SOUND

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OVERVIEW

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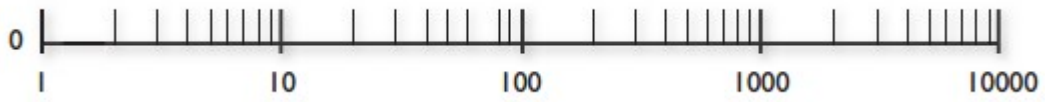
- Introduction to sound
- Digital audio
- MIDI audio
- MIDI versus digital audio
- Audio file formats
- Adding sound to multimedia projects

INTRODUCTION TO SOUND

- Vibrations in the air create waves of pressure that are perceived as sound
- Sound waves vary in sound pressure level (Amplitude) and in frequency or pitch
- Sound pressure levels are measure in decibels (dB)



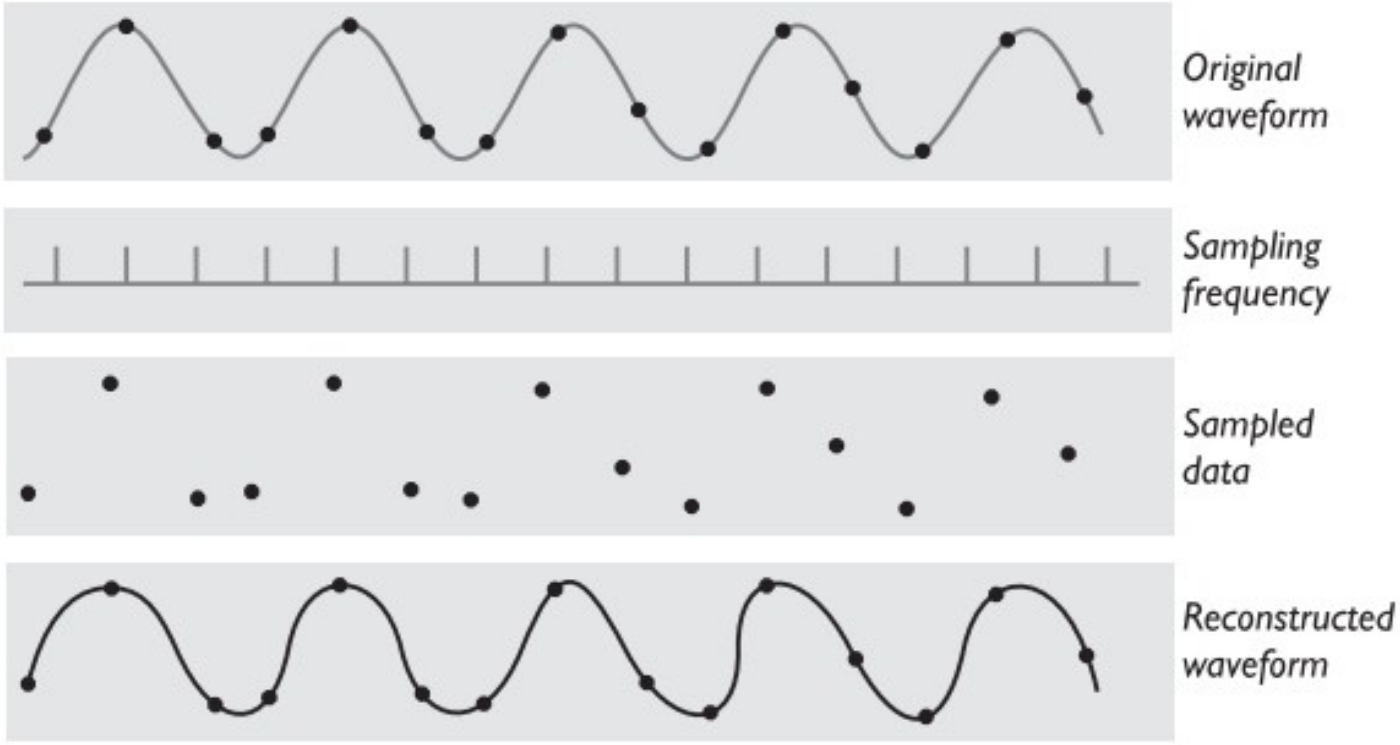
DIGITAL AUDIO

- Digital audio is created when you represent the characteristics of a sound wave using numbers.
- **Samples** represent the amplitude (or loudness) of sound at a discrete point in time
- **Sample rate** (or **frequency**) the number of samples taken per second, measured in hert or kilohertz (1kHz = 1000Hz)
- **Sample size (or** Bitdepth**)**: the number of bits used to represent the value of each sample

DIGITAL AUDIO

- Human ear: 20 Hz- 20 KHz
- The three sampling frequencies most often used in multimedia are: 44.1 kHz , 22.05 kHz, and 11.025 kHz
- Sample sizes are either 8 bits or 16 bits

DIGITAL AUDIO

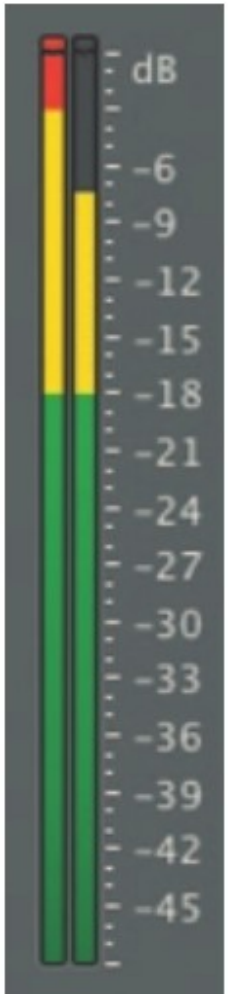


MAKING DIGITAL AUDIO FILE

- Crucial aspects of preparing digital audio files are:
  - Balancing the need for sound **quality** against file **size**. Higher quality usually means larger files, requiring longer download times on the Internet and more storage space on a CD or DVD.
  - Setting proper recording levels to get a good, clean recording.

MAKING DIGITAL AUDIO FILE

- Setting Proper Recording Levels
  - Recordings that are made at too low level are often unusable
  - Recordings that are made at too high level may contain an unpleasant crackling or background ripping noise
  - Set the right levels by paying attention to digital meters and try to keep peak levels between –3 and –10



EDITING DIGITAL AUDIO FILE

- Editing digital records
  - Tools: Audaxity, Adobe audition
- The basic sound editing operations that most multimedia producers need including trimming, splicing and assembly, volume adjustments, format conversion, resampling or downsampling, fade-ins and fade-outs, equalization, time stretching, digital signal processing (DSP), multiple tracks.

EDITING DIGITAL AUDIO FILE

- Trimming: Removing “dead air” or blank space from the front of a recording and any unnecessary extra time off the end.
- Splicing and Assembly: removing the extraneous noises.
- Volume Adjustments: raising or lowering the overall volume by a certain amount
- Format Conversion: converting files to other format. Data may be lost when converting formats

EDITING DIGITAL AUDIO FILE

- Resampling or Downsampling: reducing the number of samples.
- Fade-ins and Fade-outs: helping to smooth out the very beginning and the very end of a sound file
- Equalization: modify a recording's frequency content so that it sounds brighter (more high frequencies) or darker (low, ominous rumbles)

EDITING DIGITAL AUDIO FILE

- Time Stretching: alter the length (in time) of a sound file without changing its pitch
- Reversing Sounds: playing backward all or a portion of a digital audio recording
- Multiple Tracks: editing and combining multiple tracks

EDITING DIGITAL AUDIO FILE

- Once a sound effect is processed and mixed onto a track, it cannot be further edited, so **always save the original** so that you can tweak it again if you are not happy.

DIGITAL AUDIO FILE SIZE

- Audio resolution determines the accuracy with which sound can be digitalize
- The formulas for determining the **size** of a monophonic digital recording in **bytes**:

  sampling rate * duration of recording in seconds * (bit resolution / 8)

- The formulas for determining the **size** of stereo recording in **bytes**:

  sampling rate * duration of recording in seconds * (bit resolution/8) * 2

Note: Sampling rate must be converted to Hz

DIGITAL AUDIO FILE SIZE

- Calculate the file size of a five-second recording sampled at 22 kHz, 16-bit stereo (two tracks)

MIDI AUDIO

- MIDI (Musical Instrument Digital Interface) is a communications standard for electronic musical instruments and computers.
- MIDI provides a protocol for passing detailed descriptions of a musical score, such as the notes, the sequences of notes, and the instrument that will play these notes
- A MIDI file is a list of time-stamped commands that are recordings of musical actions , when sent to a MIDI playback device, this results in sound

MIDI AUDIO

- MIDI is a shorthand representation of music stored in numeric form
- It is not digitized sound
- A sequencer software and sound synthesizer is required in order to create MIDI scores
- MIDI is device dependent

MIDI AUDIO

- One problem with MIDI is that the quality of the actual sound you hear will vary depending on the quality of your computer's sound hardware
- Since they are small, MIDI files embedded in web pages load and play promptly
- The length of a MIDI file can be changed without affecting the pitch of the music or degrading audio quality
- Working with MIDI requires knowledge of music theory

MIDI AUDIO

- Test your MIDI files thoroughly by playing them back on a variety of hardware devices or with different MIDI players before you incorporate them into your multimedia project.

MIDI VERSUS DIGITAL AUDIO

- MIDI is device dependent, digital audio is device independent
- MIDI files are typically much smaller than digitized audio
- MIDI files may sound better than digital audio files when played on a high-quality MIDI device
- With MIDI, it is difficult to play back spoken dialog, while digitized audio can do so with ease
- MIDI does not have consistent playback quality, digital audio does
- Need knowledge of music theory in order to run MIDI, while digital audio does not have this requirement

MIDI VERSUS DIGITAL AUDIO

- Choose MIDI:
  - If you don’t have enough RAM memory, or bandwidth for digital audio
  - If you have a high quality sound source
  - If you have complete control over the playback hardware
  - If you don’t need spoken dialog

MIDI VERSUS DIGITAL AUDIO

- Choose digital audio:
  - If you don’t have control over the playback hardware
  - If you have the computing resources and bandwidth to handle the larger digital files
  - If you need spoken dialog

MULTIMEDIA SYSTEM SOUND

- Multimedia sound is either digitally recorded audio or MIDI music
- Most computers have sounds ready to use
- Mac and Windows have built in sound recorders

AUDIO FILE FORMAT

- A sound file's format is recognized methodology for organizing data bits of digitized sound into a data file
- The most common sound formats you might use are wav, aif, aac, flv, mp3, mp4, mov, swf, wma, ogg, or for ringtones, m4r, aac, midi, mmf, 3g2, 3gp, 3gp2, and 3gpp.
- Be sure your audio software can read and write the formats you need

VAUGHAN'S LAW OF MULTIMEDIA MINIMUMS

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- There is an acceptable minimum level of adequacy that will satisfy the audience, even when that level may not be the best that technology, money, or time and effort can buy

ADDING SOUND TO MULTIMEDIA PROJECT

- Before you start:
  - File formats compatible with multimedia authoring software being used, along with delivery mediums, must be determined
  - Sound playback capabilities offered by end users' systems must be studied
  - The type of sound(background music, special sound effects, or spoken dialog) must be decided
  - Digital audio or MIDI data should be selected on the basis of the location and time of use

ADDING SOUND TO MULTIMEDIA PROJECT

- Steps:
  - Create or purchase source material
  - Edit the sounds to fit your project
  - Test the sounds to be sure they are timed properly with your project

ADDING SOUND TO MULTIMEDIA PROJECT

- Space consideration
  - Compression techniques reduce space but reliability suffer
  - Space can be conserved by down sampling or reducing the number of sample slices taken per second
  - Many multimedia developers use 8-bit sample sizes at 22.05 kHz sampling rates because they consider the sound to be good enough

ADDING SOUND TO MULTIMEDIA PROJECT

- Audio recording:
  - Recording on inexpensive media rather than directly to disk prevents the hard disk from being overloaded with unnecessary data
  - The project's equipment and standards must be in accordance with the requirements

ADDING SOUND TO MULTIMEDIA PROJECT

- Keeping track of your sounds:
  - It is vital to maintain a high-quality database that stores the original sound material
  - Give your sound files helpful names

ADDING SOUND TO MULTIMEDIA PROJECT

- Sound for the Internet:
  - The sound is actually not part of the web page but is a separate file with its own address on the Internet, which is “embedded” in the page
  - Several methods for playing digital or MIDI sound from a web page:
    - Using HTML
    - Using Adobe’s Flash

ADDING SOUND TO MULTIMEDIA PROJECT

- Testing and Evaluation:
  - During editing and authoring, regularly test the sound-and-image synchronization of your project.
  - If you are delivering your sound on the Web, test it with different browsers and different connection speeds.
- Be sure you understand the implications of using copyrighted material

ADDING SOUND TO MULTIMEDIA PROJECT

- Sound and image synchronization must be tested at regular intervals
- The speed at which most animations and computer-based videos play depends on the user's CPU
- The sound's RAM requirements as well as the users' playback setup must be evaluated
- Copyrighted material should not be recorded or used without securing appropriate rights from the owner or publisher