Proceedings of the Institute of Acoustics

CURRENT TRENDS AND THE FUTURE OF AUDIO IN THEME PARKS

L A Gedemer

Arup Audio Visual, Los Angeles, California, USA

1. INTRODUCTION.

In the last decade there has been a flood of entertainment technology into the average home. Technology such as computer games with 3-D audio, satellite dishes, and home theater systems, to name just a few. Because of this, people are becoming more technically savvy and therefore more demanding of how they are being entertained. This is especially true when a person has to pay an average of $40 (US) to visit a theme park and be entertained outside their home.

For years theme parks have relied on dramatic visual effects to attract and entertain visitors. But what about the use of audio? Typically theme parks do not invest nearly as much money on audio technology and acoustics as they do on visual technology. With hearing being such a large part of the overall sensory experience, why would theme parks tend to slight it? If audiences are expecting more from entertainment venues, can theme parks continue to overlook the importance of audio as a means to attract and entertain visitors?

In this paper we will examine the evolution of audio technology in theme parks in an effort to answer these questions. We will explore the current technologies being used and their effectiveness in producing dynamic aural experiences, especially for mass audiences. We will also look at some of the newer technologies and their ability to improve the overall entertainment experience.

2. AMUSEMENT PARKS AND WORLD EXPOSITIONS: THE EARLY THEME PARKS.

We can trace part of the origins of theme parks back to a small park in Denmark called "Dyrehavsbakken" or Deer Haven Park. This park was the king's private deer hunting forest where he opened a small section to a band of gypsies. Within this section of the forest the gypsies set up a type of carnival which dates back over 400 years and still exists today as a small amusement park. Of course we can imagine the audio in such a park was simply live musicians using home made instruments to accompany the various performers, animal rides and games of chance.

As amusement parks aged the use of audio was slow to change. As we look at some of the theme parks of the early 1800's, such as Coney Island in New York and Tivoli Gardens in Copenhagen, we can see that in their early days the audio "system" of choice was still live musicians. We can assume that the choice of using live musician was simply a matter of using the only form of audio available. If you go to Tivoli today you will notice that little has changed. I'm sure the decision to keep Tivoli as it is was driven by the need to maintain the park's old fashion charm. I encourage anyone who is interested in theme parks to visit Tivoli, as it was Walt Disney's inspiration for his theme parks.

As we look into the mid 1800's to early 1900's we notice the advent of world expositions and fairs. These are the true precursor to modern theme parks as we know them today. World expositions today are typically put in the same class as theme parks because it is not uncommon for some part of the

exposition or fair sight to remain as a permanent park after the exposition is over. Many expositions share the same ideas and technology with theme parks. In fact the famous "Small World" ride was originally an attraction at the World's Fair in New York in the 1950's before it became part of Disneyland.

Refocusing on audio as it pertains to expositions, there is a parallel between what technology is used and the purpose of the attractions at an exposition. To explain this we must first look at the purpose of an exposition. World expositions and the attraction within them are typically used to promote ideas, countries, and products. In order to educate people to the items being promoted, expositions will use entertaining rides and attractions. A good example of this is at the New York World's Fair where General Electric used the attraction "Home of the Future" to promote their new household appliances. Considering that General Electric is a technology company, their attraction had to be technologically advanced and was considered quite revolutionary for it's time. With the early expositions, the rides and attractions were simple as was the audio technology used within them. As with the early amusement parks, it wasn't a matter of using the best audio technology but that of using the only technology available at the time. The audio devices often used were old fashion cartridge tape machines and phonographs. Since many of the attractions at expositions were temporary there was no need to use equipment that had long life spans and the audio quality of these devices was considered adequate.

3. THE EARLY THEME PARKS.

We will move on from world expositions and fairs and take a look at Disneyland, the first modern day theme park.

Walt Disney took much of his inspiration from the early world expositions. He liked the idea of entertaining and educating people at the same time. The earliest Disney rides and attractions were simple, the technology available and people's expectations were not developed quite yet.

Television was in its infancy, most forms of entertainment technology as we know them today did not exist, and people were basically easy to impress. People's expectations are almost always paralleled by their frame of reference. If you don't know what good audio is, you won't expect it. With this in mind, the early theme and amusement parks chose audio equipment that could simply produce sound 12 hours a day, 7 days a week. Sonic quality was not an issue. There was now new driving forces behind equipment choice: robustness and reliability. Nobody wanted to pay to get into Disneyland if the attractions weren't working.

Disney and other theme / amusement parks were quick to notice that their target audience responded to astonishing visual effects. These included firework shows, dancing robots, beautiful landscaping and unusual fantasy type buildings. Of course, these types of visual effects cost money, in most cases, a lot of money. Usually working with a limited budget, it was easy for the theme park owners and designers to make the determination that the money should be allocated towards great visuals effects and not audio. The assumption was made that the audience would be so knocked out by a dancing robot that they would not care about the quality of the background music being played. This is especially true if the audience is in a moving ride vehicle.

Most theme / amusements parks in the 1950's through 1970's used cartridge tape machines as an audio source device, tube amplifiers, and basic 8" paper cone loudspeakers. There was little or no audio processing involved. Towards the 1970's, as computer technology really started to blossom, it

was common to store recorded audio on an erasable-programmable-read-only-memory chip also known as an EPROM. Eproms allowed short duration audio to be stored on a small chip that was highly robust. This robustness was due to the lack of moving parts on an eprom circuit card, unlike its precursor the cartridge tape machine. Eproms were favored by theme parks because they could conceivable last forever, thereby saving money in the long term. Eproms could store multiple, short duration sound effects such as gunshots that would automatically be triggered to play by a switch closure. This switch closure was usually provided when a ride vehicle passed a certain part of the ride "track" tripping a switch.

The use of any type of acoustic treatments during this period was almost unheard of. There was a strong belief in the theme park world that acoustics only belonged in the serious world of performance halls.

4. THE LAST 20 YEARS.

In the 1970's, theme parks guests started to change. They had grown up with television, 8-track tapes, quadrophonics, and men walking on the moon. People were basically becoming tougher to amuse. In the 1970's Disney gained a bit of competition in the form of several smaller theme park chains and its now biggest competition, Universal Studio Tours. Universal allowed the guests a completely different experience. Instead of the Disney ingredients of amuse, entertain, and educate; Universal chose to let people live in their favorite movies. People loved it, even if it meant getting eaten by a huge mechanical shark.

Universal was allocating budgets that had never been seen before in other theme parks..As movies budgets were growing so were the budgets that allowed people to "ride the movies" [TM] as the Universal slogan goes. Disney was always trying to out do the competition, and was more than happy to join in the big budget race. These budgets allowed new technologies to be explored and exploited. Unfortunately this didn't always include audio. The perception amongst theme park designers and owners was that fantastic visual effects provided a much more dynamic show and therefore a higher return on investment. Audio was still very much viewed as a "necessary evil", with loudspeakers providing nothing more than background music and destroying the look of the attraction. The source of audio was still cartridge tape machines and eproms.

Probably the best thing that ever happened to theme park audio was the development of the compact disc in the early 1980s. Suddenly people we hearing almost perfectly clear audio everywhere: their home, their car, in the movie theaters and even while they were jogging. Soon after compact disc players moved into the mass market people wanted to hear digital audio in the one place they really expected to be entertained, theme parks. This demand from the public was driven by the rising cost of entrance fees. The irony here is that the entrance fees were inflated to pay for all the new visual and robotic technologies while the audience was hoping they were going to get the clean, all digital audio experience they were getting out of their CD players.

Theme parks were trying to figure out how to use the new disc based technologies which included both compact discs and the audio / video laser discs. Their use quickly became apparent; compact discs were advertised as being a way to store audio indefinitely on an almost indestructible medium. This appealed to the accounting staff at most theme park companies. Unlike tape based audio cartridges which eventually wore out and needed to be replaced or eproms which could only hold a few seconds of audio at low bandwidths, compact discs could play 72 minutes of full bandwidth stereo audio and

presumably last forever. Now everyone was happy. The audience got their digital audio and the theme park got their robust, reliable audio source.

Up until this point I have not mentioned much about the other devices found in a typical audio playback signal chain. This is because the changes to amplifier and speaker technology moved much slower than that of audio source equipment. Since most theme park attractions do not utilize signal processing, all the different analog and digital signal processors developed over the years did not have much of an impact on theme park audio system design up to this time. I will take a moment now to explain why theme parks do not usually use audio processing as part of the permanently installed audio system. Usually a sound track for a theme park ride or attraction is composed of music and / or sound effects mixed together. Since most ride and attraction spaces are shaped much differently than the typical recording studio, this presents a need to mix the audio within the ride / attraction space itself. This process insures that the final audio mix has been optimized for the space, especially in terms of compensating for the room acoustics i.e. having the room response equalized out of the final mix. This whole process is called the "on sight mix". Unfortunately, this process a led many ride and attraction developers to believe that all acoustic problems can be compensated for in the final on sight mix, hence the severe lack of acoustic treatment in many theme parks.

Let's take a look at what has been happening within the last ten years. The advent of the compact disc was a big step forward in theme park audio. It took awhile to catch on everywhere though. While I was at the Walt Disney organization in the early 1990s we were just starting to replace all the old cartridge tape machines and eproms with compact disc players and laser disc players. Not all eprom cards were replaced though. One of the reasons was that there was still a need to provide short duration sound effects. Compact disc players were too expensive to use for just a 5 second triggered gun shot sound effect. For this reason, audio systems for parks such as Paris Disneyland, the Warner Brothers parks and most of the exposition sights around the world utilized a mix of eproms, compact disc players, and where audio and video needed to be associated together, laser disc players were used. Again, the rest of the audio signal chain was made up of some basic processing (if any), amplifiers, and speakers.

Times have changed and people have changed how they expect to be entertained. The other day I sat at my computer and was able to download a game that had amazing graphics and included a three-dimensional audio plug-in. Twenty years earlier I would have been watching my monophonic black and white television and been quite satisfied.

It has only been within the last few years that trying to provide immersive audio or some type of surround audio to large audiences has become the focus. This is due to the fact that large-scale immersive environments such as flight simulator rides / theaters, three – dimensional film theaters, stunt shows, and mixed live / movie theaters have become quite popular with today's computer-age audiences. The complexity of these shows has led theme park audio system designers to explore more computer based audio sources, mixing, matrixing and routing. These devices allow the system designer to do elaborate changes in audio source positioning, something that is critical to providing a truly immersive and dynamic show from an audio standpoint. Realizing that an immersive experience is based on dynamic effects in the visual as well as aural domain, we are now starting to see more theme parks put large amounts of money forward to develop complex audio systems.

One of the best examples of this that I can give is the recently opened Universal Studio Tours "Terminator 2 in 3-D" or "T2-3D" as it's called. This show has just about every visual and audio trick in the book. There is a three-dimensional film, a robotic Arnold Shwartzenegger (complete with Harley Davidson), live stunt actors on wireless microphones, over 200 tracks of prerecorded audio and 6

machine gun toting robots. All of this for a 5 minute attraction at a cost of over 100 million dollars (US). The on sight mix took six months to complete and the computer programming for all the computer based audio systems took over nine months. To date this audio system includes one of the largest Peavey Media Matrix systems ever installed. "T2-3D" is one of the first times I've seen an attraction built with acoustics truly in mind from the beginning. Universal hired an acoustic consulting firm early in the project, realizing that the complex audio positioning they were trying to accomplish would be impossible with out seriously considering the acoustics of the show space. This show has become Universal's most popular and highest income earner to date.

I recently asked the vice president in charge of audio production at Universal what drove audio equipment decisions for their new park in Florida. He told me that it was a combination of the following:

1. Flexibility: especially computer based devices that allow changes to be made quickly and after the system has been installed.
2. Reliability: the accountants still expect a 5 – 10 year life span on all technical systems. If there is down time for an attraction for any reason, there will almost always be an associated loss of revenue.
3. Ease of use: the average theme park attraction operator is an 18-year-old kid on holiday. Theme parks also tend to turn over staff often, so new staffers have to be trained on the equipment quickly.
4. Quality: theme parks want to present a good show so that the guests will return and spend more money.

Universal is using and interesting way of designing the audio systems for this new park, more of a consultant versus a design / build contractor type approach. They designed the system with generic "boxes" of equipment with the idea of actually specifying the equipment to be used as close to the opening day as possible. Universal feels that this approach will allow them to utilize the newest equipment and technology on the market. At Arup we call this approach to system design waiting until the "last responsible moment".

In most other theme park designs, the equipment was determined sometime as many as three to five years before the park was actually built. The benefit to this approach is that allows a project budget to be determined early on and is easy to track through out the life span of the project using a standard 5% per year equipment cost inflation multiplier. It also allows a theme park owner to rest assure that he is using equipment which has been proven on the market for at least the duration of time between equipment specification and installation. The unfortunate drawback to this approach is that audiovisual equipment changes so rapidly that a theme park may overlook new equipment that can either solve an existing problem or improve the overall quality of the show, or perhaps both.

After traveling the world extensively designing and installing audio systems, there is another driving force to audio equipment choices that I find interesting: demographics. I've noticed that the composition of the audience will quite often help determine budgets for equipment and the equipment itself. Not surprising, the more teenaged boys a theme park expects in the audience, the more money they put into advanced audio and visual technology. Why? Teenaged boys use more new technology are have shorter attention spans than any other demographic group. They also tend to spend quite a bit of their (or their parents) disposable income. Go to a video game arcade sometime, you'll see what I mean.

5. WHAT IS AHEAD FOR THE FUTURE?

Looking into the future has always been a good trick, especially when it comes to technology.

I see theme parks using more computer technology. Computer servers connected to a high-speed digital network can provide multiple channel, random access, high quality audio and video. As computers become more robust, computer servers will fill all the needs of the typical theme park audiovisual system: reliable, flexible, easy to operate, and high quality. One of the large benefits of a server-based system is the ability to edit and download audiovisual content over a modem or other type of network connection. This can be especially useful if an American company installs a system in China. In the past, if a change was made to a show after it was installed, new audio tracks had to be either hand carried or shipped to the theme park sight for re-installation. With a server-based system, if a show changes, you could simply dial into the system and download any changed to the audio tracks. There is also the consideration that computer servers would allow the theme park guest to change the content of a show as he / she sees fit. Imagine being able to customize your experience at a theme park. My personal choice would be to change all the words to "It's a Small World After All". I'd pay good money to be able to do that!

Holographic, three-dimensional, spatial, and immersive are all the new audio buzzwords. I think we will see an expansion from the typical 5-channel surround systems, which the average consumer can now buy for their living room. People will refuse to pay $40 to get into a theme park if the entertainment experience is better in their home. Immersive, larger-than-life attractions seem to be the key to pulling in large audiences at theme parks, such as our T2-3D example. Many audio companies are now touting true three-dimensional or holographic audio. I'm a bit skeptical to these systems due to their physics defying properties, but after listening to some of them I can truly say that they are an improvement on standard surround sound. As these systems become more developed I expect to see more of them in theme parks.

Acoustic simulators and modeling tools will move out of the acoustic consultant's office and into the world of theme parks. This, I believe will be driven by simple real estate economics. Land and buildings are expensive. If theme parks can make a guest believe, through acoustic manipulation, that they are in a much larger space than they actually are in, you can accomplish the same result in less real estate. You could possibly build a virtual theme park inside a big city, high rise building. An acoustic simulator teamed with an audiovisual server could prove to be a very powerful tool.

We will also start to see all-digital audio systems in theme parks. More and more theme parks are starting to put in fiber optic cable. An all-digital system would allow a great deal of audio information to travel down a single fiber optic line. Where in today's theme park each attraction has it's own equipment room, an all-digital system could be housed in one central equipment room and networked out to the entire theme park. Especially if all the audio (and visuals) were on one of those audiovisual servers. Needless to say, this would save a great deal of money in space and equipment and be much easier to maintain.

As you can imagine, all this newer technology will come at a price, mostly a higher price. This, I believe, will start to split the theme park market between the stronger, larger firms who can afford the latest technology and the smaller firms who will need to continue relying on the older, less expensive technology. A logical progression to this might see the extinction of the smaller theme parks due to their inability to provide the audiences with the high-tech, expensive attractions that they will continue to demand.

CURRENT TRENDS AND THE FUTURE OF AUDIO IN THEME PARKS

The possibilities for the future of theme park audio are truly endless. Technology will continue to evolve by leaps and bounds while the theme park audiences will become more technically savvy. These two thoughts will continue to merge and become the main driving force in the choices of audio equipment for the world of theme parks.