When Worlds Converge
The Coming Supernova of Entertainment and Education

THE ENTERTAINMENT TECHNOLOGY CENTER (ETC) at Carnegie Mellon University takes an interdisciplinary approach to fostering in its students an understanding of how to use technology to entertain, inspire, and teach. The ETC, created in 1998, offers a two-year program that culminates in the master of entertainment technology (MET) degree, jointly conferred by Carnegie Mellon's College of Fine Arts and its School of Computer Science. Don Marinelli, codirector of the ETC, is a professor of drama and arts management. His codirector, Randy Pausch, is a professor of computer science, human-computer interaction, and design. Marinelli notes that advances in computer technology are constantly expanding the realm of the possible with regard to creating imaginative, virtual experiences for entertainment and education. The ETC's goal 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 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 in 1998, new technical toys and tools were spurring changes in both students and society that many recognized as having the potential to dramatically alter entertainment and education and, indeed, lead toward edutainment, 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 master of entertainment technology (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. In 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. A sampling of the ETC’s industry partners includes Intel, Microsoft, Kodak, Disney, EA (Electronic Arts), the New York City Fire Department, and the Carnegie Museum of Natural History.

The ETC’s third pillar is entrepreneurialism. 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 two-year 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

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

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

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**What Is Entertainment Technology?**

The phrase “entertainment technology” refers to a very real world of entertainment experiences made possible by the advent of 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 “entertainment technology” refers to the following:

- Networked and free-standing interactive computer games
- Avatar creation and utilization
- Massively multiplayer online games
- Specialty venues such as theme parks, themed retail outlets, and specialty restaurants
- Motion-based rides
- Virtual reality utilizing head-mounted displays or other technologies such as CAVES
- Wearable computing for entertainment purposes
- Immersive display environments such as planetaria and Omnimax
- Interactive robot animatronics
- Synthetic interview technology
- Speech recognition
- Augmented reality
- Telepresence for entertainment and education purposes
- Sound synthesis, surround sound, 3-D sound, and streaming audio
- Entertainment robotics
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 a 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 FDNY (Fire Department of New York) Simulation**

The FDNY recently launched a virtual training program, HazMat, sponsored originally by Microsoft and built by the ETC based on initial ideas developed at MIT. HazMat is designed to train firefighters in emergency first-response protocol and decision making. The program simulates high-density areas such as subways and shopping malls, as well as smaller areas such as office buildings and storage facilities. 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.

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.

**Alice**

Alice is an interactive 3-D 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 3-D virtual objects that students use to create programs that are 3-D “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 grades 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.

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These projects and others are described in more detail on the ETC’s Web site at 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 and bound only by our imaginations.

Don Marinelli is professor of drama and arts management at Carnegie Mellon University. He is also co-director of the Entertainment Technology Center, a joint initiative between the School of Computer Science and the College of Fine Arts. He was integral in creation of the university’s Master of Arts Management program and, more recently, the new Master of Entertainment Technology degree. Marinelli can be reached at thedon@cmu.edu.