Media Production

AUDIO & VIDEO

Practical module which will introduce students to the basic principles of digital audio and video

Course Structure

3 Practical + 1 Tutorial Hour per week (2 * 2 hour lab)

MAC lab R304/TV Studio S102/ Radio Studio J201

100% CA

Outline

Audio Concepts

Digital Audio

Record & Edit Digital Audio

Video Production

Video Technology

Record, Edit Digital Video

Assessment Strategy

50% CA - Digital Audio Project

- 35% Audio Piece 1
- 15% Audio Piece 2

50% CA - Video Production Project

Physics of Sound

Sound is a complex relationship involving
a vibrating object (sound source)
a transmission medium (usually air)
a receiver (ear)
and a perceptor (brain)

As the sound vibrates it bumps into molecules of the surrounding medium causing pressure waves to travel away from the source in all directions

Sound is the rapid change in air pressure

The **speed** at which sound travels depends upon the density of the medium in which it is travelling

Sound waves are manifest as **waveforms**

A wavelength is the distance that sound travels through one complete cycle of pressure change.

Sound is described in terms of two characteristics:

- Frequency
- Amplitude (or loudness)

Frequency

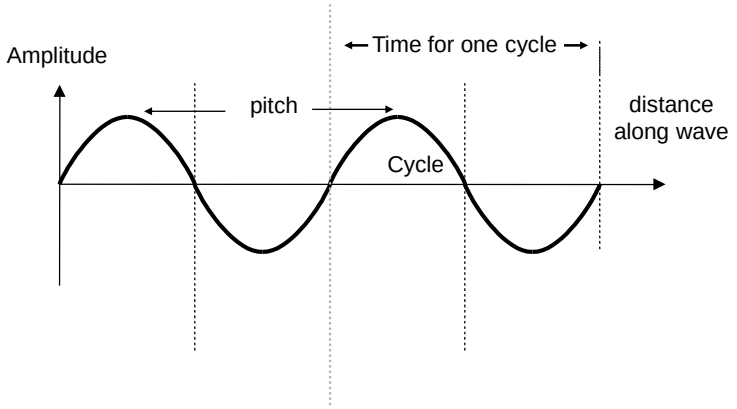
- The rate at which sound is measured
- Number of cycles per second or Hertz (Hz)
- Determines the **pitch** of the sound as heard by our ears
- The higher frequency, the clearer and sharper the sound, the higher pitch of sound

FYI:
Low frequency – **Bass** (*pronounced 'beys'*) – 20Hz to 250Hz approx.
High frequency – **Treble** above 6kHz

Amplitude

- Describes the sound pressure displacement above and below the equilibrium atmospheric level
- Sound's intensity or loudness
- The louder the sound, the larger the amplitude.

Waveforms



Decibels

A decibel (**dB**) is the relationship between two powers (*ratio*) expressed as a logarithm.

- A sound 10 times more powerful is 10 dB.
- A sound 100 times more powerful than near total silence is 20 dB.
- A sound 1,000 times more powerful than near total silence is 30 dB.

See this YouTube link

Decibel requires a reference level

- Acoustic (Reference is 0 dB SPL: Hearing Threshold)
- Analogue (Reference is 0 dB VU : Voltage)
- Digital domains (Reference is 0 dB FS = Maximum Possible)

Note :

SPL(Sound Pressure level) FS (Full Scale)

On the **decibel scale**, the smallest audible sound (near total silence) is 0 dB.

- Near total silence - 0 dB
- A whisper - 15 dB
- Normal conversation - 60 dB
- A lawnmower - 90 dB
- A rock concert or a jet engine - 120 dB
- A gunshot or firecracker - 140 dB

Any sound above 85 dB can cause **hearing loss**,

dB in Mixing

- In a Digital Mixing environment, the meter allows you to change output levels.
- Here the reference point is the maximum signal level (full scale FS)
  0dB FS = maximum possible
- Need to ensure there is no **Clipping** in the audio output
- Clipping occurs when a signal level exceeds the maximum permissible amount, and distortion occurs
- If a digital signal is clipped, it is permanently and irreparably distorted and damaged.
- **NEVER** allow clipping in a digital system.

Basic Digital Audio Concepts

Sampling rate : Number of sample taken of a signal in a given time (usually one second)

Bit depth: Describes the accuracy of the audio data

Channels

Bit rate : Measured in kilobits per second (Kbps) is a function of the bit depth and sampling rate

Sampling rate

- The more samples taken per second, the higher the accuracy.
- Typically measured in **kilohertz (KHz).**
- CD audio has 44,100 samples per second (44.1KHz).
- 8 KHz produces lower quality radio sound.
- Standard sampling rates include “8KHz”, “11.025KHz”, …
- The high-end 96K is used in DVD, but is not applicable to the Web.

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Bit depth

- Also called “sampling resolution” or “word length”.
- The more bits, the better is the quality of the audio (and a larger file of course).

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Channels

- Audio file can support one to six channels of audio formats.
  - Mono – one channel
  - Stereo – two channels
  - Some others – three, four channels.
  - Six channels – 5.1-channel surround sound.

Bit rate

- Audio files are measured in terms of bit rate which is measured in kilobits per second (Kbps).
- It can be calculated by dividing the file size by the time (in second) to play the audio clip.
  - E.g. 3Mb file play in 30 seconds
  - 3000k / 30 = 100kbps.
- Quality at different compression rates

Web Audio Formats

WAV/AIFF (.wav/.aif/.aiff)

The Waveform Audio File format (.wav) was developed by Microsoft, supports arbitrary sampling rates and bit depths.

The Audio Interchange File format (.aif, .aiff) was developed for Macintosh platform.

They are less likely used on the Web, due to MP3 and Streaming.

MP3 (.mp3)

- Able to maintain excellent sound quality at very small file sizes.
- The compression reduces an audio file to one-tenth of its original size.
  - E.g. 40MB file → 3.5MB
- MP3 is the file extension for MPEG, audio layer 3.
- Layer 3 is one of three coding schemes (layer 1, layer 2, and layer 3) for the compression of audio signals.

Apple QuickTime Audio (.mov)

QuickTime is a well-known video format, but it can create audio-only movies.

QuickTime is a container format, which is able to store still images, movie formats

Excellent compression, true streaming

MIDI (.mid/.midi)

MIDI stands for “Musical Instrument Digital Interface” which is developed for electronic musical instruments.

MIDI files are very compact and very good for low-bandwidth delivery.

Instruments are “piano, drums, bass, orchestral strings, …”

RealMedia/RealAudio (.rm/.ra)

RealAudio is a server-based streaming audio format.

The RealServer responses to the requests and delivers the streaming packets, including the bandwidth negotiation.

A robust RealServer can support thousands of simultaneous listeners.

Good for continuous-playing audio and live broadcasts to a large group of people.

Windows Media (.wma/.asf)

- Windows Media is a streaming system.
- It wraps all media elements into a Active Streaming File (.asf).
- Audio may be saved as non-streaming Windows Media Audio format (.wma).
- Good for continuous-play audio.
- The encoder and player is Free, shipped with Windows OS.

Choosing an audio format

Audio Needs	Suggested formats
Short voice greetings	WAV, AIFF, MP3
News broadcasts	Streaming solutions (RealAudio, Windows Media)
Background music	MIDI, WAV
Radio-style or Live broadcasting	RealMedia System