An Academic's Field Guide to Electronic Arts

Observations based on a residency in the spring semester of 2004

Randy Pausch

**Professor of Computer Science, HCI, and Design
Co-Director, Entertainment Technology Center
Carnegie Mellon University
etc.cmu.edu
pausch@cmu.edu**

Executive Summary

The Studios at Electronic Arts (EA) have future staffing needs for more than 1,000 new hires each year, and EA would like to fill 75% of these positions with university graduates. EA currently fills only 10% of new positions from universities, traditionally preferring to hire people with industry experience. Many universities have expressed a desire to train people for employment at EA; in that spirit, I spent the spring semester of 2004 in residence at Electronic Arts educating myself about their needs. This document contains my observations about EA, tailored for an academic audience. I conclude with curricular recommendations for a two-year Masters-level curriculum containing students from different undergraduate backgrounds. I discuss what has worked at Carnegie Mellon's Entertainment Technology Center and what might work in a more traditional setting.

Facts academics should know about EA:

- EA plans to fill over 1,000 positions/year in the near future.
- EA has traditionally hired 10% of new hires from universities and wants to increase that number to 75%.
- Making games at EA is a team sport: between 20 and 200 people work on each game.
- EA is a huge company, bigger than Apple and Pixar combined. EA has a $15B market capitalization and $3B/year in revenues.
- EA is a ruthless meritocracy with a brutally honest culture, especially for critique and feedback.
- One of EA's major strengths is in management of people and process.
- The largest sin at EA is not delivering your game on time.
- EA has a very young, energetic work force.
- People at EA work long hours, in large part because of their great passion for making games.

Specific recommendations for creating a masters program are:

- Focus the curriculum on interdisciplinary, team-based projects
- Establish internship and/or co-op opportunities for students
- Get students to appreciate other disciplines' talents, vocabulary, and values
- Give students practice in creative problem solving with real constraints
- Teach students about project management, preferably by having them do it
- Hire faculty with real industry experience
- Make students finish something to a real quality standard
- Cover the "soft skills" of interpersonal interaction, public speaking, writing, etc.
- Create mechanisms to help you correct your curricular mistakes as quickly as possible

The Context for this Document

I am a Professor of Computer Science at Carnegie Mellon University. In 1997, Drama Professor Don Marinelli and I founded the Entertainment Technology Center (etc.cmu.edu), which offers the two-year "Masters of Entertainment Technology" degree, jointly conferred by the School of Computer Science and the College of Fine Arts. Our center has a very strong relationship with EA: they hire approximately 40% of our graduating class each year, and have a commitment to hire at least 10 summer interns each summer from our center. In the fall of 2003, EA expressed an interest in having faculty spend time in residence to help establish their relationships with academia. Having done a sabbatical with Walt Disney Imagineering in 1995, I took this opportunity to educate myself more about EA's internal processes. I spent the spring semester of 2004 in residence at the Redwood Shores facility, where corporate headquarters, publishing personnel, and studio personnel are located.

It immediately became clear to me that neither EA nor academia have any real understanding of how the other operates. This document is intended to educate academics about EA, how it operates, and what its real needs are. I conclude with descriptions of the Carnegie Mellon ETC curriculum and a design for a more traditional approach. I also recommend the IGDA curriculum framework described at http://www.igda.org/academia/ .

The work in residence was done under full NDA, but this document has been cleared by Electronic Arts for public distribution. Much of this report is based on in-person conversations with EA employees, as well as my direct observations. I was given access to everyone I asked to meet with, and I thank EA and its personnel for being so gracious with their time. Like any visitor, I saw a subset of the corporation through a particular prism, but I believe my view, whatever its limitations and flaws, will be useful to academics interested in how to prepare students for EA.

Basic Facts about Video Games & American Culture

Most people reading this document have probably heard the statistic that the U.S. video game market is the same size as the domestic box office[1]. Video games are indeed big business. A typical high-end game can cost tens of millions to develop, market, and distribute, but a hit can make hundreds of millions in revenue. A typical console (e.g. Playstation 2) game sold at retail costs $49. There can be lots of variation, but here is an approximate breakdown of where that $49 goes:

Retailer keeps	$17
Console manufacturer gets	$8
Marketing & distribution	$4
Publisher/developer split	$20

---

[1] That is a slightly "trumped up" statistic: it includes all the hardware console dollars and ignores the video sales of movies.

Modern games are highly complex engineering accomplishments; games can easily be over a million lines of code and most programming is done in C or C++. Consoles, rather than PCs, dominate the economics. Since consoles last approximately five years the industry is on a five-year economic cycle. In 2004, we are nearing the end of a cycle that has been dominated by the Sony Playstation 2; within the next two years both the Playstation 3 and the Xbox 2 are anticipated.

I continue to be amazed at the cultural impact of video games and how age-stratified it is. When I told college-aged students (especially male ones) I was spending a semester at EA, they lit up like Christmas trees. When I told people over 35, especially academics, I was spending a semester at Electronic Arts, the most common reaction was "What's that?" Video games have now captured the imaginations of our youth, and EA is a major beneficiary of this; many students want to work for EA because they grew up playing EA games. A good cultural icon for this phenomenon is to remember that while the previous generation grew up wanting to be on the Wheaties box, modern athletes yearn to make the cover of games like EA's *Madden Football.*
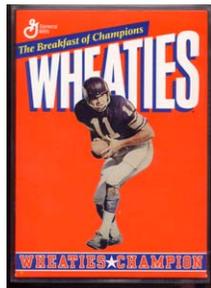
Icon for previous generation   **Icon for current generation**

Basic Facts about Electronic Arts (EA)

 EA was founded in 1982 and has been publicly traded since 1991. In North America, EA has major studios in Redwood Shores, California (Silicon Valley), Vancouver, Orlando, and Los Angeles. EA has grown both organically and through acquisitions. For example, EA acquired the Orlando studio, called "Tiburon," (maker of *Madden Football*) and the Maxis studio (maker of *the Sims*) (previously located in Walnut Creek, CA and recently relocated to Redwood Shores).

Sometimes EA both develops and publishes a game, and sometimes EA publishes games made by other developers, through the "EA Partners" program. Working with an external studio as the publisher gives EA a good opportunity to decide whether or not to acquire that studio. EA makes and publishes games in most genres, such as

Leaders in Market Capitalization	
Microsoft Corp [MSFT]	$270.2 B
Oracle Corp [ORCL]	$61.9 B
SAP AG [SAP]	$47.1 B
Computer Associates International Inc [CA]	$15.6 B
Electronic Arts Inc [ERTS]	$15.5 B
Symantec Corp [SYMC]	$14.4 B
Softbank Corp [SFTBF.PK]	$14.3 B
Veritas Software Corp [VRTSE]	$11.5 B
Infosys Technologies Ltd [INFY]	$11.1 B
Adobe Systems Inc [ADBE]	$9.4 B

Figure 1: By market cap, EA is the fifth largest software company.

4

sports games, racing games, first-person shooters, simulations, etc. EA publishes a very diverse portfolio, with approximately 70 titles each year. (For example, each Sims "expansion pack" is a separate title.)

EA has a market capitalization (number of shares of stock times the current stock price; basically, what it would take to purchase the entire company) of over 15 billion dollars. When I checked, it was the fifth largest publicly traded software company in the U.S. (See Figure 1). EA stock has out-performed Microsoft stock roughly by a factor of two in the last 14 years. In Figure 2, EA stock performance

Figure 2: EA Stock Performance (ERTS) vs. Microsoft (MSFT) and the NASDAQ index (IXIC).

(ERTS) is shown in blue, and Microsoft (MSFT) is shown in red. To see how good these investments were, note the NASDAQ index (IXIC) in green and the tiny blip in 2000 that was the "dot com" bubble. The day I started my residency at EA, I calculated that a dollar invested in Microsoft 14 years earlier would have been worth $40. That same dollar, invested in EA, would have been worth $80. Most Computer Science professors don't think of EA (or other game companies) as big software companies, but we should. For example, EA's market capitalization is 50% bigger than Adobe's. (Table and Figure from www.yahoo.com).

In terms of revenue, EA now makes roughly 3 billion dollars/year. That makes it one of the largest software companies in the world. Interestingly, by revenue three of the ten largest software companies are in the video game business, four out of ten if you count Microsoft.

2003 Net Revenue By Platform

EA's fiscal year runs from April 1 to March 31, and in FY 2003, EA had 22 titles that sold over 1 million units. A hit
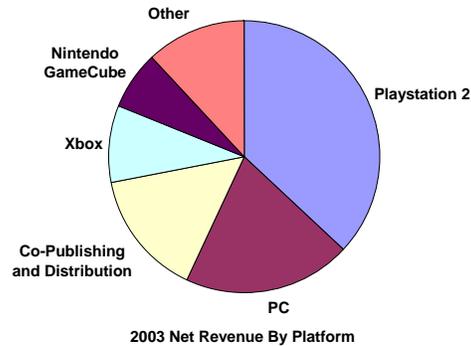
Figure 3: EA's revenue, by hardware platform.

game can sell over five million units. At $50 a copy, that's $250 million in revenue. EA publishes on all major platforms and is platform agnostic (See Figure 3). EA has over two billion dollars in the bank, and roughly half its revenue comes from outside the U.S. (Just as Madden football is big in the U.S., FIFA soccer is huge outside the U.S.). Figure 4 shows net revenue by geography (All revenue figures are based on data from NPD Funworld).

5

The most important statistic to most readers of this document is that EA will be making on the order of 1,000 or more new hires each year, with a goal of having 75% of those come directly from universities.

EA Corporate Culture

EA is structured into three large components: corporate (legal, finance, etc.), publishing, and studios, with obvious operational overlap. This document concerns the studios and their culture, although some aspects of corporate culture are also relevant.   EA is a favorite of Wall Street partially because of EA's consistency of EA's earnings growth and the absence of surprises. As with all

EA 2003 Net Revenue By Geography

Japan 3%
Asia Pacific 4%
Europe 35%
North America 58%

Figure 4: EA's Revenue by Geography

corporations, quarterly earnings reports are important events, and EA obviously cares about return on investment (ROI). In fact, some games are killed early in production when it is projected they will make money, but not enough money -- after all, the resources, especially people, working on that project would be better allocated to a title projected to have a higher ROI.

EA deeply wants to be viewed as an entertainment company, not a software/technology company. They believe this would increase the value of their stock because, by the standards of entertainment companies, EA produces revenue very reliably. Moreover, there is a nagging sense of frustration that EA is not given enough respect by either Wall Street or the man on the street: companies like Pixar and Apple have much greater name recognition amongst those over 40, but in fact, EA is substantially bigger in market cap than Pixar and Apple combined!

Probably the most surprising thing I learned about EA is that its leaders, including its creative leaders, describe it as a packaged goods company like Procter and Gamble or Nabisco. This makes sense: EA makes a product that goes into boxes and is sold at retail, so it certainly **is** a "packaged goods" company; nonetheless, I found this an excellent way to reorient my way of thinking about the company. Management frequently talks about Stock Keeping Units (SKUs), which refer to the unique product identifier when the package is sold at retail. For example, a game shipping in five languages, on both the Playstation and Xbox, would have 10 SKUs. The portfolio of products and the management of that portfolio's balance and growth is a top priority for management. Even the rank and file understand the importance of the business aspect: as one executive put it, "We all agree that commerce defines success." Although EA's marketing muscle is undeniable, the one variable that correlates best with sales is quality, one mechanism used at EA to assess quality is the review site www.metacritic.com . Games depend much more on word of mouth and intrinsic quality than movies; films can

use tricks like denying critics advance screenings, advertising heavily, and "opening on many screens" to get a big gross sale before word of mouth kicks in, but games cannot. Consumers pay over five times as much for a game as a movie ticket, and they are expecting to invest fifty hours, not two.

When preparing students for EA, the most important thing to know is that EA is a ruthless meritocracy. There is no better place for a bright, hard-working person, but mediocre performers are not tolerated. So, as they say, "play hard or go home." Educational programs intended to prepare students for EA should establish high quality standards and push their students hard. EA may "need lots of bodies" in the coming years, but they only want the best.

EA rewards its workers well and still gives stock options in the classic Silicon Valley way. Anyone who has been at EA long enough and in a high enough capacity probably doesn't need to work for the money, and they are called "volunteers." On some cubicles there is a sign saying "DFWMIFV: member since 4/1992" -- that stands for "Don't Fool[2] With Me, I'm Fully Vested." However, there seems to be little or no deadwood. Some people leave when they no longer need the money, but those who stay are still passionate about making games.

Early on, a Carnegie Mellon student said about an internship, "I really learned the value of having a good manager." I've heard many students say that, but only after they've had **bad** ones. This student was relaying the opposite; he had learned the value of a good manager by having a **good** manager. In fact, there are many good managers at EA, because management is highly valued. EA excels at making games, in part because it treats game making as a management exercise every bit as much as a creative exercise.

While the corporate and publishing divisions have fairly stable processes in place, the studios are constantly changing processes, as is the case everywhere in the video game business. Even what one might think of as "mundane" aspects, such as the art pipeline (the process of creating art and getting it into the run-time engine) are highly variable across projects and sometimes even within a project. Processes tend to be highly optimized for current, local circumstances and to change rapidly. EA does almost no R&D, as a university would describe it, and there is no publication of papers. In terms of technology, I was surprised to learn that EA only holds about a dozen patents. It has not historically protected intellectual property (IP) via patents but is becoming more interested in doing so. EA is currently ambivalent about the open source movement; one of their major concerns is that if it uses open source code, that the code's "openness pedigree" be unassailable, to avoid later claims of ownership.

EA is a brutally honest culture. As stated above, it is a ruthless meritocracy. If employees are good, they will be given challenges, a career path, and a chance to grow. If they are not performing, they will be told so in no uncertain terms, given a chance to improve, and fired if they don't. This brutal honesty and feedback is part of the culture of consistently making successful games. Much of this happens in the famously brutal

---

[2] Okay, "Fool" isn't what it really stands for, but you probably already guessed that.

project reviews that senior management periodically conducts of each title in production. Schools preparing students for this culture need to prepare their students to receive unadulterated feedback in pressure-laden situations.

Each EA studio operates relatively autonomously, with a "World Wide Studios" component that oversees all the studios. This worldwide component, for example, is where people like the Chief Technical Officer are housed. The members of the World Wide Studios are relatively few, and almost everyone on the studio side is not only within a specific studio, but works on a specific title, which is a profit and loss center. As a result, much of the control is highly de-centralized; the EP (Executive Producer) of a title is really running a small company, in terms of authority. Management above the EPs -- the Studio Heads and General Managers (GMs) -- act as centralized management that allocates resources between projects. EPs make their case to higher ups to get more resources. One of the things that EA is best at, and is not an option for their smaller competitors, is shifting staff power from one title to another if a title is falling behind schedule.

The studios at Redwood Shores, Vancouver, and Orlando are all nice work locations with attractive physical spaces including cafeterias. The Redwood Shores campus sports a high-quality gym, four-story atrium and a large "campus green" where people play soccer or Frisbee at lunchtime. Internally, the spaces tend to feel like Intel: it is a cubicle culture (the CEO has a standard-size cubicle, just as at Intel) but with a physical layout to encourage more communication. The Los Angeles Studio is in later stages of construction and is intended to be a top-notch facility with gym and other amenities.

The largest sin at EA is not delivering a title on time. Predictability is a key virtue to management, and control of process is crucial. When I asked, "what is this company's comparative advantage vs. other video game companies?" The most common answer was "we are better managed than our competition." The video game business is very time sensitive; many titles are timed to ship in time for Christmas sales, sports titles are tied to the season opening of sports, and movie titles must release in time frames corresponding to the movies. Making an outstanding game, but delivering it late, is not as profitable as making an acceptable quality game on time. EAers talk about "maximum on-time quality." EA veterans say that the major reason games ship late is due to a lack of focus in the design vision: "games are usually late because the development team doesn't know what it is building."

EA is a young company; I am 43 and I felt absolutely ancient during my time there. Employees over 50 are rare, even in senior positions. Ironically, they feel that the company is aging; 10 years ago, the median age was probably in the mid to late 20s. Although it is now higher, EA still feels a bit like *Logan's Run.*[3]

---

[3] *Logan's Run* is the 1976 Sci-Fi movie (and Farrah Fawcett's screen debut) about a society where everyone is killed on their 30th birthday to maintain the ecosystem. Adding insult to injury, most EA employees are too young to have seen this film in its theatrical release, and didn't know the reference. Did I mention I felt ancient while at EA?

If there is anything that is clear at EA, it is that the rank and file employees are absolutely passionate about making video games. They have grown up playing games, and for many this is truly their dream job. On the university side, we have seen this phenomenon as well; most grown ups do not realize how emotionally strong the draw is to this career path. The employees at EA are extremely proud of the quality of the product they make, and many talked about how good it felt to see it on a store shelf, much the same way people who make movies feel seeing their product in the theater.

From the management perspective, it is clear that EA is extremely good at franchise management, brand management, and watching the bottom line. EA has released yearly versions of some titles, like Madden Football, for over a decade. Each year, the franchise title has some new "hook," (such as a new special effect, or the updated database of players on each team) and the company reaps a revenue stream by updating an existing product.

EA is an **extremely** disciplined company, especially by the standards of a video game company. Its founders and leaders were and are an interesting mix of gamers and MBAs, and this company is a for-profit company that takes its management seriously. Two quotes came to mind from interviews: "EA has a lower capacity for self-delusion than other video game companies," and "we are good at killing our pet projects if they don't progress rapidly enough."

Many key personnel at EA did not attend college. In other companies I have dealt with, this leads to a devaluation of college (as in, "I didn't need it, so nobody else does.") At EA, they are more likely to say "Yes, but I did it when games were smaller and simpler; nowadays, the education is really important. However, what matters is the education, not the reputation. Several times, I heard stories from hiring managers about the "insufferable arrogance" displayed by students from highly prestigious universities. At EA, it's definitely what you learned that matters, not the "brand name" of where you learned it.

EA has a very strong sense of ethics, both in terms of corporate behavior, such as accounting, as in terms of the product they make. The party line is that Larry Probst, the CEO, "won't make a game he can't play in front of his mother." EA was one of the early adopters of the rating system, feeling it was both socially responsible and prudent business practice. EA believes that the center of the market is where the money is; while not a perfect analogy, one could say that EA is a little like the "Disney of the video game business" in that regard.

EA, like Intel, is a very paranoid company; there is no sense of resting on their laurels or of taking anything for granted. They are well aware of what they perceive their weaknesses to be. My personal perception is that major concerns for EA should include:

1) EA's major innovation is more likely to be in technology and the process of game creation, rather than game play, story, etc. EA tends to license rather than internally generate IP ("intellectual property") for characters and stories.

2) There are many cases where local vs. global control of resources seems to be over-optimized for the local case. For example, if a student does a summer internship with title A and does an outstanding job, if title A is not hiring the following May, that student has no real leg up getting hired at EA, although EA has valuable information about the student's ability to perform at EA.

3) EA has almost no internal knowledge of how universities operate; only 2 of their 4,300 employees have ever been on tenure track. I spent a lot of my time at EA helping educate their personnel about how universities operate. This is important, because in order to achieve the goal of 75% of new hires coming from Universities, EA will need to interface more closely with the university culture.

One topic I have explicitly not addressed is the issue of gender. Clearly, volumes could be written on the topics of how to get more women both playing and making games, and EA clearly wants to have more women doing both, but a detailed investigation of this simply wasn't possible with my limited time. When the Executive Producer of "Lord of the Rings: Return of the King," Neil Young, states that his team was 22% female and receives cheers, it is both a triumph and a reminder that EA, like the entire video game industry, is currently a heavily male, testosterone-laden culture. Two gender-related points I will make in passing: First, "The Sims" is the all-time best selling game and it is roughly 50-50 by player gender. Only time will tell if this is the key to the future, or merely a fluke.   Second, recent surveys have shown great increases in female game playing, but those are mostly middle-aged women who are "casual" gamers, such as at MSN, Yahoo, or Pogo; there is no evidence these women have any interest in crossing over to console or PC gaming.

EA's biggest challenge is the dramatic increase in team size. There are other grand challenges in terms of game design and content, for example, how to get greater emotional involvement with games and characters, but the biggest challenge is clearly management of large teams.

How Games Are Made

Team sizes at EA have been constantly growing. During the lifetime of the PS2, team sizes have grown from a typical game requiring 20 people to a typical game requiring 100, and some games have employed over 250 people during the total development process.   Teams begin small; a pre-production team tries to identify the core essence of a game and distill it into what EA calls the **"X" factor for the project: a pithy statement that will keep both the development team and the publishing/marketing team focused.** Example X factors:

- Lord of the Rings: "Live the Movie"
- Medal of Honor Rising Sun: "Step into the boots of a WW II soldier and survive the chaotic attack on Pearl Harbor"
- FIFA Soccer 2004: "Off-the-Ball Control"

One EP said that the key question to ask during pre-production is "What kind of fantasy experience will we provide?" An early chore for the pre-production team is to build a

"vertical slice" that goes to full depth and acts as a demonstration of concept that the given approach is viable. The key objective is to "remove innovation" so that the later parts of production can proceed in a highly productive, parallelized fashion. Developers fall into trouble when they have to innovate and/or do design work in parallel with production of large amounts of content. There can be many layers of early prototyping, and the goal is to make these prototypes feed into the eventual game that is built rather than be throwaways. The prototypes also provide a valuable mechanism for making time estimates for creating the full game.

One of the biggest challenges for EA is the centralization of tools and technology; currently most titles "fend for themselves," with very little code reuse across EA's portfolio. (There is more code reuse in the Vancouver studio, especially amongst the various sports titles). As games become more complex, finding ways to leverage effort across titles is a major focus for EA, but it is both a sociological and a technical challenge to do so, especially since the career reward structure is heavily based on each individual title's performance.

Useful things to know about technology at EA:

- I always felt badly that our "pipelines" (how 3d models are created, skinned, animated, and brought into a run-time engine) at Carnegie Mellon were messy and fragile. I no longer feel guilty; EA has as many pipelines as projects, and they are highly ad-hoc and painful to maintain.

- Programming for consoles is highly skewed by dealing with a powerful CPU surrounded by a small, slow main memory.

- Most programming is done in C or C++. Many different scripting languages, some locally developed, are used: LUA is the closest thing to a commonly used scripting language.

- Projects use source control systems, but there's no company-wide standard system.

- There were no surprises to me in terms of the tools they use: MAYA, Softimage, Alias, Photoshop, etc., plus many internal, proprietary tools.

- An accurate bug database is crucial to the success of a game. One title I learned about had a 14,000 bug database entry; it is not uncommon to have thousands of "known shippable" bugs on a title, which are mostly obscure and unlikely to be seen by typical consumers.

Jobs at EA

Making games at EA is a team sport. I cannot overestimate how many times this point was made to me, basically in every conversation I had. EA needs employees who can work in teams and communicate well within their discipline and with people

from other disciplines. Technologists almost never fail to advance in their careers due to lack of technical skills; it is nearly always a deficit of "soft skills" that hold them back. Public speaking is also crucial in both formal and informal settings if one aspires to move upward into the management chain.

EA employees must be willing to work very hard. EA is interested in top performers and rewards them handsomely, but mediocre performers will not be happy for long at EA.   This is a company that is so honest that its previous goal statement of "Be the #1 People Company" was amended to "Be the #1 Company for High Performing Individuals and Teams," to reflect this concept. As is the case with many publishing-based businesses, there are "crunch times" with long work hours before deadlines, followed by "down times" after those deadlines are met. I believe EA would like to reduce both the length and severity of crunch time; finding the management processes to do so is an ongoing challenge in a still-developing medium.

Engineers

In the early days of game creation, programmers controlled the creative process. Now, programmers provide their service to a team and must be customer oriented -- their "customers" are artists, producers, and other engineers. Engineers who have interdisciplinary experience are highly valued. The major challenges for engineers at EA are:

- working on an interdisciplinary team
- writing software in groups
- working on a project with 20-200 people, and resulting management challenges
- learning to engineer code for a rapidly changing target
- dealing with legacy code

Artists

Traditional art skills, rather than computer-tool fluency, are highly valued. EA generates a lot of concept art, and the "artist's eye" is technology independent. The biggest challenge for artists is dealing with flawed tools. **A rare (and valuable) breed is the technical artist who is savvy enough to write script code or plug-ins.**   Types of art positions include:

- level builder
- lighters
- shaders
- modelers
- texture map painters
- concept artists
- animators
- effects artists
- technical artists

- concept artists

Designers

Every aspect of an EA game (including, for example, the installation software) should be designed to enhance the end user experience, so the design work is very broad. A designer may do anything from game design to two-dimensional user interface elements to sound design.

Producers

Producers are responsible for filling gaps and "owning the user experience," defined as "beginning the first time you read the first word about the game and ending the last time you put the game down." These are the people with spreadsheets, punch lists, and schedules. They keep the trains running on time and coordinate the pieces of the puzzle. Being detail oriented and having great people skills are crucial for producers. As team sizes grow, producers play an increasingly important role in video game creation.

Testers

Testing in the game industry is still primarily done by people rather than automated systems. Producers create test plans that are then implemented by a swarm of testers. Testers beat on the alpha and beta versions until the bugs have been driven out. Testing used to be a path by which a highly motivated individual could eventually gain access to a production job; while not officially impossible, it is now difficult to move from testing to production.

Managers (Directors of Development, or "DD"s)

In addition to producers, EA has DDs who are managers. They typically come from engineering ranks, and their primary job is to interface between producers and engineers. They manage resources, hire and fire engineers, and are responsible for people, processes, and technology.

Executive Producer (EP)

The EP is the single hardest job at EA and the one that EA's management is most concerned about being able to fill as EA grows. EPs are basically the combination of the director and producer for a feature film; they are responsible for both the artistic and financial aspects of the game. All the EPs I met were extremely different in style, but were all impressive people who could lead teams, inspire subordinates, and make hard decisions. The EP fights political battles for resources, sets the quality bar (are we shipping or fixing this bug?), and is ultimately responsible for the user experience. "The buck stops here" is the credo of the EP. EPs can come from all walks of life, although there is some perception that a person with some level of technical background can become an EP at a younger age because they have a better "snow job detector" when

communicating with their technical staff. Getting people to EP faster is a major challenge for EA. Universities should be asking the question: "Will our curriculum help create people who will rise through the ranks to eventually become EPs?"

Teams and Team Structure

There is no single "EA way" that a game team is structured; each title tends to be a reflection of its EPs personality. It is common to have more artists than engineers (programmers) on a game, and that may explode as the next generation consoles have larger capacity media to store art assets (DVD vs. CD-ROM).   As team sizes have exploded, EA has scrambled to find new ways to manage these larger teams.

The current best practice is the "Pod" structure used by Neil Young as EP in *Lord of the Rings, Return of the King*.   Rather than breaking his hierarchy down into engineering, art, design, etc. departments, he created 3-20 person "Pods," each of which took on a different aspect of the game, such as "command and control."

Interns and Co-ops

One major cultural change at EA is the appreciation of the value of student internships and co-ops.   I wish this were because EA had finally realized the value of interns as a path to hiring (and that may be coming.) The real reason interns are greatly appreciated is the recent observation that high quality summer interns can be productive members of a team at a fraction of the cost of a real hire. Interns and co-ops are partially subsidized by the central EA management in order to make them attractive to individual teams.

Changing the Culture with University Hires

EA has historically filled fewer than 10% of its positions with students straight from college, but has stated a goal of filling 75% of open positions straight from universities. Since the advantages of hiring an experienced worker are obvious (older, more mature, more experienced), why does EA want to do this? I heard the following reasons in interviews as to why EA wants to hire students straight from University:

- To energize the culture: even though the culture felt very young to me, by historical EA standards, it is getting older.
- Younger workers draw lower salaries, so there are cost savings.
- To stay technologically current on state of the art tools and techniques. This is especially important since EA, by the standards of a technology company, does not invest heavily in continuing education.
- To get "pre-qualified but malleable individuals," meaning that they get the ability to teach them the best practices EA knows, which EA presumes are, on average, superior to what workers would learn at competitors.
- Young kids don't know what's impossible.
- There is a certain idealism at one's first job; one's second job (not unlike one's second marriage) tends to be less idealistic.

Not everyone at EA thinks going to 75% university hires is prudent, or even possible. However, everyone agrees that the implementation of their hiring goals rides on ensuring that there are enough veterans to coach the rookies and educating managers about the extra challenges inherent in managing someone who is at his or her first job.

Game Industry vs. Film Industry

As team size grows and the need for an established production process grows, many individuals feel that the game industry needs to adopt the film production process. Opponents point out that neither the economic model nor the production model for film is appropriate for making interactive software, since film relies on technology that has been stable for fifty years, and the game industry changes out its hardware every five. Also, the "create/dissolve" model of putting a team together for a film and then disbanding it doesn't acknowledge the need for institutional memory in software and tools development. Related issues are whether things like the unionization, intellectual property, and revenue distribution models of the film industry are appropriate for the game industry.

At EA, there has been a recent push to align artist job titles and descriptions with those of their counterparts in the CG movie industry, to enable employees to more easily transition between the two industries. These transitions are becoming more common. Until recently, there had been a notion that games were second-class citizens to film (much as television has been considered a second-class citizen). Recent events indicate that artists no longer view games as a place where "people who couldn't make movies" would go.

Some jobs transfer more easily than others: lighters, tools programmers, and technical art directors seem to transfer most easily. Modelers often have trouble due to the limitations on polygon count in games (technology may eventually make this moot). Ironically, animators often have a difficult time transitioning from film to games, in part because animation in film is always done in a context, but animation in games is "context independent." Said another way, game animators must be good at creating snippets of animation that can be pieced together as part of a larger whole, such as a walk cycle. One thing is clear: if you hire a person with film experience into a gaming job, it's a good idea to give them a mentor about games.

Specific Curriculum Recommendations

I abhor curriculum design because it inevitably devolves into the exercise of making lists of courses in search of a magic formula of knowledge that we can pour into our students' heads. In most disciplines this is wrong-headed, and in the area of preparing students for EA, it is particularly wrong-headed. I do not believe there is a collection of lecture material that will properly prepare students. Rather, I think that faculty should ask the following holistic questions about the educational experience:

1) How will students learn to sharpen their own technical/artistic/whatever skills?
2) How will students learn to respect people from other disciplines and work with them effectively?

3) How will students learn to work as part of a team?
4) How will students learn about project management, how to manage, and how to be managed?
5) How will students get real world knowledge interleaved with their schooling?
6) How will students learn the "soft skills" of interpersonal interaction, public speaking, writing, etc.?
7) How will my faculty do course correction for the inevitable mistakes we will make?

The interesting thing about these questions is they are combinable. I recommend making a two-dimensional matrix and asking about the 49 resulting boxes; this forces you to think about how you plan to teach each of these things.   In fact, I urge you to not think in terms of "how will we teach it?" but rather, "how will they learn it?"   We urge you to take a holistic design approach to your curriculum; any good curriculum will leverage your local strengths. Here are a few high-level guidelines that I think will work for everyone:

1) Establish an internship and/or co-op program to give students real industry experience
2) Put teams of different disciplines together, make them build things, and give them honest feedback
3) Barring rare exceptions, do not let students pick their own teammates
4) Use formal project management techniques, including projection tools (e.g. Microsoft Project), source code control systems, etc.

At the Entertainment Technology Center at Carnegie Mellon (etc.cmu.edu), we created a project-based curriculum where our students are continuously working in small interdisciplinary groups that make things. This has worked well for us, and EA has hired almost 40% of our graduating class the last two years.   My semester at EA validated our curriculum, as I did not find glaring deficiencies in the approach we have taken at Carnegie Mellon. The largest changes we will make are regarding #4 above. To date we have had small (4-7 people) teams using informal management techniques: we plan to formalize them and investigate working with larger team sizes.

When designing its curriculum, each university should play to its strengths. If you ask me to create the optimal curriculum, I will describe CMU's: not because I am self-centered, but because Don Marinelli and I already went through this exercise and "voted with our feet." **At Carnegie Mellon, we offer a two-year, "Masters of Entertainment Technology" degree, jointly conferred by the School of Computer Science and the College of Fine Arts**. It is important to note that, even though we seem to have created a curriculum that EA is pleased with, we did not design a curriculum targeted at video gaming; our aim was always much broader (theme park attractions, children's museum attractions, video games, Web site design, edutainment, etc.) and we believe that approach led us to a curriculum that happens to be very good for producing people for EA.

Here is the Carnegie Mellon Curriculum:

First Year Fall

Building Virtual Worlds
Introduction to Entertainment Technology
The Visual Story
Improvisational Acting

First Year Spring

ETC Interdisciplinary Project Course II
Elective

Industry Internship

Second Year Fall

ETC Interdisciplinary Project Course III
Elective

Second Year Spring

ETC Interdisciplinary Project Course IV
Elective

Note that each "Project Course" is three courses' worth of credits; in semesters 2, 3, and 4, students spend 75% (or more) of their time on the project. In each project course, we make the grade be 50% based on the "product" - what they make and how well it functions. Barring unusual circumstances, all students working on a project get the same "product" grade. The other 50% of the grade, the "process" portion, is individualized. We require our faculty have individual meetings with each student to go over that student's personal process (how effectively they are working and interacting with their team members) at least twice a semester, but preferably four times. This is the invaluable (and painful!) part of our curriculum. It is labor intensive and emotionally exhausting, but it works.

Our first semester looks the most like a typical curriculum. In fact, the *Building Virtual Worlds* (BVW) course is nothing more than a version of the project course with training wheels. (This is why subsequent project courses start their numbering at II – BVW is really "Project Course I"). In BVW, four person interdisciplinary teams make interactive head-mounted display (HMD) based virtual reality worlds on a two-week production schedule. The process mirrors the project course, but in miniature. (One notable exception: the individual process grade is 1/3, not ½, and comes from the peers in this course, not the instructor). We use virtual reality because it gives our students practice with the exact pipeline process used for video game creation, but the design challenge of

an HMD (low resolution, but a great sense of 3d awareness and immersion) forces them to think hard about how to design for the medium, rather than devolving into just making what they have already seen in commercial games. Here are course descriptions of the first semester courses, taken from etc.cmu.edu:

ETC Project Course
Project courses are "group independent studies," where teams of 3-7 students work on a focused project during that semester. The number of projects per semester will vary. The primary objective of the courses is to provide a hands-on working experience with teammates who are from different backgrounds and disciplines. Other objectives are to experience project management, and have the possibility of working with an external client (some projects have external collaborators).

The requirements for a project are that:

1) **The team contains both technologists and non-technologists**
2) **The team must create a working prototype/artifact**
3) **The work and student behavior must be closely supervised by a faculty member**

Introduction to Entertainment Technology
This class is an overview of the current state of linear and non-linear narrative as embodied in both traditional and emerging media. Particular emphasis is placed on the notion of technology as a mechanism for embodying character, story, and expression, rather than on the technology itself. Examples are drawn from sources such as traditional media and fine arts, CD-ROM and other video games, theme parks and other location-based entertainment venues, and the Internet. This is a lecture-based course that has traditional, individual students' assignments involving critical analysis and writing.

Improvisational Acting
This course uses the craft of improvisational acting to foster team building and encourage students to overcome their inhibitions when working with others. In this course students will learn how to work together as an ensemble, how to develop a dramatic theme or idea, how to respond to moments of uncertainty on stage in a quick and confident manner, and how to increase the students' awareness of what takes place moment-to-moment on stage. This course will introduce and drill students in improvisational techniques and exercises that will enhance their abilities in performance. In this course, students will learn the rules of improvisation, warm-ups, anti-editing, and the exploration of space and time. Students will commence with an exploration of C.R.O.W.,(i.e., character-relationship-objective- and-where), followed by 'offers,' 'assumptions,' and 'give-and-take,' such as character storytelling and the furthering of space and time.

Building Virtual Worlds
This is a project course, where interdisciplinary teams build desktop and immersive (helmet-based) interactive virtual worlds. The course will cover both the technical

mechanics of world building, environmental design, interactive game design, non-linear storytelling, and related topics.

The Visual Story
This course explores the relationship between the story structure and visual structure of film and discusses how this relationship is applied to new forms of media, such as video games.

Electives

We offer very few electives within the ETC, although we are currently investigating extending them. The major ETC-based electives are:

Game Design
This is a lecture and project based course that teaches the mechanics and processes of good game design. The principles learned in this class apply equally well to card games, board games, party games, athletic games, and computer games. Students will analyze many types of games, and design many games of their own, alone and in groups, using these principles. Anyone interested in interactive entertainment or in creating compelling experiences should benefit from this course.

Introduction to Sound Design: Design & Media
This class is designed to familiarize students with a variety of digital audio software applications and approaches to sound design. Students will have hands-on experience recording, editing and converting digital audio files in addition to creating sound effects. The course will also address sound design approaches for games, film and the web. Weekly lab/lecture format will discuss special topics, technologies and techniques, and will include critiquing each other's work. Primary objectives include:
- To provide a hands-on introductory approach to sound design and digital editing for use in interactive media presentations/applications.
- Explore streaming audio formats, audio delivery on the web and corresponding user interface issues.
- Learn software applications and basic studio and field recording methods for subsequent digital sound editing.
- Discover the ways audio is integrated into film, games and web pages to augment interactive experiences.
- Discuss ways in which sound can enhance user experience in new media applications.
- Present final projects based on techniques learned in class.

Maya
This is a lecture and project based course on how to create environments, effects, and characters using Alias | Wavefront's Maya Complete 5.0.

Most electives are taken from the broad menu provided by Carnegie Mellon: although below we provide a recommended list, we will allow any Carnegie Mellon course where

the student can make the case. For example, students planning to work in Japan have used language courses to learn Japanese.

Pre-Approved Carnegie Mellon Electives

Computer Science
Artificial Intelligence
Computer Graphics I & II
Media Technology
Wearable Computers/Rapid Prototyping
Physically-based modeling

Robotics
Robotic Art Studio

Electrical and Computer Engineering
Digital Signal Processing
Multimedia Communications: Coding, Systems, and Networking
Engineering and Public Policy
Science Technology and Ethics

Mechanical Engineering
General Robotics

Design
Computer Basics: Computer Design
Seminar in HCI Design
How People Work With Things

Drama
Fundamentals of Drama
Sound I & II
Acting for Non-Majors
History of Architecture and Decor
Fundamentals of Directing
Camera Techniques
Producing for Film & Television
Development of Film Technique
Screenwriting
Introduction to Playwriting
Advanced Playwriting
Advanced Topics in Playwriting

Music
Introduction to Computing and Music Technology
Electronic and Computer Music

Sound Recording I & II

Art
Electronic Media Studio
Advanced Electronic and Time-Based Media: 3D Animation
Advanced Electronic and Time-Based Media: Robotic Art Studio

English
Culture Communication and Technology: Mapping the Internet
Survey of Forms: Screenwriting
Writing in the Professions
Designing Interactive Multimedia
Writing for Multimedia
Writing in Software Engineering
Computers and Writing
Writing for Multimedia
On-line Information Design

Philosophy
Issues in Multimedia Authoring

Psychology
Human Factors
Visual Cognition
Production Systems Models of Thought
Cognitive Processes and Problem Solving
Visual Perception

Public Policy & Management
Internet and the Law

Film
Introduction to Screenwriting
Script Analysis
Lighting for Film & Video
Film Editing
Sound for Film
Producing for Film & Television
Animation Basics

Designing Your Own Curriculum

Obviously, the Carnegie Mellon ETC curriculum may not work for you. Our university gives us great freedom to do non-traditional things. Before giving a more generic approach to a curriculum, I want to place a few bounds: I do not seek to address what I call the "literacy criticism" aspects of graduate study of games -- while a noble pursuit, it is not mine in this document. I am focusing on a pragmatic curriculum targeted at a

future practitioner who will be making games. I also recommend you consult the IGDA curriculum framework, which many knowledgeable people have worked on, at http://www.igda.org/academia/ . It does an excellent job of going into detail on what might be contained in specific courses. Operating under the assumption of a two-year (four semester), professional masters program that admits students with a variety of backgrounds, if I had to work within a more traditional framework, here is what I would recommend for a two-year curriculum:

More Traditional Masters Curriculum

First Year Fall

Improvisational Acting
Do 5 two-week Interdisciplinary Projects
Game Design (primarily board games)
Elective

First Year Spring

Usability Engineering/HCI Design
Game Development (build prototypes)
Interactive Storytelling (Non-linear Narrative)
Elective

Industry Internship

Second Year Fall

Project Course I (Masters Thesis)
Survey: History of Video Games, et. al.
Public Speaking and Business Writing
Elective

Second Year Spring

Project Course II (Masters Thesis)
Industry Economics and Management
Elective

I've put an elective in every semester. I think that's important for several reasons:

1) It allows you to create "tracks" that have four full semesters of content, if you so desire.
2) It allows students who come in with holes in their background to fill them immediately - the ETC curriculum has no electives in its first semester, and that sometimes frustrates us.
3) It means that students who have divergent interests can satisfy them through their time at your university, without ever feeling too "locked in."

Most of these courses are self-explanatory. The Game Design and Game Development may best be interleaved in a two-semester sequence where students are alternating between non-computer and computer-based prototypes. Two courses is slightly more than is needed, I feel, but better safe than sorry.   The *Interactive Storytelling (non-linear narrative)* course is intended to present mechanisms for creating and experiencing non-linear stories.   This is the course that I feel needs the most innovation, and I yearn to see what various universities come up with. My co-director Don Marinelli's course *Introduction to Entertainment Technology* covers some of this territory, basically doing an **analysis of video games using Aristotle's poetics combined with some of Janet Murray's work** from *Hamlet on the Holodeck* and Clark Dodsworth's *Digital Illusion* text.   I personally think that theme parks are a rich source of material on this topic.

What I don't like about the curriculum I've described is that it's not easy to leave for a semester to do a co-op, which the ETC has found very valuable.

The aspects of this curriculum I would urge you to keep intact

1) **Don't even think about removing the internship** - all programs with internships gain great value from them.

2) I'm sure it seems strange, but **I think improvisational acting is the single most important course in this curriculum.** It is important to note that this is not the kind of improv you may have seen, for example, on the television show *Whose Line is it, Anyway?* That kind of improvisational comedy is very entertaining, but this course is about how to make a narrative flow in real time, which boils down to always leaving your partner with a path to follow based on what you say: in other words, don't paint him or her into a corner. All three of the following swear by it, as a team-building and community-building vehicle:[4]

   - Carnegie Mellon's Entertainment Technology Center
   - EA University (EA's internal continuing education program)
   - Pixar University (Pixar's internal continuing education program)

3) **The *Do 5 two-week Interdisciplinary Projects* course, in the first semester, sets the tone for the entire two years.** The course is just what it sounds like: At Carnegie Mellon, this is the *Building Virtual Worlds* course, where students are in teams of four and make a virtual reality world in two weeks. Then we shuffle the teams and they do it again with a different team, for a total of five times. At the USC film school, the production students make five films in their first semester. I don't know if there's something magical about doing it five times, but I do know that it won't work as well if you only do one or two projects in the semester. The key is to make the projects so short that people have the interdisciplinary experience and then move on

---

[4] It may be that improv requires an outstanding teacher to pull this course off, and all three of these organizations have been blessed. The ETC uses Brenda Harger (bharger@andrew.cmu.edu), and both EA and Pixar use Rebecca Stockley (company@batsimprov.org). I would recommend you have one of them do a workshop with whoever is going to teach your course, in order to share their approach.

before they can work with someone long enough to start hating them. And it's crucial to not let the students pick their own teammates. It's secondary what they do, so long as the students are excited about it, and the projects require a variety of skills and allow the students to appreciate the team's diversity.

4) **The extended project course, where the student or team makes something substantial and brings it to completion**. I've called this "thesis" in parentheses because I realize that many universities require a master's thesis. At those universities, your largest challenge will be how you address what is fundamentally a team activity in the model that requires an individual thesis. I wish you the best of luck; that's a tough nut to crack.

Tracks

A common technique is to provide specific tracks within the curriculum that are fulfilled by a specific collection of electives. The most obvious tracks are

- Engineering
- Design
- Production/Management
- Art

I will not bother to fill in the detailed electives for each track; that certainly will require scavenging from existing course listings at your given university, so it is best done as a locally optimized exercise; the IGDA curriculum gives some guidance. I would require sound design in the design, production, and art tracks; sound is currently underutilized in most games.

If I had Three Years…

If I had three years (six semesters), I would assume both intervening summers would be internships, and I would seriously consider a mandatory co-op in either the 4th or 5th semester to provide a seven-month, contiguous work experience opportunity. Therefore, I would only really have one more semester's worth of courses to add, and they would be:

- sound design
- animation
- figure drawing OR concepts-of-computing
- another elective

I think "sound design" and "animation" are self-descriptive. For the "figure drawing OR "concepts-of-computing," I would have students broaden themselves: technologists would take figure drawing, and non-technologists would take a course that attempts to teach them the basics of what programmers do. The Alice system (www.alice.org) would be an effective vehicle for a gentle introduction to 3d interactive programming, and the course would also cover topics such as what a client/server architecture is, the basic mechanisms involved in game software pipelines and rendering techniques, etc. The

primary purpose is to allow non-techies who move into management/production to better understand programmers.

Tools

Academics often ask EA employees, "What tools do you use?" The subtext is that if the universities just use the same tools as EA, the students will be magically prepared. Instead, faculty members should be asking, "What are the right tools that maximize students' learning-by-doing?" Currently, tools for authoring 3D content are particularly frustrating: Lithtech, Unreal Tournament, and other choices all have a high initial cost for learning to use the tool. Carnegie Mellon's ETC provides two 3d authoring tools, Alice (www.alice.org) and Panda3D (www.panda3d.org), as freely available, open source tools. Alice is useful for non-programmers who wish to create 3D content or for providing a simple programming experience for non-programmers. Panda3D was originally developed by Walt Disney Imagineering's Virtual Reality Studio and has been used for theme park attractions and for Disney's massively multiplayer online game, *Toontown*. It is a commercial-quality, open source engine with great flexibility, and we believe it will become the lingua franca for University game authoring.

Common Traps

Here are the common traps I see people falling into when designing curricula:

- **Thinking the only person who works at EA is the lead game designer**. These curricula are designed to create the ultimate game designer, and tend to produce students who believe they should show up their first day at work and be given a team of 50 to work under them. Train your students to work their way up the career ladder, choosing a career path that will let them eventually become the top dog. And remember, at EA the top dog isn't the game designer per se; it's the EP.
- **Living in the Ivory Tower**. Getting faculty with real industrial experience is crucial. This often requires getting your department head or Dean to be flexible: very few people have Ph.D.s and game industry experience, for example. The residencies I have done at Disney and EA have been immeasurably valuable to me as an instructor.
- **Assuming engineers can be critiqued like artists.** The ETC made this mistake and it almost killed our program**.** Students who have spent four years as Computer Science or Engineering majors have lived in an objective world where they have never had to stand in front of a crowd and defend their subjective design decisions. Think hard about how to critique them without making them hostile and/or completely demoralized.

Summary

The Studios at Electronic Arts (EA) have future staffing needs for more than 1,000 new hires each year, and EA would like to fill 75% of these positions with university graduates. EA currently fills only 10% of new positions from universities, so this calls for a radical change in the way university students are educated for this industry. I spent the spring semester of 2004 in residence at Electronic Arts studying EA's needs.

Although it sounds self-serving, one of the major results of my semester at EA was a validation that the Carnegie Mellon ETC approach was in the "sweet spot," specifically that our focus on:

- interdisciplinary team projects
- industry internships and co-ops
- creative problem solving
- making technologists and artists full and equal partners
- forcing students to make finished prototypes

was directly meeting EA's needs for employees. Based on my residency, the major changes to our curriculum will be teaching more formal management processes that properly support large teams.

Each university that attempts to create a program to train students for the video game industry should examine their local capabilities and play to those strengths. Above all, I recommend that you plan to make changes early on as you discover what is and is not working: it is only through being flexible and nimble that Carnegie Mellon's ETC was able to adjust as we learned what was and wasn't working well.