention spans for learning if the approaches you take really engage them. It is possible to get learners of *all* ages *totally* involved in learning *any* subject matter, and tools are increasingly available to help you do this. Using them may, however, mean re-thinking much of what you believe about teaching and training.

- If you are a <u>student or trainee</u>, don't despair; relief is on the way. The days of sitting bored to tears in classrooms or in front of a boring computer or Web-based training screen are numbered. If you want to make things better faster, seek out and lobby for the approaches described in this book. You and your fellow learners will be glad you did!

Marc Prensky is an internationally acclaimed thought leader, speaker, writer, consultant, and game designer in the critical areas of education and learning. He is the author of Digital Game-Based Learning (McGraw-Hill, 2001), founder and CEO of Games2train, a game-based learning company, and founder of The Digital Multiplier, an organization dedicated to eliminating the digital divide in learning worldwide. He is also the creator of the sites <www.SocialImpactGames.com>, <www.DoDGameCommunity.com> and <www.GamesParentsTeachers.com> . Marc holds an MBA from Harvard and a Masters in Teaching from Yale.   More of his writings can be found at <www.marcprensky.com/writing/default.asp>. Contact Marc at marc@games2train.com.
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