BINUS UNIVERSITY

Course : 0553T / Multimedia System
Year : 2015

SOUND
Session 04

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OUTLINE

- The Power of Sound
- Digital Audio
- MDI (Musical Instrument Digital Interface)
- Audio File Format
- Working with Sound
- Guidelines for the Use of Sound

The Power of Sound

- Definition of Sound :

Rapid vibrations

transmitted as

Air pressure variations

manifest as

Waveforms

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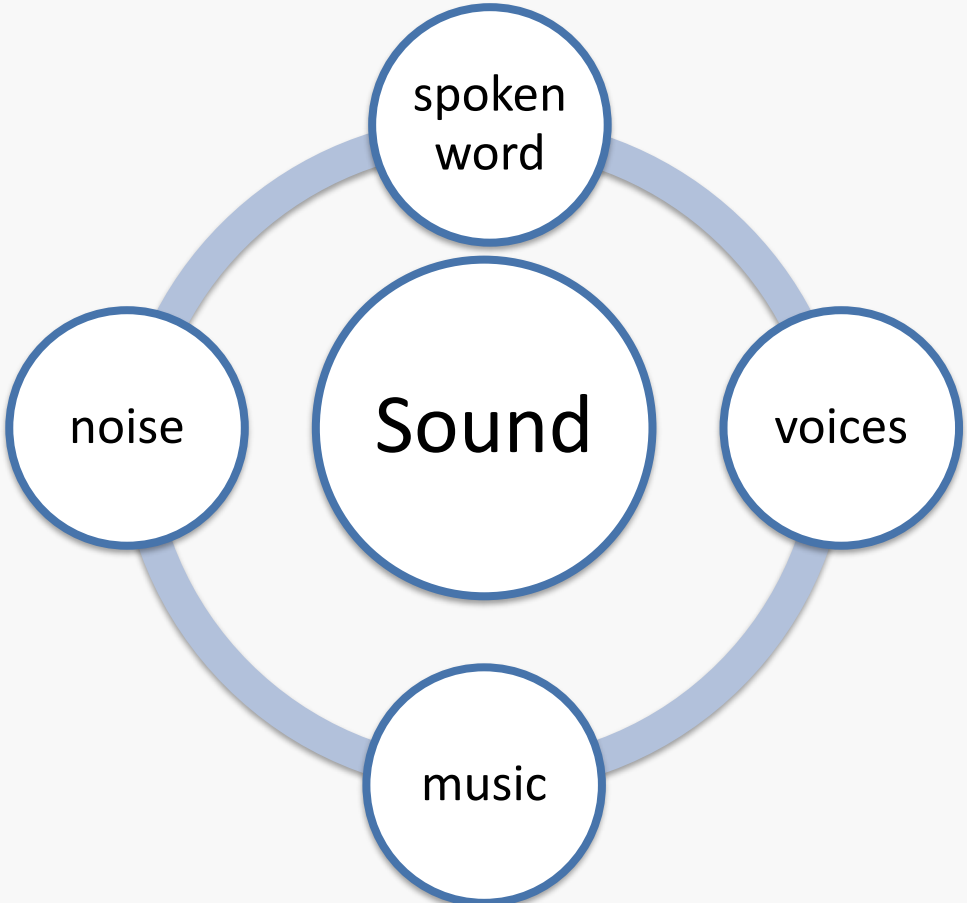
The Power of Sound

- Many sound waves mixed together from :



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The Power of Sound

- Sine wave is a simple wave that regularly repeats a smooth transition from high to low pressure. (Figure 4.1)

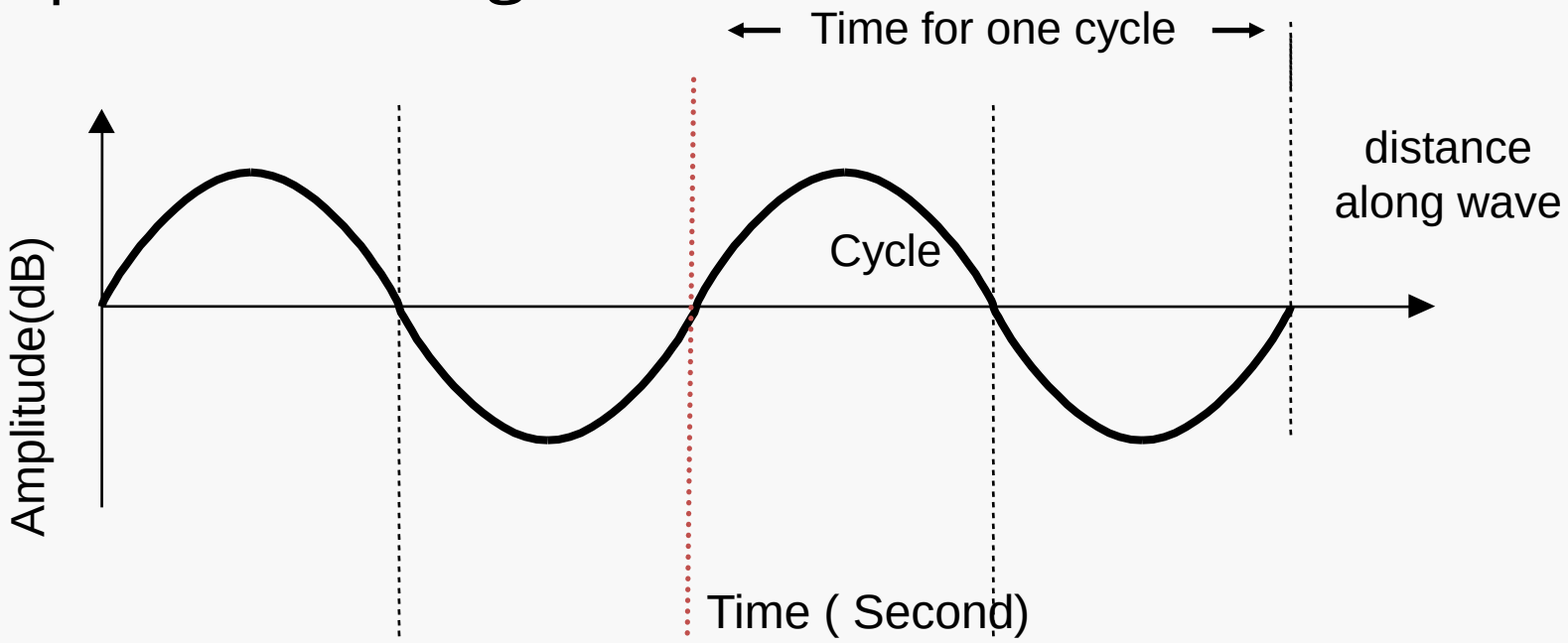

Figure 4.1 A sine wave

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The Power of Sound

- A sine wave captures three essential feature of sound :

Amplitude

- A measure of sound pressure or the amount of energy associated with the sound (Db=decibel)

Frequency

- The number of times a waveform repeats in a given interval of time (Hz = hertz)

Duration

- The length of time it lasts

Digital Audio

- Digital Audio is created when you represent the characteristics of a sound wave using numbers.
- Digitized sound is sampled sound.

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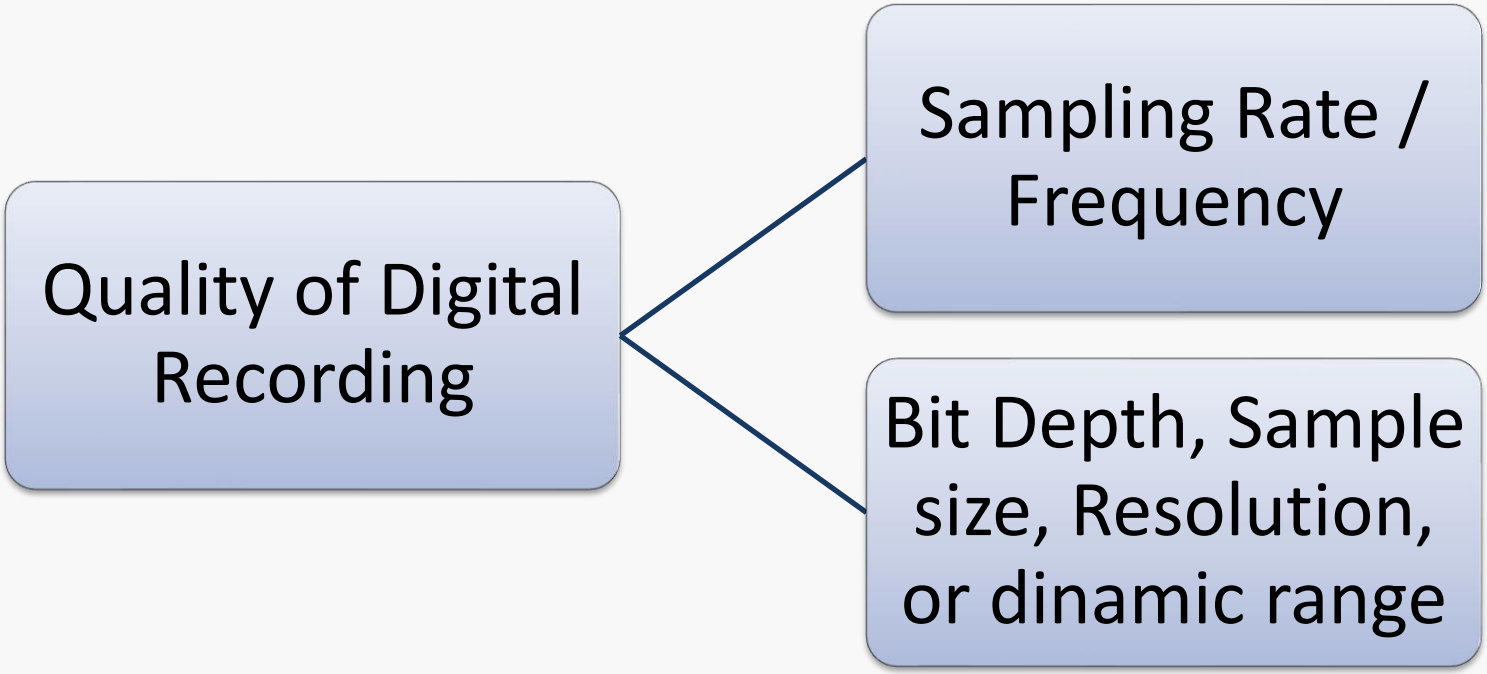
Digital Audio



Digital Audio

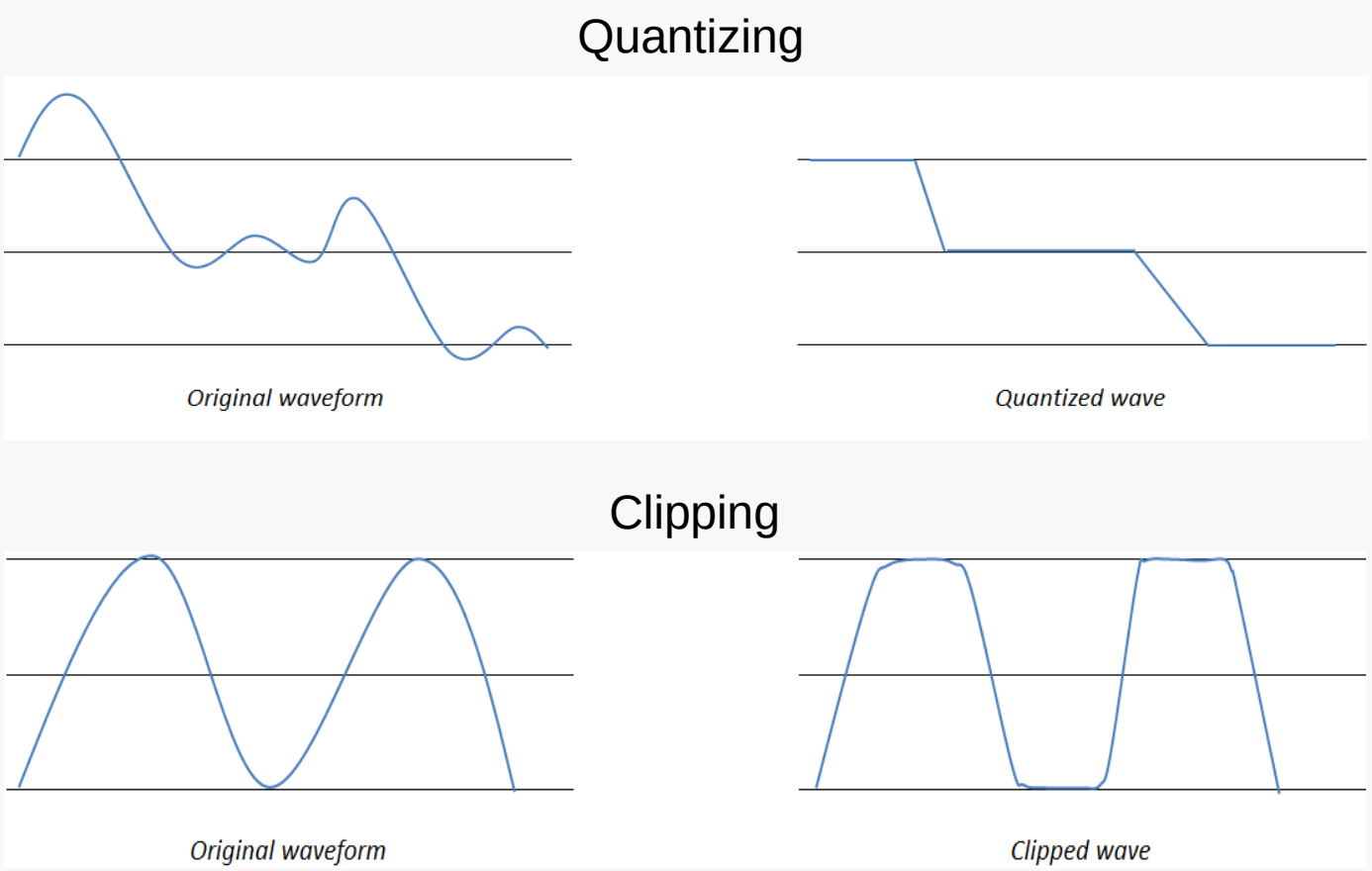
- Sampling Rate : how often the samples are taken
- Bit Depth : how many numbers are used to represent the value of each sample.
- The more often take a sample and the more data store about that sample, the finer the resolution and quality of the captured sound when it is played back.

Digital Audio

- Quantization : rounding a sample to the closest available value.
- Quantization can produce an unwanted background hissing noise . The solution is to record with a higher sample resolution (example : using 16 bits rather than 8 bits)
- Clipping : a different form of distortion related to wave amplitude.
- Clipping can produce a harsh, distorted sound

Digital Audio

- Figure 4.3 Quantizing and Clipping



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Digital Audio

- Formula for determining the size (in bytes) of a digital recording :
  - For a monophonic recording :

    Sampling rate x duration x (bit resolution / 8) x 1
  - For a stereo recording :

    Sampling rate x duration x (bit resolution / 8) x 2

Note : Sampling rate measured in kHz.
Resolution measured in bits per sample

Digital Audio

- Example :
  - Calculate the file size for 1 minute, 44.1 KHz, 16 bits, stereo sound

$$\frac{\mathbf{44100 * 60 * 16 * 2}}{8}$$

  - The size is 10.594.000 bytes

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Digital Audio

- Audacity : a free, open source sound-editing application for Windows, Macintosh, and Linux.
- The Basic sound-editing operations :
  - Trimming
  - Splicing and Assembly
  - Volume Adjustments
  - Format Conversion
  - Resampling or DownSampling

Digital Audio

- The Basic sound-editing operations (continue) :
  - Fade-ins and Fade-outs
  - Equalization
  - Time Stretching
  - Digital Signal Processing (DSP)
  - Reversing Sounds
  - Multiple Tracks

Digital Audio

- The advantage of Digital Audio :

Its consistent playback quality

A wider selection of application software and system support for digital audio

Do not demand knowledge of music theory for preparation and creating digital audio

Digital Audio

- In general , use digital audio in the following circumstances :

Don’t have control over the playback hardware

Have the computing resources and bandwidth to handle digital file

Need spoken dialog

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MIDI

- MIDI (Musical Instrument Digital Interface) :
  - A communication standard developed in the early 1980s for electronic musical instruments and computers
  - It is not digitized sound
  - Depends on the capabilities of sound system, the quality of the computerized musical instruments, and the capabilities of sound system.

MIDI

Musical Instrument Digital Interface

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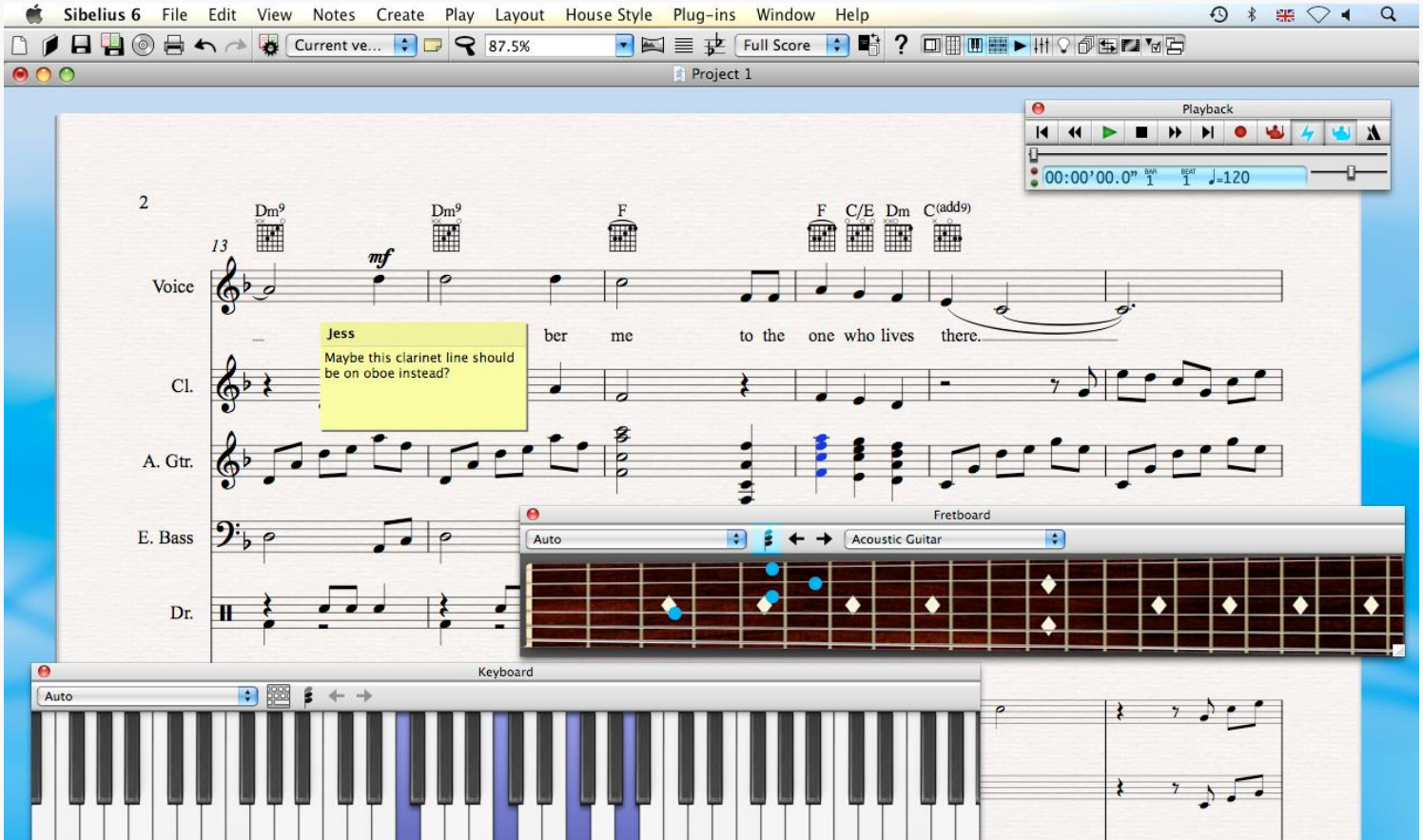
MIDI

- To Make MIDI Scores :
  - 1. Notation Software



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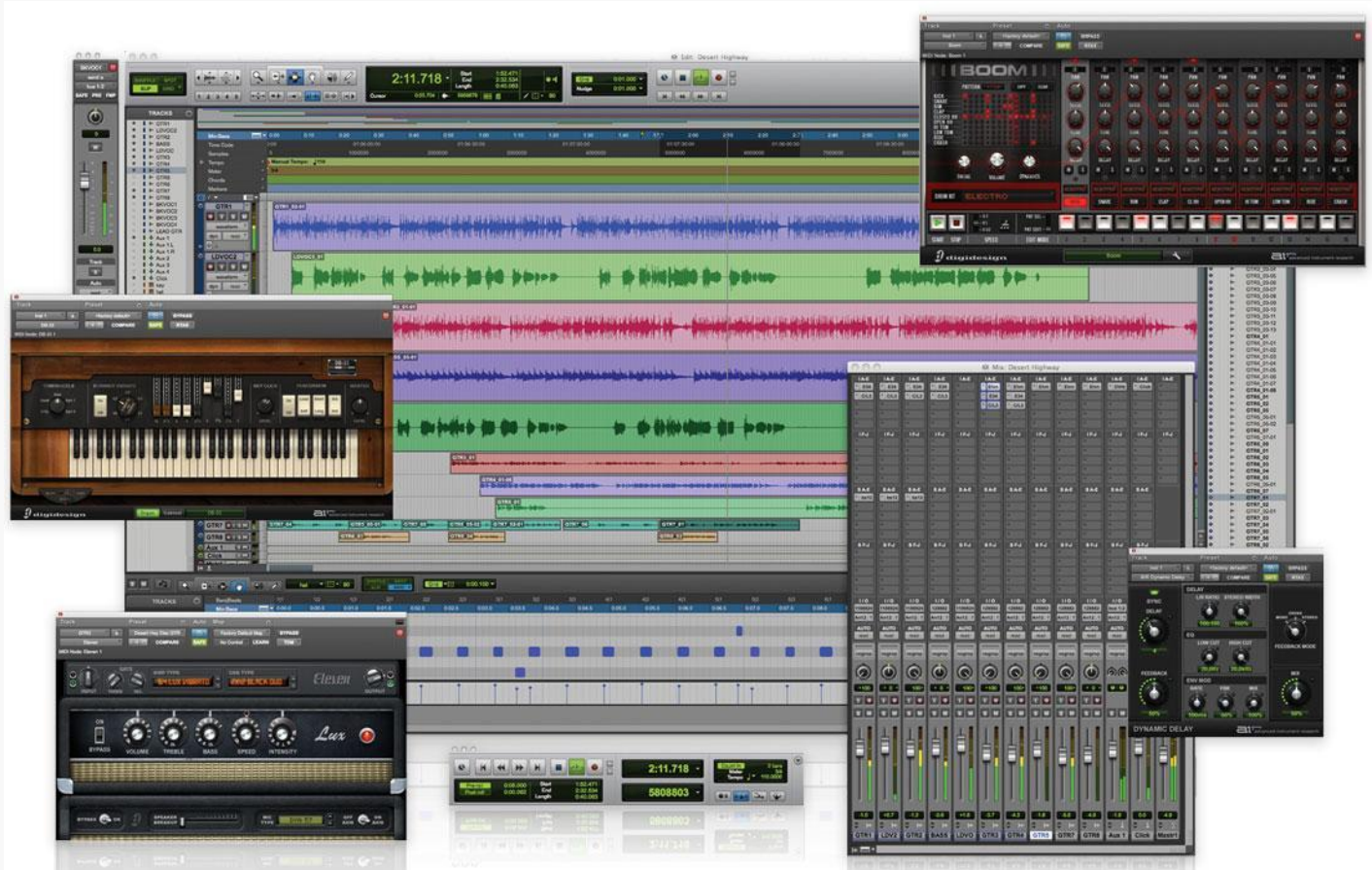
MIDI

- To Make MIDI Scores :
  - 2. Sequencer Software



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MIDI

- To Make MIDI Scores :
  - 3. Sound Synthesizer

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MIDI

- Advantages of MIDI :

Small size

May sound better than digital audio

Editable

Can be converted to musical notation.

MIDI files embedded in web pages load and play more quickly than their digital equivalents

MIDI

- Disadvantages of MIDI :

Can’t easily be used to play spoken dialog

Represent musical instruments only

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MIDI

- Use MIDI in the following circumstances :

Digital audio won’t work

Have high quality MIDI sound source

Have complete control over the machine on which your program will be delivered

Don’t need spoken dialog

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Audio File Format

.WAV	.MPEG
OGG	.AIFF
.MP3	.MP4
.M4a	.WMA
.MOV	AAC

Working with Sound

- Vaughan's Law of Multimedia Minimums :

> 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.

Working With Sound

- Brief overview of the process :
  - Determine the file formats that are compatible with multimedia authoring software and the delivery medium
  - Determine the sound playback capabilities
  - Decide what kind of sound is needed
  - Decide where and when to use either digital audio or MIDI data
  - Acquire source material by creating it from scratch or purchasing it
  - Edit the sounds to fit your project
  - Test the sounds

Guidelines of The Use of Sound

- Basic guidelines of the use of Sound :
  - Identify the purpose of the sound
  - Use high-quality sound
  - Conserve file space
  - Consider the playback environment
  - Avoid excessive use of sound
  - Organize sound files

SUPPORTING MATERIAL

- http://entertainment.howstuffworks.com/midi.htm
- http://www.jiscdigitalmedia.ac.uk/guide/an-introduction-to-digital-audio
- http://www.indiana.edu/~emusic/etext/MIDI/chapter3_MIDI.shtml

Exercise

- Explain the function of sound wave quantize!
- Calculate the file size totals that need for digital recording with specification below:
  - Sampling rate = 66.2 KHz
  - Bit Solution = 16 bits
  - Duration = 2 minutes
  - Stereo sound