Music Technology and Storage

Group 10 – Peridot

Elizabeth Gao, Alex Grabast, Natalie Horne,

Jessy Johnson, Monica Starr, and Michaela Wubbels

Over the years the music industry has changed and adapted to the needs of society. What started out as a simple idea, turned into a reality. Music storage used to involve huge, wasteful products. Recording music used to be difficult and tedious. Now we are thankful that we have many technological advancements like sound editing software, compact discs, speakers, and mp3 players.

Sound editing software

There is a basic process that all sound editing software follows. The software enters and takes out vibrations to make the music faster, slower, lower, or higher. This is called frequency, and it is measured in hertz or kilohertz. It may contain different waves at different speed levels and volumes, too.

Sound, amplitude, level, and gain are measured in decibels (dB). If you bring the music up 6 dB you bring the amplitude up by ½ and the power up by ¼ .Amplitude is the size of vibration that makes the music louder or softer.

There are many different sound editing software options available, two of which are Garage Band and Audacity. Garage Band is software that works like a teacher. It teaches you to play the instrument you have and what you can do with the instrument. Audacity also does the simple things that Garage Band does. You can record live audio and adjust volume. You can

change the pitch and the speed. Some effects you can do with Audacity are making the music echo, reversing the music, making the bass louder, and removing hissing or humming.

How CDs are made

The music industry has come very far since 1983, but there is one thing that has not changed. That is the compact disc, or CD. The idea started in the early 1970's when Laserdisc and Phillips experimented with audio-only optical discs. In 1979, Phillips and Sony merged. They created the "Red Book," the standard CD. By 1983, compact discs were in stores. Over the course of the next ten years, many other versions of the compact disc were created. These include CD-ROM, with read-only memory, and CD-P, which is user-recordable. Though the CD has not changed much, the manufacturing process has. Over time it has become much more modern and efficient.

CDs are manufactured in the "clean room," a dust free area. The air in the room is sent through a special filtration system to ensure that it is dirt and dust free. The workers are required to wear special clothing. All these regulations are required because just one particle of dust can make a CD useless.

The first process in the manufacturing of CDs is preparing the disc master. The disc master will eventually become the actual compact disc. First, the music is recorded onto an audio tape. Then, the audio tape is transferred onto a .75 in. video tape. The data, or subcodes used for indexing and tracking music, are added to the audio data on the tape, or pre-master. The pre-master is then turned into a disc master, a disc made of specially manufactured glass. It is polished smooth and coated with a layer of adhesive and then a layer of photoresist material. The disc is now 9.45 in. (240 mm) in diameter and .24 in. (6 mm) thick. The disc master is then cured in an oven. After being cured, the disc master and the pre-master are placed in a laser machine which plays back the initial audio on the pre-master. The audio is then

put into a device called a CD encoder. The CD encoder generates an electronic signal that powers a laser. This laser will use chemicals to cut grooves in the photoresist layer on the disc master. These grooves will become pits. The spiral track of pits and lands is what the CD players read. Lastly, a metal coating is put on the disc, which is usually silver.

The next process to create a compact disc is electroforming. To begin electroforming, another metal layer is added to the disc, usually nickel. This metal layer is put onto the disc using an electric current. Then, the disc is placed in an electrolytic solution. While it is in the solution, a metal layer forms on the disc. This layer is then pulled off the disc. It has a negative impression of the disc's track. This metal is called the "father metal." It is used to create a "mother metal" which has a positive impression of the track. Next, the "mother metal" is used to create a "son metal." This has a negative impression of the track. It will be used to create the actual CD. The "son" is rinsed, dried, and polished. It is then put into a machine that punches a hole in the center and makes the CD the correct diameter.

The final process in manufacturing a CD is reproduction. To start, the "son" is placed in a mold and covered with polycarbonate plastic. The plastic now has a positive impression of the disc's track. The center hole is punched out again and the CD is scanned for flaws. The disc is coated with aluminum first. Then, a protective layer of acrylic plastic. To finish off, the company's label is printed on.

The compact disc has advanced the music industry by cutting down on the materials used to store music. Over seventy minutes of music can be stored on the small disc. This is much more time than anything else the industry has used, which is why the disc has been popular for twenty-five years. The manufacturing may take some time, but the end result makes it all worthwhile.

How CDs are read

Compact discs are read by lasers that are able to read the pits and bumps on their surfaces. Pits and bumps are the same, but it depends on which side you are looking at. They appear as pits on the aluminum side and as bumps on the side that the laser reads. The process of reading a CD starts in the CD player. Inside a CD player, there is a very small laser beam and a tiny Photoelectric cell (an electronic light detector). When you start the CD, it begins to spin at a high speed of 500 rpm. The laser beam turns on and starts at the center of the CD and makes its way to the outside, reading the information on the disc. The motor slows gradually as the laser and photocell scan. The laser then flashes up onto the underside of the CD (shiny side) and bounces off the pattern of pits. It then lands on the flat areas of the disc; the flat areas reflect the laser back whereas the pits scatter the light.

Whenever the light reflects back, the photocell detects it and realizes it has found land. It sends back a burst of electronic currents to an electric circuit. The electronic circuit records this as the number one. When light does not reflect back, the photocell sees no land and the electric circuit records the number zero. Together the laser and the electronic circuit eventually create a pattern of ones and zeros that were originally stored on the disc in the factory. This process of zeros and ones is called binary digits. Another electronic circuit decodes these binary numbers and converts them into a pattern of electronic currents. A speaker then transforms the electric current into sound. This is an example of electric energy being converted into sound energy that you can enjoy.

Speakers

The quality of sound depends on the speakers in any sound system. The electric signal stored on things like CDs, tapes, and DVDs are taken in by the system’s speakers, which is the component that turns it into actual sound that we can hear. In order to understand speakers,

you have to understand sound. The brain creates an understanding of the sound around us by the vibrations from the ear drums. Sound travels from one source to the eardrum by changes in air pressure that flow into the ear. We hear music, TV shows, and movies, because of changes in air pressure caused by speakers. Different levels of sound are produced by speakers, which change the vibrations attacking the eardrum. The height of pitch involved in sound is increased by fast fluctuations in air pressure. The pitch becomes lower when the fluctuations are slower. When the eardrum reacts quicker than normal, amplitude is created. This produces higher volume level that we can hear.

The air pressure changes create sound waves that hit our ear drums, which changes how our ears react to the sound produced by the speakers. When speakers receive information from things such as TV or CD's, they recreate the sound. That way, our brains will be able to interpret it. We hear the sound through our eardrums from when speakers change the air pressure inside, and expel it outwards.

Different types of speakers create different sound experiences that we hear. Subwoofers are woofers that are designed for low frequencies. They can add a bass response to home stereo system, which are often used to enjoy movies and television. Amplifiers are used to increase volume level, which you will usually see in rock concerts or performances. Speakers are a very important part of sound systems, which let us enjoy music, television, and other electronic devices. How they produce sound for our personal enjoyment is simply phenomenal.

mp3 Players

The abbreviation mp3 stands for MPEG Audio Layer-3. Most mp3 players are typically 96-128 kbits per second. The lower the amount of kbits per second, the lower the quality of sound, or audio. Mp3 players can last anywhere from 10-28 hours on a single charge. The basic parts of an mp3 player are the dataport, memory, microprocessor, the digital signal

processor (DSP), display, playback controls, audio port, amplifier, and the power supply. An mp3 player needs all of these to be an mp3 player. Those were just some of the basic parts of an mp3 player, though. Some of the newer versions have other additions.

There are several different memory devices. There is internal flash memory, compact flash cards, smart media cards, memory sticks, and internal micro drives. When you select a song to listen to, the mp3 player must pull the song from its memory. It then has to recover the mp3 encoding, then putting it through a digital-to-analog converter. Then it is turned into sound waves and it amplifies the analog system. You can now hear the song you selected through your headphones or speakers.

Music technology has changed throughout the years. We now have editing software, mp3 players, speakers, and compact discs. These recent changes in technology have made music more accessible and more portable, so music plays a bigger role in the daily life of many people.

Citations

"(1.3) Amplitude and Frequency." *How Music Works*. ChordWizard Software Pty Ltd, 2010. Web. 5 Mar. 2011. <http://www.howmusicworks.org/hmw103.html>.

Apple Inc. "GarageBand '11." *Apple*. Apple Inc., 2011. Web. 5 Mar. 2011. <http://www.apple.com/ilife/garageband/>.

"Audacity: Free Audio Editor and Recorder." *Audacity*. Audacity development team, 2011. Web. 5 Mar. 2011. <audacity.sourceforge.net>.

Brain, Marshall. "How CDs Work" 01 April 2000. HowStuffWorks.com. <http://electronics.howstuffworks.com/cd.htm> 05 March 2011.

Carpesomediem. "How Do Speakers Work?" *Hubpages*. Hubpages Inc., 2011. Web. 5 Mar. 2011. <http://hubpages.com/hub/how-speakers-work>.

"Compact Disc." *EDinformatics: Education for the Information Age*. N.p., 1999. Web. 7 Mar. 2011. <http://www.edinformatics.com/inventions_inventors/compact_disc.htm>.

Harris, Tom. "How Speakers Work" 02 February 2001. HowStuffWorks.com. <http://electronics.howstuffworks.com/speaker.htm> 05 March 2011.

Riaz, Rashid. "Compact Disc." How Products Are Made. 1994. *Encyclopedia.com.* 7 Mar. 2011<http://www.encyclopedia.com>.

Woodford, Chris. "CDs and DVDs." *Explain That Stuff!* N.p., 26 Nov. 2010. Web. 7 Mar. 2011. <http://www.explainthatstuff.com/cdplayers.html>.