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Audio and Video

- Introduction
  - Functions of AV in Multimedia
- Types of Sound
  - Digitised Sound
  - Synthesised Sound
- AV is Resource-Hungry!
- Compression
- Streaming
- Incorporating AV in The Web Page
- Applications of AV on the Web

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Multimedia Without Sound?

Functions of Audio and Video

1) Adds Realism
2) Stimulates Emotion
3) User Feedback
4) Creates an Identity
5) Narration / Instruction

For multimedia website, file size and waiting time is the main concern!

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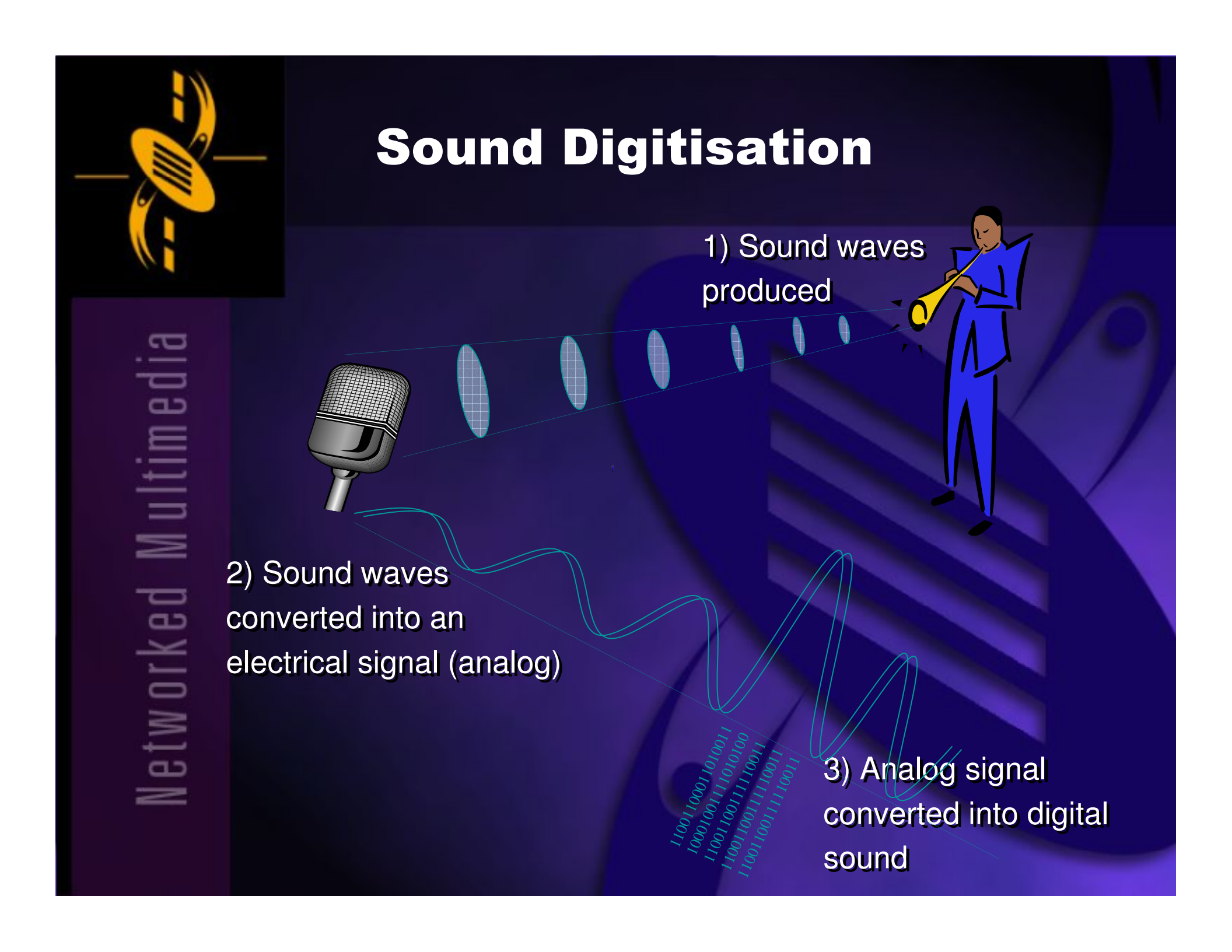
Types of Sound

Two types of sound can be created and used in your multimedia projects:

1) Digitised Sounds
Created from some outside source (like a recording or a microphone)

2) Synthesised Sounds
Generated completely by computers

Sound Digitisation



Sound Digitisation

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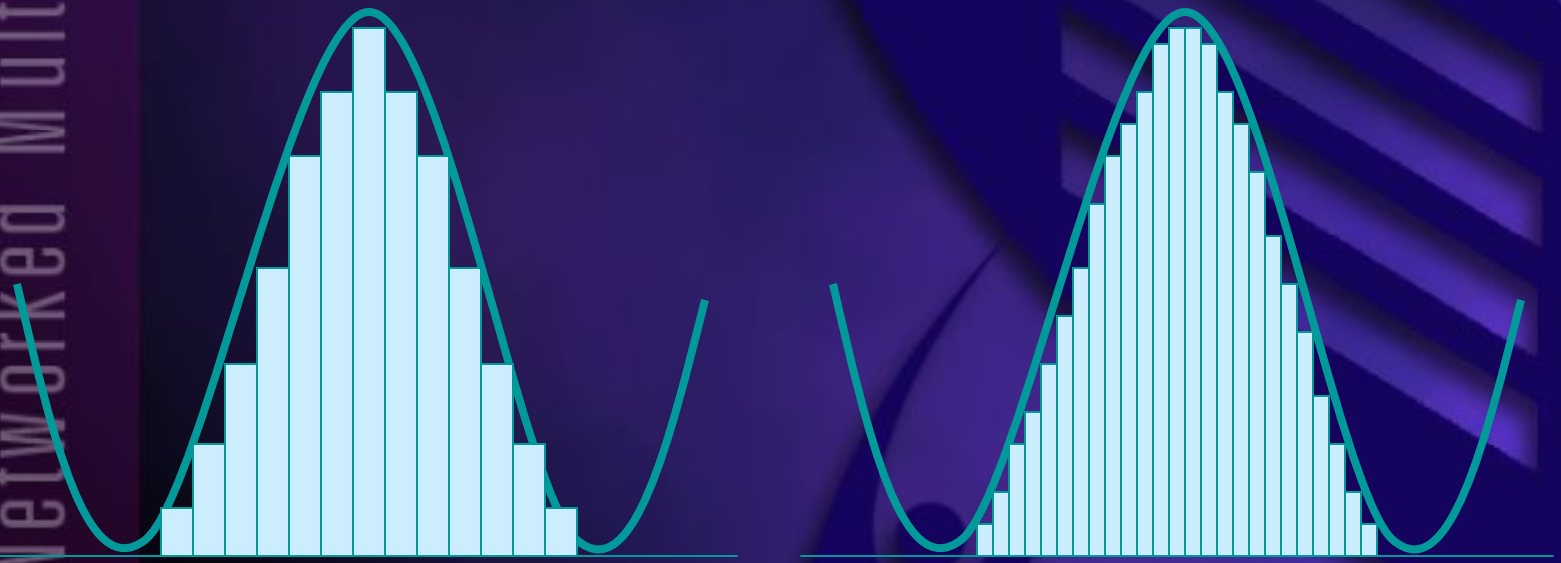
Sound Info

1) Sampling Rate

- the rate at which a continuous wave-form is sampled
- measured in Hertz (Hz) e.g.: 11, 22, 44Khz
- 10 megabytes per min for CDs quality



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Sound Info

2) Sampling Size (Resolution)

- the amount of information stored for each sample
- measured in bits per sample e.g.: 8, 16 bits

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Sound Info

3) Sampling Mode

- the number of sampling channels
- mono or stereo

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Sound Info

Calculation of File Size

1) For a mono recording:

sampling rate X duration X (bit resolution/8) X 1

2) For a stereo recording:

sampling rate X duration X (bit resolution/8) X 2

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Sound Info

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Calculation of File Size

1) 10-second mono recording at 22.05 kHz, 8-bit

22050 X 10 X (8 /8) X 1 = 220,500 bytes

2) 10-second stereo recording at 44.1 kHz, 16-bit

44100 X 10 X (16/8) X 2 = 1,764,000 bytes

Sound Info

File Size Versus Quality

Rate	Resolution	Mode	File Size (per second)	
44,100 Hz	16-bit	Stereo	172 kb	CD-quality
22,050 Hz	8-bit	Mono	22 kb	Radio-quality
11,025 Hz	8-bit	Mono	11kb	Telephone-quality

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Synthesised Sound

Musical Instrument Digital Interface (MIDI)

- a standard for computerized musical instruments
- can record music by using a sequencer
- is NOT digitized audio, but rather sheet music

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MIDI

Musical Instrument Digital Interface (MIDI)

MIDI is a code that gives musical instructions. In the same way that the notes on the music sheet tell musicians what to do, MIDI code gives instructions to synthesizer keyboards, drum machines, and other electronic instruments.

“ Play this note, this loud, for this length of time, on this instrument…”

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The MIDI Studio

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MIDI

Differences between Digitized Sound and Synthesised Sound

File size

digital sound has much bigger file size

Editing

MIDI can be easily edited

AV is Resource-Hungry!

Example (Video):

A single digitised frame of video requires 1 MB of storage space. Assuming the video standard requires 30 frames per second, how much disk space is needed to store a 2-hour-long movie without any compression?

30 frames in 1 second → 30 MB

There are 2x60x60 seconds in 2 hours

Disk space required = 2x60x60 x 30 = 216000 MB

AV is Resource-Hungry!

How to cut down the file size?

- reduce frame rate
  - e.g. from 30 fps to 15 fps
- reduce resolution
  - e.g. from 320x240 to 160x120
- compression
  - e.g. MPEG

Compression

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Why compress? / What is compression?

Smaller file size ==> faster download

<< Compare mp3 and wav>>

Compression is a process by which audio files are reduced in size without significant loss in quality.

Compression

How does it work?

Requires a matched set of algorithms:

1) Creator of media - compress

2) Receiver of media - decompress

The complete specification (algorithm) for compressing and decompressing the data is called a CODEC

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Compression

MPEG (Moving Picture Experts Group)

- Based on thorough Psychoacoustic Modeling
- By analysing what the ear and brain actually perceive when listening to a certain range of frequencies, engineers behind MPEG are able to determine the various frequencies they could safely cut out of the signal
- This substantially reduces the file size even before applying compression

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MPEG

(Moving Picture Experts Group)

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- Moving Picture Experts Group is a working group of ISO (International Organization for Standardization, ISO is not an acronym, the name derives from the greek word iso, which means equal)
- Founded in 1946, ISO is an international organization composed of national standards bodies from over 75 countries. For example, ANSI (American National Standards Institute) is a member of ISO.

Compression

Varieties of MPEG

- Also known as layers
- The layers varies in terms of complexity of algorithms
- The higher the layer, the more computing power is required to encode and decode
- The pay-off is that these more processor-intensive layers yield better compression ratios

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Compression (MPEG)

(definition from http://www.pcwebopaedia.com/)

MPEG-1

Most common (NTSC): 352-by-240 at 30 frames per second (fps). This produces video quality slightly below the quality of conventional VCR videos. (VCD is based on MPEG-1 file with a specific setting)

MPEG-2

Most common: 720x480 and 1280x720 at 60 fps. with full CD-quality audio. (MPEG-2 is used by DVD-ROMs) More processing power is needed compared to MPEG-1

Compression (MPEG)

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MPEG-4

Graphics and video compression algorithm standard that is based on MPEG-1 and MPEG-2 and Apple QuickTime technology. It is designed to transmit video and images over a narrower bandwidth and can mix video with text, graphics and 2-D and 3-D animation layers.

MP3

File extension for MPEG, audio layer 3. Layer 3 is one of 3 coding schemes (layer 1, 2, and 3) for the compression of audio signals. Layer 3 shrinks the original sound data from a CD (with a bitrate of 1411.2 kilobits per second of stereo music) by a factor of 12 (down to 112-128kbps) without sacrificing sound quality. (small file, Internet transmission)

Streaming

Why stream? / What is streaming?

Before streaming

- User would need to download the entire audio or video clip before it can be heard / seen.
- The World Wide Wait

After streaming

- As soon as browser has buffered a bit of the file, it starts playing for the user to hear, continuing to receive data until the transmission is complete.

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Streaming

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Downloading	VS	Streaming
• long waiting time		play while downloading
• file saved		file disposed
• with industry stds		no standards yet
• acceptable quality		low quality
• low cost		expensive to set up
• easily set up		complex

Incorporating AV

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Two Common Ways (this week's lab)

- Linking
- Embedding

Do's and Don'ts

- Place HTML tags at the bottom of the page
- Don't make sounds play on every page!
- Do give your visitors a choice

Applications of AV

- Video on Demand
- Web TV/ Web-Casting
- Web Radio
- Video Conferencing

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