How are electronics changing the way we make and listen to music?

View the video segment “Toy Symphony” to learn about some creative new ways in which music and electronics can be combined.
Catching a Sound Wave

Everyone knows that music and electronics go together. If you want to hear music, you turn on a radio or TV, choose a CD or DVD to play, or listen to a computer file downloaded in MP3. All of these formats use electronics to record, play, and amplify music. Some of the most recent developments in music also use electronics to produce the music in the first place. For example, the orchestral music playing in the background of the last blockbuster movie you saw may not have been played by an orchestra at all. It may have been produced electronically on a computer.

Music consists of sound, and sound is a wave. Inside your TV or stereo equipment, electronic circuits represent sound waves as analog signals or digital signals. In analog recordings a peak in the original sound wave corresponds to a peak in the current. Radio and TV broadcasts are usually analog signals. The sound wave is converted to electromagnetic waves sent out through the air. Your radio or TV set receives these waves and converts them back to a sound wave.

In digital sound recordings the system samples the incoming sound wave at frequent intervals of time, such as 44,100 times per second. The system measures the height of each wave and assigns it a number. The numbers form a digital signal. This information can then be stored and transmitted. The playback electronics, such as CD players and DVD players, convert the signal back to a sound wave for you to hear.
Digital Devices

In a compact disc (CD), the numbers representing the sound wave are coded into a series of microscopic pits in a long spiral track burned into the plastic of the CD. A laser beam scans the track and reads the pits, converting the data back into numbers. This information is then converted into sound waves by an electronic circuit in the CD player. CDs can store up to 74 minutes of music because the pits are only a few millionths of a meter in size. Digital videodiscs (DVDs) often have several layers, each with a separate data track, and use even smaller tracks and pits than CDs use. As a result, a DVD can store seven times as much information as a CD.

The amount of computer space needed to represent a song in normal digital format is too large to store very many songs on a single device. However, the development of a compression program called MP3 decreases the size of a typical song to one-tenth its original size. This enables you to buy and download a song from the Internet in minutes instead of hours and store files on your computer or MP3 player without taking up too much space.

Making Music

These advances in recording and playing music enables you to listen to music, whatever your taste in music happens to be. Electronic technology also allows you to change the music or even generate your own music, as shown in the video. Recording engineers used to work with large electronic consoles with hundreds of switches in order to blend different singers and background

MP3 players store digital files that are compressed in size.
instruments or to add special effects such as echoes or distortion. Now this can all be done on a laptop computer, using the Musical Instrument Digital Interface (MIDI).

MIDI technology is an advancement in digital technology. Whereas CD, DVD, and MP3 files represent the sound waves themselves, MIDI files represent the instructions for another device—such as an electronic instrument—to play the music. With MIDI, you can connect an electronic keyboard directly to a computer and compose and edit your own music, layer in the sounds of different instruments, and dub in special effects. Once you understand how to use electronics to produce the sound waves you want, you can become your own favorite band.

Every year, scientists develop new technologies affecting the way we produce and listen to music. As advances in music technology are made, new questions arise.

• Are there electronic sounds that no one has heard before?
• How will the development of music technology affect who is producing music?
• What type of devices will people be using to listen to music in 50 years?

Home recording studios are possible because of new electronic technology.

UNIT PROJECTS

As you study this unit, work alone or with a group on one of these projects.

Multimedia Presentation
Put together an informative presentation that explains how electric guitars work.
• Gather information about electric guitars. Learn how they use both electricity and magnetism.
• Give a presentation that uses mixed media, such as a computer slide show, model, poster, or tape recording.

Build a Radio
Build a working radio from simple materials.
• Using books or the Internet, find instructions for building a simple crystal radio.
• Collect the materials and assemble the radio. Modify the design of the radio to improve it.
• Demonstrate the radio to the class and explain how it works.

Design an Invention
Design an electronic invention.
• Select a purpose for your invention, such as a toy, a fan, or a burglar alarm. Write a paragraph that explains the purpose of your invention.
• Draw a sketch of your design and modify it if necessary.
• Make a pamphlet to advertise your invention. If possible, build the invention and include photographs of it in the pamphlet.

Learn more about careers in music and computer science.