# RETHINKING ENTERTAINMENT TECHNOLOGY EDUCATION

## by John Huntington


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The extravagant sets, colorful costumes and dramatic lighting dazzle the audience, and the crowd leaps to its feet and cheers wildly at the end of each spectacular song and dance number. Sondheim? No, *Spears*. Yes, that one: Britney. It's quite possible that you weren't one of the hundreds of thousands who saw Ms. Spears' recent live (er, um, *mostly* live) concert tour. But it's something everyone interested in entertainment technology—and, for that matter, the future of theatre—should see (a DVD of the show is now available[1]). As crass the commercialism of the event[2], as trite the music and insipid the stories, the use of entertainment design and technology was, simply, astounding. And I'm not just talking about the stunning effects involving Ms. Spears' bare midriff, but about the seamless integration of entertainment technologies which created what this show really was: state-of-the-art live theatre.

Figure 1. Britney Spears Live.

While rock concerts, of course, have existed for many years, Ms. Spears' show is a prime example of a form of live entertainment that evolved only because of its powerful storytelling use of entertainment technology: the elaborate spectacles now on Broadway; the mega-spectaculars that line the strip in Las Vegas; the live shows in theme parks incorporating everything from stunt players to video presentations; the countless corporate and special events which tightly integrate sophisticated presentation technology in hotel ballrooms, convention centers and arenas on a daily basis; the media spectacles now found in churches; the audio-video events intricately woven into most modern major sporting events; the show-oriented technology found throughout the retail world, from Times Square to the local mall; the mammoth "sports-entertainment" shows the WWE (formerly WWF) produces live twice every week in arenas around the country; the holiday reviews, Superbowl halftime shows and Olympic ceremonies that get more spectacular each year; the list goes on and on.

Whatever you may think of the cultural impact of these new forms of entertainment, the audience is voting with its dollars, and the language of live-performance storytelling is now evolving fastest outside the theatre world. These new high-tech mega-spectaculars have taken traditional theatrical techniques, and have morphed and augmented them into something new. So why do so many college programs act as if theatre is still the only game in town? How many college programs are covering these new technical subjects adequately? If a college does cover these subjects well, will prospective students interested in high-tech entertainment technology even consider attending such a program? If I were a student today

interested in live entertainment technology, I might choose to study electronics, video production or computer networking. And that would be a tragedy. I valued my entertainment technology education as a student; it has been useful to me as I have worked throughout the entertainment industry; and I value it today in my job as a professor of entertainment technology. Learning about and working in our field not only prepares students for a life in any endeavor, but also teaches communication, problem solving, critical thinking, leadership, teamwork and the critical importance of meeting deadlines—all traits highly valued in any field.

the new technology that is knocking on theatre's door... is all about trying to enhance and vivify the simple, pure power of theatre, allowing us to touch the audience and bring them into the stage experience in ways never before possible.

The production-intensive conservatory theatre education model works well for actors, directors, playwrights and designers. However, for technically minded students, I don't believe the college educational system has adequately responded to the needs of this new media-saturated, entertainment-driven world. If you took technicians fresh out of a typical, traditional conservatory college theatre program today, and dropped them backstage at a Britney Spears concert, they would likely be utterly lost and adrift in a vast sea of technology. This concert featured highly sophisticated video systems, synchronized pyro, flame effects, hundreds of moving lights, automated scenery, show control systems, enormous rain curtains, digital audio systems, lasers, you name it. Today, what used to be considered special effects are now core show technologies.

Of course, not every theatre school in the country needs to educate students in these high-tech areas, but it's my hope that enough eventually do to adequately service the needs of the entertainment industry, and, by doing so, elevate the state of the theatrical art. As noted director Marcus Stern[3], Associate Director of the American Repertory Theatre, member of the Harvard faculty, and someone who is comfortable both with actors and entertainment technology says, "It seems that so many people fear or simply do not understand the new technology that is knocking on theatre's door. If employed with care and used judiciously, this new technology is never about trying to obscure the simplicity and purity of theatre. It is, in fact, all about trying to enhance and vivify the simple, pure power of theatre, allowing us to touch the audience and bring them into the stage experience in ways never before possible."

## THE MARKET

The broader show business market is now essential for the growth and continued good health of the entertainment technology industry as a whole. Few manufacturing, rental, production, or supply companies can survive any longer on theatre alone. They must now diversify into multiple related markets: corporate and special events, concerts, themed retail, systems contracting, etc. The numbers make clear why these companies go after these markets. In the 2000-2001 season, all of Broadway grossed $643 million[4], and Broadway tours nationwide grossed $541 million[5]. The 363 theatres in the 2001 Theatre Communication Group national survey of not-for-profit theatres grossed a total of $555 million (excluding contributions)[6]. That totals $1.73 billion annually in ticket sales for most of the live theatre in the U.S., commercial and not-for-profit. That's pretty impressive, but keep in mind that the concert industry *alone* grossed $1.75 billion in 2001[7]; the *residential,* high-end custom A/V installation market in 2001 was valued at $2.6 billion[8]; the corporate presentation market is often estimated at about $3 billion annually[9]; the U.S. amusement and theme park industry grossed $9.6 billion in 2001[10]; and the electronic systems contracting industry (which includes permanently installed audio/video and other entertainment-related systems) was valued at $26.2 billion[11] in the same period.

## WILL TECHNICAL STUDENTS FIND ACADEMIC THEATRE TODAY?

At age thirteen, I saw Led Zeppelin live, and I was totally awestruck. Since I couldn't (and still can't) sing like Robert Plant, I dreamed of working backstage. I bought all the books I could find on everything about entertainment technology, which, some twenty years ago, wasn't much. When I entered my small-town high school, I got involved with the school's theatre productions, and did lights for local bands with a lighting system I built myself. All the while, my dream was to tour on a rock-and-roll crew, and when it came time to go to college, the closest program to backstage rock–and-roll I could find was theatre. I got into an excellent undergraduate program, and there, was drawn into the world of theatre not because of my love for traditional drama, or from any interest whatsoever in performing, but instead because working on a show was exciting, the process was fun and the people were great.

In addition to the school's theatre productions, I worked local crew for the concerts that came through my college. There, in the early eighties, I found more lights and bigger sound systems than in the average theatrical production of the day, but, coming from a theatrical technology background, the systems with which I was working pretty much made sense to me. Today, however, I believe the split is much more dramatic between what is taught in many academic theatre technology programs and what happens in the professional world of live entertainment. In addition, there are now alternatives to theatre schools for students

like me. So it seems less likely than ever that technically inclined students will fall into the theatre world as I did.

To test this hypothesis, I did a search on the Google Web site for "backstage careers in entertainment technology." First in the list of results[12] was a sponsored link to Full Sail[13], a "Center for Media Training" in Florida, whose leagues of identically-uniformed students are a familiar sight as they swarm over many trade shows such as AES and LDI (but not USITT), promoting the school with an evangelical zeal. On its flashy Web site, Full Sail offers "real world education," including a thirteen-month Associate of Science Degree in "Show Production & Touring" aimed squarely at the commercial live entertainment market. The Web site lists numerous alumni working throughout the entertainment industry, and all the amazing equipment with which students get to work. This program is certainly attractive to college-age students, and, from Full Sail's track record, is clearly filling a need in the market. However, it's unfortunate that Full Sail doesn't take its approach further, and offer a more academically rigorous bachelors degree, as that broader exposure would give students more ammunition to carry beyond the skills needed for that first job.

The first non-sponsored link in my list of Google results was to the program in which I teach, the Entertainment Technology program at the New York City College of Technology (City Tech, see below). After that was a high school with a broken link, several links to articles about performers, and then two British technical theatre groups: ABTT and BECTU. Next was a large state college out west. Good, I thought, finally a theatre department. No, the site (not bad, by the way) was for the college's Tourism and Convention Administration Department. The first conservatory theatre department I came across in my Google search was the *sixteenth entry* in the list.

Digging further, I checked the International Communications Industry Association (ICIA) Web site, which has a special section[14] called "Students and A/V Careers." It says:

> AV professionals combine their creative, technical and customer service skills and knowledge every day to do their work. … AV Professionals are: In demand, Well paid, Challenged, Trained in a high-tech industry. … Ever seen the MTV studio live, on-air? That was designed and installed by the ProAV industry. Ever seen the room that NASA uses to track the space shuttle? That was designed and installed by the ProAV industry. Ever wondered how they project those gigantic images at a concert, arena or stadium? Those are designed and installed by the ProAV industry. ProAV technology involves the manufacturers who make it, sales people who sell it, designers who design it and installers who install it.

If you were nineteen, had been brought up on MTV, concerts, theme parks and WWE, and you never caught the theatre bug in high school because all the arts programs had been cut, would you even consider a degree in theatre? The chances that young students would consider a theatre degree today seem lower than ever, and that is a great loss for both the students and the entertainment industry.

## TIME FOR A CHANGE

You might be thinking that this is simply a marketing issue: Schools just need to get listed on Google properly and reach technical students better in the high schools to let them know there are viable careers in the entertainment industry. That would be a step forward, but while students might get many useful life skills from a theatre degree, will they find the knowledge they will need for careers in this new high-tech world? How many college theatre programs teach their technicians the basics of video, a technology critical for so many live events today? How many programs require their lighting and sound students to take classes in math, science and electronics, the foundations of all entertainment technology? How many lighting students get experience with moving lights? How many theatrical lighting classes cover DMX, the core control technology of all of modern lighting? What about MIDI for sound? And, how many teach show control, the technology that ties all these systems together? If these subjects aren't inside the curriculum, how are students supposed to learn them?

If enough colleges around the country don't teach these sophisticated entertainment technologies (certainly not every school can or should cover them all), someone else is going to do it—the market is clearly there. Schools like Full Sail are out there, and trade associations like the National Systems Contractor Association (NSCA) and the ICIA are currently filling the gap by hiring their own instructors, and offering extensive professional and continuing education and certification at their trade shows and throughout the year. But why aren't we doing this in the existing college programs instead?

### "We can't afford these new technologies."

With the ever-decreasing costs of entertainment technology, this argument holds less water every year. A tiny video projector capable of outputting amazingly high resolution and brightness can be had today for the price of a decent sofa. So why is anyone still using slide projectors? Digital sound equipment just gets cheaper and cheaper; a computerized sound playback system capable of playing back hundreds of cues simultaneously on many tracks is now cheaper than a single reel-reel tape deck. Show Control systems are increasingly software-based, capable of running on cheaper and cheaper personal computers. And, you don't need a whole theatre of this equipment to teach these technologies to students. With even a few inexpensive moving lights, and (critically) laboratory, non-production time during which students can experiment, the important concepts can be learned.

### "We can only spend money on what the shows need."

What an institution *can afford* is simply a concrete representation of its organizational priorities. Is the goal of your program to produce shows or to educate students? When shows are picked and budgets set solely to support the needs of the performers, a dual disservice is done: the technicians and entertainment engineers are getting shortchanged in their educa-

PHOTOS COURTESY THE AUTHOR

Figure 2. A student working backstage at the City Tech Haunted House.

If enough colleges around the country don't teach these sophisticated entertainment technologies (certainly not every school can or should cover them all), someone else is going to do it.

tional experience, and accordingly, the theatrical state of the art is not being pushed forward.

"Britney is not creating art and that's what we do. So, we don't need to cover these technologies."

In my opinion, it's a *good* thing that, in an average year, over two million people attend a live WWE "sports-entertainment" event[15]. Why? Because they are getting out from behind the TV and attending an entertainment event in person. What if just 1% of those people enjoyed the experience so much that they decided to try another live event like a play or musical?

"We only educate artists, not techies."

The use of the word "techie" is demeaning, as it infers that technicians have less talent and creativity than actors, designers or directors, have less worth to our industry and, therefore, to society. Technologists speak the languages of technology, science and engineering, and in my experience, are likely to be capable of making a living doing something related to what they studied. Isn't it possible for these people to make as valuable a contribution to society as actors, designers, or directors?

"We can't allow technicians time away from productions since we need them to produce shows."

This attitude, frankly, is exploitative of technical students. Where I teach, we have working, middle-aged Broadway stagehands come to take classes. Why? Because with today's incredibly complex and sophisticated entertainment technology systems, it's just not possible to learn enough on the job. So if the technical students in a school are working hundreds of hours on productions, how on earth are they going to learn the theory behind the technologies? If you want the technical students to be cheap labor, be honest and either pay them for their time, or give them a tuition break, and assume, since they are working, that they will need extra time to finish their degree.

"If we replace some humanities courses with more vocationally-oriented subjects, we will produce uncultured students with no sensitivity to the art."

When I was working at the Metropolitan Opera, I was surprised that many of the stagehands, the majority of whom had little or no college education, were quite sensitive to the nuances of the opera. In the off times, I often heard stagehands interspersing discussions of sports (the chief topic of conversation) with critiques of the merits of singers, conductors and designers, and discussing and explaining the stories of the operas[16]. In other places, I've seen some of the most stereotypical stagehands and technicians display immense pride after taking part in the creation of a beautiful moment on a stage. The vast majority of technically inclined people I've ever met, union or non-union, on Broadway or struggling off-off, work in the entertainment field because they love it and wouldn't

want work anywhere else. All these people have skills that could make them more money in other industries, but they work in entertainment because they love solving complex technical problems to support the work of artists.

I also think that there are many different successful paths to learning, and technically minded students may not be best served by a compulsory overload of humanities courses. I'm not, of course, advocating the abolition of humanities altogether, but within the common-sense limits of general core course distribution requirements, requiring (or simply allowing) more science, math and technology courses and less general humanities for entertainment technology students would be helpful to many students and would not be a dangerous thing to do. Brilliant and legendary Nobel-prize winning scientist Richard Feynman, who made enormous and significant contributions to so many fields, had this to say in an interview in one of his books[17] in a section called "Avoiding Humanities":

> I've always been very one-sided about science and when I was younger I concentrated almost all my effort on it. …I didn't have much patience with what's called the humanities, even though in the university there were humanities that you had to take. ...It was only afterwards, when I got older, that I got more relaxed, that I've spread out a little bit. I've learned to draw and I read a little bit, but I'm really still a very one-sided person and I don't know a great deal. I have a limited intelligence and I use it in a particular direction.

Of course, the brilliant Feynman here is being typically self-effacing, having written books and presented papers on everything from quantum electrodynamics to the relation of science and religion, and from acting in plays at Cal Tech to his famous appearance before Congress (bucking the system) to testify as to true cause of the Challenger disaster. Certainly Feynman was not hurt by a minimal exposure to and effort in humanities courses.

While I'm in no way comparing myself to the brilliance of Feynman, I find that I learn in much the same way. When I was in college, I was required to take two semesters of art history. While my scenic design, scenic painting and props friends ate up the course, I slept through most of it because I just couldn't see the relevance of the topic to my life or my career, and I had been working too late the night before in the theatre. Of course, as a professor, I know that college-age students don't understand everything about why or what they should be taking. However, if a topic is not critical to the student's overall success, and they are going to shut down and do the minimum to just barely get through such courses, wouldn't it be better for them to at least learn something in a topic in which they are interested? As a student, I was fascinated by electronics and similar topics, and I would have been wide-awake and learning in those classes, had they been available, and that is knowledge I could have used throughout my career. But since I was totally turned off to art history in college, I (almost intentionally) learned just about nothing from the class. I've since learned more about the topic touring art museums around the world while traveling (for work, mostly) than I ever could have when I was twenty. Only now is the topic of interest to me.

## WHAT TECHNOLOGIES DO WE NEED TO COVER?

In my opinion, there are a number of new core technologies that need to be at least introduced in college entertainment technology programs, and incorporated into student learning objectives. Of course, not every student needs to be required to take a course in every one of these subjects. But many of these topics are important, and should be included in general course work, with the possibility of advanced study if the student finds an interest. Here's a list, in no particular order:

- Math and Science (especially Physics). These topics are the basis of electronics, optics and mechanics, which underlie everything we do, and, therefore, need study. For many theatre technology students (including me), math does not come easily, but an understanding of the basic principles and the scientific method are critical to being able to master modern entertainment technology (and the modern technological world for that matter).
- Basic Electronics. Electronics underlie nearly everything we do today in entertainment technology. Electronics, of course, is a very broad term, but students should be introduced to at least the basics of circuits, resistance, capacitors, transformers, power supplies, etc. (I was once regarded as a "genius" on a huge outdoor concert because I used a voltmeter to check the power supply on a broken lighting console—a basic skill I learned in a vocational electronics class I took on my own time during college.) Many college physics departments offer a highly theoretical, math-intensive electronics course, but entertainment technology students, being so practically oriented, might do better in a more vocationally oriented, hands-on program.
- Electrical Power Distribution. Students should know about three-phase power, cam-lock-type connectors, feeder cable, etc. The vast majority of events a student will end up working on outside academic theatre will involve temporary power hook-ups.
- Rigging for Shows. A large percentage of the shows in the real world are done with trusses and chain motors, not counterweight rigging systems. All students should have at least an introduction to this kind of temporary rigging.
- Computer Systems and Networking. Obviously, this is critical for nearly every system today, from lighting to sound, and from video to scenery, and students shouldn't have to learn it on their own by hacking the campus network. Teach the basic concepts of TCP/IP, addressing, network configuration, etc.
- Moving Lights Operation, Configuration and Programming. The need for expert moving light programmers is small, but a huge percentage of lighting rigs outside academic theatre today depend on moving lights, so every lighting technician today should have at least a basic proficiency in these areas.

• Sound System Design and Engineering. Many theatrical sound courses focus on soundscore creation, but the vast majority of sound for live events is reinforcement. Being able to equalize a microphone to keep it from feeding back is probably a more valuable job skill than being able to edit a sound effect.

• Entertainment Control Systems. This includes electrical control system basics, serial communications, DMX-512 and MIDI in depth (bit-level), etc. Show Control takes these concepts even further.

• Video Systems. I'm not talking about filmmaking or video production here, but instead video signals, signal distribution and projectors, with a minimal emphasis on camera work and editing. Shows large and small depend on video these days, and there are plenty of people who know (and plenty of other programs that cover) camera operation, editing, etc., but a very small number that really know video signals and systems, and can actually design, troubleshoot and get video systems working.

• Structures. As scenic designers get more daring, it's important that technical designers are able to help push the envelope safely. The only way to do this is to actually learn and do some engineering. It's even possible to do this without calculus.

• Mechanics and Scenic Automation. Since a huge number of shows today rely on automated scenery, the basic concepts of machine tools, mechanisms, motion control and methods should be introduced.

• Permanently Installed Electronic Systems. Employees with a background in entertainment technology do very well in the electronic systems contracting industry, since they understand the art of presentation and also, if not most importantly, know how to meet deadlines. This industry is screaming for qualified employees all over the country, so students should at least get an introduction to conduit, terminal strips, wiring practices, code considerations, etc.

On my own time, I went outside both my college and graduate schools to take electronics and computer programming courses at local community colleges

## SMALL STEPS TO HELP SOLVE THESE PROBLEMS

Where do we go from here? Here are a few small steps you could take in your program to address the problem.

• Give technical students the respect and support they deserve (don't deride them as "just techies"). This is free, but the payback is enormous.

• Allow flexibility in your curriculum to accommodate technically skilled students. If possible, bring the coverage of the new core technologies listed above into your program requirements, or at least don't penalize students for studying the subjects outside your department or school.

• If your school doesn't, or can't, offer hands-on electronics, computer systems and networking courses, investigate other ways to allow those topics into the curriculum. Team up with another department in the school, or allow students to transfer credits in from a local community college, and allow students to substitute those courses for other courses not as central to the student's career. On my own time and around the overly heavy, under-credited production schedule, I went outside both my college and graduate schools to take electronics and computer programming courses at local community colleges, because I was not able to find those classes inside my curriculum. This became a burden since I couldn't replace any other required courses with my outside classes, but the knowledge gained in those courses has been extremely useful throughout my career.

• Increase the number of credit hours granted to technical students for production work, so they will be able to take a reasonable load of classes and still have time to study and do their homework in the technical classes.

• Pick one show each year to allow the technical students to stretch their legs. At City Tech, we do an annual "Haunted House" as a major production. Why not try a "themed" attraction? This is a great break from the routine for everyone, and a great opportunity for students (technical as well as design/acting/directing) to try, experiment, learn and push the limits.

• In schools, when funding technological purchases, consider the training purposes of technical students, not just what is needed to support this season's shows. This may take considerable convincing of those in control of the purse strings, but the only way to move towards addressing these issues is to effectively make the argument about the importance and impact of the technologies on the industry and the art. If you truly don't have the money, investigate grants, industry donations and other funding sources.

• In addition to USITT, encourage your students to attend commercially-oriented trade shows such as AES, IAAPA, InfoComm, LDI, NSCA and ProProduction. Give them time off from classes as necessary, especially as seniors, because they need exposure to non-theatre people in order to understand the nature and scope of the whole entertainment industry.

## LARGER STRUCTURAL CHANGES TO HELP SOLVE THESE PROBLEMS

Some schools have tried structurally different approaches to entertainment technology education to address the needs of the industry. Here at City Tech, we only train technologists—we have no actors or directors in the program. Our focus is on entertainment technology, not on design, since the job market for technical students is far better than for designers. Even so, we always encourage creativity, and we've had graduates admitted directly into prestigious graduate design programs. We focus on laboratory-based education, rather than on the classic conservatory model, and offer a Bachelor's degree and four certificates (lighting, sound, scenery and show control).

The Bachelor's degree includes a broad array of core classes in the humanities, science and math, and within that framework we require theatre history, script analysis, and other similar classes. Beyond that, we require the standard basics of stagecraft, and also offer as electives most of the new core technology courses detailed in the list above. Our labs were furnished with incredible support from the industry and with a generous grant our department worked hard to get from the Alfred P. Sloan Foundation. We only do a few full productions a year, cast from the overall school population (which certainly has its drawbacks), and do several smaller events (like one-day video setups or special events). We require an internship and a practical "culmination" project, and we work closely with the New York IATSE locals, and assist students in job placement. Given our location in NYC, and the thousands of nearby professional opportunities available for our students, we are able to exploit this approach fully, more so (of course) than would be possible in many other locations around the country.

However, there are other structurally different approaches that can also reach the same goals of including new technologies and other show forms without so radical an approach as we have taken. At Cornish College of the Arts in Seattle, a group of professional designers, stage managers and technical directors created the Performance Production Department as an independent department, not merely a technical branch of the theater, music, or dance departments. Dave Tosti-Lane, one of the founders and current Chair of Performance Production at Cornish reports: "This approach allows the department to offer students production experiences in more than one milieu, supporting productions of all three performing departments at Cornish." Professor Tosti-Lane has incorporated an enormous amount of technology into his program, and allows students the flexibility to take a range of technical subjects, even though the school's focus is still primarily on design.

Yet another approach can be found at Purdue University, situated in rural Indiana where a program such as what we have at City Tech would not be possible. Rick Thomas, Head of Design and Technology Programs in Theatre, says, "I firmly believe that the core of the problem is that by and large theatre programs are housed in liberal arts or humanities departments, performing arts schools, etc. These programs traditionally require a massive education in the humanities, leaving minimal amount of time in a student's program for a solid foundation in engineering and technology. At Purdue, I've gotten around this dilemma by helping to develop Purdue's interdisciplinary program in theatre engineering in the School of Engineering; this ensures that students get the sort of engineering foundation they require to take on the modern challenges of design and technology in the performing arts. Within this program, there is plenty of opportunity to take additional courses in theatre." In addition, motivated entertainment technology students work for pay with large on-campus producing groups. There, they can work on the bigger-budget, non-theatrical professional events using state-of-the-art equipment. Unlike many schools, this work is encouraged by the theatre department as an important component of design and technology students' education, and is generously sponsored and supported by the professional campus producing organization, Hall of Music Productions.

And, of course, it's possible to implement these changes incrementally as well. At Ithaca College, Dr. John Bracewell long ago identified the problem, and has since been taking steps to improve the situation for his students. "I'm convinced," he says, "that unless theatre schools start treating the whole scope of the entertainment industry as their legitimate field, we're in for a rough and declining ride. In past years, whenever I said that, however, I was either ignored or told I was wrong. The present department [at Ithaca] is very supportive, and I've been able to add show control and control electronics into the curriculum, giving students technical opportunities in these areas wherever possible."

## IN CONCLUSION

We need to bridge the worlds of ivory-tower theatre education with the commercial world of live entertainment production. I believe this bridge would be beneficial not just to the technical students, but to the whole art of performance. When high-tech systems such as video, moving lights, computerized sound, mechanized scenery and show control are mastered by even average entertainment technicians, they can advance the state of their craft, which will allow artists to advance the state of their art. Britney Spears wouldn't be nearly as successful without her entertainment technology (picture her alone on a bare opera house stage with no microphone). But just imagine what this technology could do in the hands of creative theatrical talent. ❖

***John Huntington*** *has worked throughout most sectors of the entertainment technology industry, is an Associate Professor at New York City College of Technology, and is author of the first book on entertainment control systems and show control:* Control Systems for Live Entertainment. *He can be reached through his show control Web site, www.zircondesigns.com. He is a member of IATSE Local #1, and lives in New York City. He will be teaching a Professional Development Workshop on show control at the upcoming USITT Conference & Stage Expo in Minneapolis.*

## RELATED WEB RESOURCES

International Communications Industries Association, Inc., the trade association for professional audio and video: **www.icia.org**.

Information about the electronic systems contracting industry's efforts to create a highly-educated work force: **www.hightechjobs.org**.

The Custom Electronic Design & Installation Association, the trade association of high-end consumer electronics (home theater, etc.): **www.cedia.org**.
The National Systems Contractors Association: **www.nsca.org**.
International Association of Amusement Parks and Attractions, the trade association for theme parks: **www.iaapa.org**.
An interesting grant-funded initiative to bring the arts and professional A/V communities together: **www.artavcomm.org**.
The entertainment technology program at City Tech: **www.citytech.cuny.edu/academics/deptsites/enttech**.
Cornish Colleges' Performance Production department: **www.cornish.edu/main.asp?sid=10**.
Purdue's interdisciplinary engineering program: **Engineering.purdue.edu/Engr/Academics/Programs/ide.html**.
Purdue's Theatre Department: **www.sla.purdue.edu/theatre/theatre**.
*Entertainment Design* article on the recent Britney Spears tour: **entertainmentdesignmag.com/ar/show_business_overthetop_pop**.

## ENDNOTES

1. *Britney Spears—Live from Las Vegas,* ASIN: B00005UKKF.
2. Pepsi logos ballyhooed from moving lights as the audience filed in, and Pepsi commercials were shown on the arena's video screens. Before Britney took the stage, the audience of pre-teens was brought to their feet with rousing chants of "Pep-Si! Pep-Si!" and "Sam-Sung! Sam-Sung!" in exchange for a few Pepsi and Samsung t-shirts. In 2001, the Britney Spears tour grossed $23.7 million, according to Pollstar.
3. In the interests of full disclosure, I have collaborated as a sound designer with Stern many times.
4. From the League of American Theatres and Producers, www.livebroadway.com/bwaystats.html.
5. From the League of American Theatres and Producers, www.livebroadway.com/roadstats.html.
6. From the TCG Web site: www.tcg.org/programs/pdf/Management_Programs/Theatre_Facts/theatrefacts_2001.pdf.
7. According to Pollstar (www.pollstar.com), as reported by the *Pittsburgh Post-Gazette*, January 4, 2002.
8. According to CEDIA, as reported in CE Pro, 2002 Buyers Guide, www.ce-pro.com.
9. According to Josh Weisberg, president of Scharff/Wesiberg Inc., www.swinyc.com.
10. According to the International Association of Amusement Parks and Attractions, www.iaapa.org/media/f-stats.htm.
11. According to the National Systems Contractor Association 2002 briefing.
12. As of August, 2002—the Web, of course, changes constantly.
13. Full Sail, www.fullsail.com.
14. See www.infocomm.org/Careers/Students/index.cfm.
15. An average of the last several years; from the WWE Web site: corporate.wwe.com (many years it's more like 2.5 million).
16. To see this phenomenon in action, see the fabulous PBS program "Sing Faster" which spotlights the stagehands at the San Francisco Opera.
17. *The Pleasure of Finding Things Out* by Richard P. Feynman, Cambridge, MA: Perseus Book Group, 2000; p. 2–3.