When Worlds Converge

*The Coming Supernova of Entertainment and Education*

Don Marinelli

*Those who distinguish between education and entertainment don't know much about either.*

—Marshall McLuhan

Advances in computer technology are constantly expanding the realm of the possible with regard to creating imaginative, virtual experiences for entertainment and education. The goal of the Entertainment Technology Center (ETC) is to take full advantage of these developments while seeking ways to infuse the creative process with the traditional dynamics of fine arts such as drama, storytelling, film, and theater.

The Entertainment Technology Center

The ETC takes an interdisciplinary approach to fostering in its students an understanding of how to use technology to enter-
tain, inspire, and teach. The ETC, created in 1998, offers a program that culminates in the master’s of entertainment technology (MET) degree, jointly conferred by Carnegie Mellon’s College of Fine Arts and School of Computer Science. The Entertainment Technology Center is the result of a direct initiative on the part of Carnegie Mellon’s president, Jared L. Cohon. At the time of the center’s founding, new technical toys and tools were spurring changes in both students and society that many recognized as having the potential to drastically alter entertainment and education and, indeed, lead toward *edu-tainment*, a blend of the two.

The evolutionary changes stemming from great leaps in technological progress are many and varied, and by now well recognized. Examples include the acceleration of generational change; an altered perception of time and space; a multisensory state of being; frequent multitasking; experientially focused activities; increased incongruity of the static image and, likewise, the notion of “pictures as portals”; and heightened expectations of the future (“If we can imagine it, we can create it.”).

The ETC grew out of this energy and sense of the future. It is built on three pillars: its academic degree program, industry research and development, and entrepreneurialism. The MET is a two-year degree program taught by an interdisciplinary mix of faculty drawn from the College of Fine Arts and the School of Computer Science. The ETC works with a variety of industry partners, ranging from small studios to large corporations, to transform how people use and interact with technology.
What Is Entertainment Technology?

The phrase “entertainment technology” refers to real-world entertainment experiences made possible by primarily computer-mediated digital technologies. The term requires an elastic and fluid definition because ongoing advances in technology make ever-new entertainment experiences and venues possible. In general, though, the term refers to the following:

- Networked and free-standing interactive computer games
- Avatar creation and application
- Massively multiplayer online games
- Specialty venues such as theme parks, themed retail outlets, and specialty restaurants
- Motion-based rides
- Virtual reality using either head-mounted displays (HMDs) or physically immersive virtual environments such as CAVEs
- Wearable computing for entertainment purposes
- Immersive display environments such as those found in a planetarium or Omnimax theater
- Interactive animatronics robots
- Entertainment robotics
- Synthetic interview technology
- Speech recognition technology
- Augmented reality
- Telepresence for entertainment and educational purposes
- Sound synthesis, Dolby surround sound, 3D sound, and streaming audio
addition to pushing the envelope of what is traditionally considered entertainment, the ETC also applies the principles of entertainment via new media in broad areas—from developing customer loyalty and branding in the digital era to training geographically dispersed workers. Industry partners include Intel, Microsoft, Kodak, Disney, EA (Electronic Arts), the New York City Fire Department, and the Carnegie Museum of Natural History. Finally, in keeping with its focus on real-world experience with real-world clients, the ETC is deeply involved in licensing student-created intellectual property, obtaining patents, and nurturing start-ups and spin-off companies.

The ETC Curriculum

The ETC is a graduate program for the left and right brain. From the moment an idea is conceived to the time it is produced, the creative and logical skills of the student are called upon. The curriculum aims to strike a balance between precise science and math and the ambiguity inherent in the creative process. The ETC faculty consist of computer science teachers and drama teachers, plus a mix of specialists in filmmaking, digital music, computer graphics, human-computer interaction, entertainment engineering, animation, modeling, texturing, painting, and legal issues relating to digital and interactive media.

The ETC’s educational philosophy is “learning by doing,” and the program is characterized by project courses in lieu of
traditional classes: 80 percent of the typical ETC student’s time is devoted to project work. Thus, the backbone of the ETC curriculum is a sequence of project courses of increasing duration, each of which places students in interdisciplinary teams that are rotated at the completion of each project. In the Building Virtual Worlds course, for example, the groups work together for two weeks; in other project courses during the second year, teams are together for an entire semester. For on-the-job training, students can take advantage of an optional summer internship or fall co-op should they wish.

ETC Projects

Project courses emphasize making real things that work. Thus, student teams must produce working artifacts, and often do so for ETC industry and nonprofit partners. The scope and variety of projects is fascinating and seemingly limitless. Indeed, the end-of-year show of ETC projects open to the campus community is wildly popular.

Cretaceous Chaos: The Dinosaur Time Machines

One of the earliest partnerships the ETC developed was with the Carnegie Museum of Natural History. The museum contains the partial-dome SkySkan Theatre, which uses five digital projectors and a wraparound screen that envelops an audience of about 60 people with full-motion imagery and surround
sound. The challenge was to create an interactive dinosaur experience geared for school-age children that was not only entertaining but also educational. The students built a system that transported the members of the audience via a flying time machine to a prehistoric landscape where they could complete their mission of taking snapshots of various dinosaurs they encountered. In the spirit of scientific accuracy, the flying time machine was built in the image of a pterodactyl—so that the dinosaurs the audience encountered wouldn’t be frightened by an unfamiliar flying machine.

The experience was fully interactive: ETC students created a real-time computer-vision system that tracked the members of the audience as they leaned left or right in their seats to control the direction of the time machine on its flight through a prehistoric canyon. While flying through the landscape, participants were surrounded by full-motion imagery. They took pictures of the various dinosaurs they encountered and learned dinosaur facts from a real-time, synthetically generated narrator. ETC students built the entire system using consumer-level commodity hardware and software.

*HazMat Hotzone*

The Fire Department of New York (FDNY) recently launched a computer-based virtual training simulation, HazMat Hotzone, sponsored originally by Microsoft and built by the ETC based on initial ideas developed at MIT. The program trains firefighters in first-response protocols and decision making in coping
with hazardous materials accidents and emergencies. The skills taught are awareness, teamwork, and decision making. The simulation is led by an instructor who aims to help first responders work together to make efficient and effective decisions.

Typical game-based training replaces the instructor with the computer. Students play the game while the system tries to teach the student. Hazmat Hotzone’s instructor-centered teaching model uses the game as a conduit through which the information flows from instructor to student, diminishing computer error and increasing the system’s capabilities. This model also successfully bridges the gap between the two major components of firefighter training: lectures and field exercises. Lectures are abstract and rely on instructor-centered communication. Field exercises are hands-on and rely on student-centered activity. Hazmat Hotzone provides instructor-centered communication while simultaneously providing student-centered activity.

Current hazmat training occurs through classroom lectures occasionally supplemented by large-scale field exercises. Unfortunately, due to the high cost and logistical difficulty involved, these field exercises can only be staged once or twice a year. Hazmat Hotzone is not intended to replace either the lectures or the field exercises. It serves in a supplemental capacity, as an affordable mechanism to apply classroom knowledge and reinforce what has already been learned.

The program simulates high-density areas such as subways and shopping malls, as well as smaller areas such as office buildings and storage facilities. (See Figure 1.) Six computer
terminals are used in the training sessions—one each for the instructor and five firefighters—because the FDNY never goes into an emergency situation with fewer than five firefighters. The scenario simulator enables the instructor to choose the location, environment, number of victims, and even the type of container holding the hazardous material. The instructor can intervene during the simulation to introduce more variables based on environmental conditions or on how victims are reacting. Participants use realistic communications gear during the simulation, meaning full headsets and radios.

Figure 1. Hazmat Hotzone simulation of emergency response
The program encourages teamwork, closely following instructions, and careful coordination of resources to successfully and safely address a terrorist event or any other emergency. Key lessons focus on protocol and tactics for assessing a situation and making decisions based on that assessment. The instructor can choose to stress specific tactics or techniques during any particular session. The FDNY likes the training program because the new FDNY recruits are comprised overwhelmingly of young people who know and like the video-game world. Further, HazMat’s virtual simulation approach blends two primary instructional strategies: theory and lectures, and live training.

**Cybersecurity: My Secure Cyberspace for Kids**

The goal of the My Secure Cyberspace for Kids Web site is to educate kids about cybersecurity and instill in them good cybercitizen habits. The ultimate goal is to make being safe and secure online as familiar to kids as brushing their teeth or looking both ways before crossing the street.

The cybersecurity team created a prototype game with a superhero theme to teach cybersecurity in a proactive manner. The target audience is 4th and 5th grade students because they must be able to read to learn and also are at the point in their curriculum where they are being introduced to Internet basics both in school and at home.

The story of the game is that the player is a trainee in the Cyberhero Defense Academy. In order to learn about cybersecurity, the player must enter CyberSpace, the city that exists
inside the Internet, and embark upon several missions. These missions are mini-games designed to teach major cybersecurity principles such as how to use judgment when sorting and opening e-mails, what sort of behavior should arouse suspicion in a chat room, the rules of Internet etiquette, the protection of intellectual property, and other fundamentals of Internet usage.

Primary style influences for these games come from television shows and cartoons that are popular with the target age range and which feature the same superpower/heroic message. Examples include the Disney Channel’s *Kim Possible*, Nick-Eldeon’s *Danny Phantom*, and the Cartoon Network’s *Dexter’s Laboratory, The Powerpuff Girls, and Teen Titans*. These shows have heavily stylized people and backgrounds in vibrant colors and heavy black outlines. The design group rightly surmised that this style would intrigue its target age range and also lend itself readily to their programming medium, Flash.

*Japanese Language Learning Software Project*

The *Kotodama* project—Japanese for “power of words”—is a prototype language learning videogame developed at the ETC. The full version of Kotodama is a role-playing game (RPG) in which players must master concepts of Japanese language and culture to gain in-game abilities. Through speech recognition input, players use spoken Japanese to accomplish game goals.

The premise of Kotodama is that words are magic. For example, a player may levitate a large rock by pointing at it and com-
manding, in spoken Japanese, “The rock rises.” Throughout the game the player collects the names of objects by pointing at them and asking, “What is this?”

The target demographic of Kotodama is high school students interested in videogames and anime. Visual style is influenced by the anime design convention made popular globally through Japanese videogames and manga comics, while story and game play follow key conventions common to popular RPGs. The player uses a familiar PlayStation2-style controller to explore unique 3D worlds inspired by Japanese culture. See Figure 2.

Figure 2. A 3D world in Kotodama
Alice

Alice is an interactive 3D graphics software program designed to provide the best possible first exposure to computer programming for learners ranging from middle school students to college students. The program addresses both the mechanical and sociological barriers that prevent many students from learning how to program a computer. With regard to mechanical barriers, Alice makes it easier to create programs by allowing students to drag and drop words in a direct manipulation interface rather than having to correctly type commands according to obscure rules of syntax. This user interface ensures that programs are always properly formed. Additionally, Alice reifies object-based programming by providing animated on-screen 3D virtual objects that students use to create programs that are 3D “movies” or “games.”

Sociological barriers, however, are far more complex to address. Alice specifically targets middle school girls by supporting storytelling, an intrinsically motivating activity for that population, which makes programming a means to an exciting end.

Alice has been shown to improve learning in college freshmen taking Computer Science 1 at St. Joseph’s University in Philadelphia and at Ithaca College in Ithaca, New York. The average final grade of those who took an Alice class prior to enrolling in Computer Science 1 was a B, compared to a D+ for those who did not take an Alice class. Not surprisingly, of those who took the Alice class and averaged a B, 88
percent went on to enroll the next semester in Computer Science 2, compared to just 21 percent of those who did not take the Alice class.

Panda3D

Panda3D is a powerful game and simulation engine originally developed by the Walt Disney Imagineering VR Studio. Panda3D was used to build various DisneyQuest attractions, such as “Aladdin” and “Pirates of the Caribbean,” as well as a massively multiplayer online game, Toontown Online. Disney released this engine to the open source community, and it is now being developed jointly by the Disney VR Studio and the ETC. Panda3D is an ongoing project for the ETC, as it is continually being developed and supported.

Panda3D is a 3D engine: a library of subroutines for 3D rendering and game development. The library is C++ with a set of Python bindings. Game development with Panda3D usually consists of writing a Python program that controls the Panda3D library.

Panda3D is unusual in that its design emphasis is on supporting a short learning curve and rapid development. It is ideal whenever deadlines are tight and turnaround time is of the essence. For example, in a class called Building Virtual Worlds (http://www.etc.cmu.edu/bvw) at the ETC, interdisciplinary groups of four students are asked to create virtual worlds within a two-week block of time. Panda3D makes this rapid turnaround possible.
These projects and others are described in more detail on the ETC’s Web site at http://www.etc.cmu.edu.

Conclusion

The Entertainment Technology Center wholeheartedly embraces the innovative use of new media to both entertain and educate. The ETC’s mix of formal and informal learning via project work and an interdisciplinary approach creates a rich environment in which creativity flourishes. Indeed, the possibilities for edutainment to teach students, train workers, and help educate the public in a variety of settings appear limitless, bound only by our imaginations.

NOTE

1. Marshall McLuhan, a cultural and media critic, in his 1964 seminal work Understanding Media exhorted humanity to move toward the twenty-first century free of the shackles of nineteenth-century perceptions.

Don Marinelli is Co-Director of the Carnegie Mellon University Entertainment Technology Center and a Professor of Drama and Arts Management in the Carnegie Mellon School of Drama.