Chapter 7. Program Elements: Sound Capturing, and Editing

Chapter Objectives

After completing this chapter you should understand and / or recognize:

- The objective of integrating audio in a multimedia application;
- Understand the basic theory of sound;
- Recognize the advantages of digital audio over analog audio;
- How to record and edit digital audio files;
- Understand the relationships between sampling rate, frequency and file size;
- Recognize different audio file formats.

Introduction

One of the most sensory appealing elements of any exiting and successful multimedia presentation is sound. Sound establishes the aural dimension, it can set the mood, establish the ambiance of your presentation. When introducing the element of sound into your application be aware that there is a fine line between good taste, supportive sound and excessive annoying sound. Quantity and quality are the key elements to be considered. Through this chapter we will explore how best incorporate sound into your presentation.

Why Sound in a Multimedia Presentation?

Sound greatly complements images, videos and computer generated animation's. Do you remember the silent movies, they were rich in images but their message was missing one of the most effective elements: sound. Presentations without sound are like silent movies, flat and not really dramatic. There are a number of functions that sound elements can play in a multimedia application.

Open Chapter 7 Interactive Guide to Multimedia CD and lets explore some of the possibilities. Among the functions of audio in a multimedia application are:

- Incorporate ambient sounds: if your presentation is related to the acquisition and development of a track of land in a natural area, you might want to record ambient sounds and play them in the background while the images present the property.

- Adding music sets the mood: Starting and ending your presentation with music set the mood in the audience for receiving and processing information. Good sound bites prompts the audience to be more open and aware of other multimedia elements such as graphics. Research has proven that you can present the same graphical elements to audiences, one with music and the other without, and they will indicate that the best graphical were those that incorporated sound.

- Sound effects can catch the interest and even wake-up your audience in an extreme circumstance. Business presentations loaded with charts and bullets can be boring. Try to incorporate every once in a while bullets with a sound effect, when clicking a button a sound might go off. Special effects can be use as attention getters. If something good for the audience is presented use a fanfare, but if trouble is ahead use a fog horn sound. Be creative.

- Narration's can be effective in training and educational applications. In training presentations designed to be used by an individual operating a computer narrations take the place of the instructor. But be aware that narration should be kept to a minimum if the application is going to be used as a presentation. In this case do not use narrations or keep them to a minimum. Usually presenters, instructors and teachers like and demand to be in control of the presentation, narrations could be disruptive.

Sound Basics

To produce a multimedia application that incorporates sound elements is not critical to have an in-depth knowledge of acoustics (the science of sound), but is important to have a basic understanding due to the fact that you will have to make a number of decisions during the computing and editing process.

Sound is produced by the vibration of an object in the air or water, vibration creates waves of pressure. Vibration of vocal cords produce sounds, vibrations in the metal of a trumpet produce music, a the vibration of the wings of a bumble bee produce a homing sound which travel in the form of waves. These waves travel at a speed of 750 miles per

hour or mach 1. When sound waves reach your eardrums, you experience changes of pressure or vibrations as sounds. These changes in pressure are detected by the nerves in the eardrums and converted into electrical impulses which are send to the brain for processing.

Analog sound (signal) generation and processing systems function in a very similar way as described above. A sound wave is detected by a microphone, pressure is traduced to an electrical signal that is processes by an amplifier which in turn sends another signal to the speakers which vibrate and create sounds.

Sound waves can be graphically described as presented in figure 7.1. They have two sections the crest and the valley.

Figure 7.1 Sound waves

Sound waves are characterized by their speed or frequency, and their amplitude. Frequency is related to the number of times the sound wave completes a cycle in one second, this is measured in hertz (Hz). Humans detects frequency of sound as pitch. The more cycles per second, the higher the pitch. Our ears can detect sound in a range of frequencies from the low end of the spectrum (20 Hz. to 40 Hz.) to the high end (20 Kilohertz). In most cases our capacity to listen and detect sounds are age related.

Amplitude refers to the perceived loudness of a sound. The amplitude is measured in decibels (dB). As more pressure is excerted by the vibrating object, the louder the sound and the greater the decibels.

Digital Sound

Digital systems translate data into numerical combinations of 1 and 0, this is also true for sound. A digital sound processing system capture the vibration of sound waves and translate them into very precise numerical combinations. These combinations can them be process, edited and retrieved by a computer as presented in figure 7.2.

Figure 7.2 Analog audio is captured by a computer and converted to digital audio.

This digital medium can edit, process and retrieve sound data with more accuracy than analog system. In digital recording systems sounds create changes in electrical values are measured, or sampled, by a device called an analog to digital converter (ADC). The signal captured by the ADC can be converted back to an analog signal by a analog to digital converter (DAC) for playback. This is illustrated by figure 7.3.

Figure 7.3 Analog to digital conversion.

During the capturing process (digitizing) the ADC system takes snapshots of the analog wave front passing along the vertical axis of the digital system This process is called

sampling rate and is measured in samples per second. The sampling rate usually ranges from 11,000 to 48,000 samples per second. This range it is also referred as hertz.

When playing back the digital signal the DAC reconstruct the analog wave front by interpolating (connecting) the points sampled by the ADC. Depending the sampling rate, the accuracy of the reproduction of the analog sound wave can change, This means that the higher the sampling rate the greater the accuracy of the playback sound.

The Advantage of Digital Sound Systems

We have already discussed the accuracy of digital sound recording as compared to analog sound recording systems. But there are a number of other advantages that we would like you to be aware of, among these are:

- No hiss. One of the advantages of digital audio recording system is that when recording it lacks unwanted noises. When the magnetic media passes over the recording head of the recorder produces an audible hiss that degrades the quality of the recording. Digital recording systems do not capture this hiss sound due to the fact that there is no recording head.

- Loss of information. When you transfer a recording from one analog system to another information is lost. As a result the more times you duplicate an analog recording the more its sound quality is degraded.

- Difficulty in accessing recorded data in analog recording systems. One of the clear advantages of digital recording systems is the capability to access data with high precision and speed. This advantage is specially important when performing audio editing. In analog editing systems, you need to physically advance or rewind a tape to reach the desired point, and this you know that is difficult and not precise.

- Sound synchronization in analog systems is difficult. If you need to synchronize sound with video or any other media it is difficult to accomplish an accurate synchronization with analog systems. Digital systems are capable of selecting a location of sound data with an accuracy of 20 microseconds.

Using Copyright Free Sound Files

We have already mentioned that one of the aspects to be concerned when developing a multimedia application is the copyrights issue. Remember that you will breaking the law if you record and use copyrighted material without first securing the rights from the owner or publisher of the material. Some of the ideas you might like to consider to avoid the use of copyrighted audio resources are the following:

- Playback music from audio CD's - your authoring language is capable of controlling the computer CD-ROM to play an specific music track(s), modify the music volume, fade-in or out as necessary. The music from a CD can be played as background music, as the application introduction, as part of an instructional component within the program (i.e. as part of a music appreciation instructional module among others).

- Purchase copyright free music and sound effects files (clip audio) - a number of companies provide copyright free music and sound effects files, these files can be incorporated into different components of your application.

- Compose, play and record your own music and special sound effects - possibly one of your multimedia development team members is a musician, he or she can play a Musical Interface Digital Interface (MIDI) instrument such as a keyboard. You could probably play and record music, develop special effects, etc.

- Secure rights releases from talent or people which you interviewed - if you interview people, or use talent to record narrations make sure that you secure releases of

the rights to the narration.
If you plan to integrate music played from a the CD in Macromedia's Director, you must use the following script. Place this script as one of the Cast members.

```
--
on initCD
   global CDSound
   --installMenu A18
   --  first, remove old objects (if any)
   if objectp(CDSound) then CDSound(mDispose)
   --  load the AppleAudioCD xobject by opening the resources in this file
   openXLib "CD-ROM XObj"
   --  create an instance named "CDSound" using the AppleAudioCD xobject
   set CDSound = AppleAudioCD(mNew)

on updateDisplay  --  this macro updates the displays in the Audio CD control screen
   global CDSound
   --  Display current track
   set the text of cast A14 = string( CDSound(mCurrentTrack) )
   --  Display current disc time
   set the text of cast A15 = "    " & string( CDSound(mCurrentTime) )
   --  Display status
   set the text of cast A16 = string( CDSound(mStatus) )
   go to marker(0)

on quitCDRom
   global CDSound
   if objectp(CDSound) <> 0 then CDSound(mDispose)  --  be sure to dispose of objects
when finished
   go to frame "xobj" of movie "•Main Menu"

--  CD-ROM control macros
--  these are the macros for the buttons in the CD Audio control screen

on CDStop
   global CDSound
   CDSound(mStop)

on pauseCD
   global CDSound
   CDSound(mPause)

on playCD
   global CDSound
   CDSound(mPlay)

on ejectCD
```

```
    global CDSound
    CDSound(mEject)

on stepForwardTrack
    global CDSound
    CDSound(mStepFwd)

on stepBackTrack
    global CDSound
    CDSound(mStepBwd)

on playTrack whichTrack
    global CDSound
    CDSound(mPlayTrack, whichTrack)

on playSegment startMin, startSec, startFrame, endMin, endSec, endFrame
    global CDSound
    CDSound(mPlaySegment,startMin, startSec, startFrame, endMin, endSec, endFrame)

-- macro FORWARD
on Forward
  global  FramNum, CDSound

    put CDSound(mstatus) into MyStat
    if MyStat = "Audio pause in operation" then pauseCD
     if MyStat = "Not currently playing" then playTrack 1
  go to frame FramNum
  put FramNum + 1 into FramNum
   if FramNum > 40 then put 5 into FramNum
-- this needs to be 5, or whatever number "Start" is at --

on Backward -- Rewind --
   global FramNum

    cdstop
    go to frame "NS"
     pause

on PauseALL
global  FramNum, CDSound

  put CDSound(mstatus) into MyStat
  if the pauseState = TRUE then
         continue
         if MyStat = "Audio pause in operation" then
            pauseCD
```

```
      end if
   else
    pause
    if MyStat = "Audio play in progress" then
        pauseCD
    end if
  end if

on Stop
  global FramNum
  cdstop
  pause

on InitAll
  global FramNum
  put 5 into FramNum

on StepBack
  global FramNum
    pause
    put the frame  - 1 into FramNum
    go to frame FramNum
    pause
```

At the beginning of the movie you must include the following script:
InitCD
Play Track 1 (identify track number to be played)

Creating and Editing Audio Files

Now you are prepared to create (capture) your first digital audio source. Please open the CD in Chapter 7 of the Interactive Guide to Multimedia. Study the section on Creating and Editing Audio Files. After doing this please open the Macromedia's Sound Edit 16 demo. We will use this demo to explore how to create and edit digital audio files.

Before you capture or record any audio source the first step you need to take is to determine three crucial aspects:

- Balancing the need for audio quality with your available RAM and hard disk resources;
- Balancing audio quality with the processing speed and sampling rate capability of the recording computer and the playback computer;
- Selecting the most adequate recording level to get a good, clean recording.

The above considerations will determine file size and quality of the recording. Keep in mind that the sampling rate determines the frequency make-up of the recording.

Recording at high sampling rates produces a more accurate capture of the high frequency content of your sound. Another aspect to take in consideration is the recording resolution. The resolution determines the accuracy with which a sound can be digitized. The more bits you use in a recording the sound playback will be more realistic.

When considering sound quality and realism stereo recording might be your choice, stereo recordings are lifelike and realistic. Mono sounds are less realistic, flat and not so dramatic, but they are small in file size, stereo sounds require twice the space as compared to mono recordings.

In order to help you make the decision on which way to go (mono or stereo) you can use the following formulas to determine file size in bytes.

Monophonic recording:
sampling rate x duration of recording in seconds x (bit resolution / 8) x 1

Stereo recording:
sampling rate x duration of recording in seconds x (bit resolution / 8) x 2

Based on the above formulas the following table will provide you information on file size in reference to file resolution, sampling rates and some comments based on our experience.

Resolution	Sampling rate	Stereo or Mono	Bytes needed for one minute	Comments
16-bit	44.1 KHz.	Stereo	10.5 MB	This is CD quality sound.
16-bit	44.1 KHz.	Mono	5.25 MB	Good quality sound for voice-overs.
8-bit	44.1 KHz.	Stereo	5.25 MB	Playback good quality sound on low-end sound boards.
8-bit	44.1 KHz.	Mono	2.6 MB	Good quality for recording a mono audio source.
16-bit	22.05 KHz	Stereo	5.25 MB	Not quite CD quality, but because high sampling rate and stereo reproduce good quality sound.
16-bit	22.05 KHz	Mono	2.5 MB	OK for narrations.
8-bit	22.05 KHz	Stereo	2.6 MB	Good for stereo recording when playback equipment quality is low.
8-bit	22.05 KHz	Mono	1.3 MB	Sounds like good AM radio quality.
8-bit	11 KHz	Stereo	1.3 MB	No advantage in using stereo.
8-bit	11 KHz	Mono	650 K	Sounds muffled, it is as low as you should go in quality.
8-bit	5.5 KHz.	Stereo	650 K	Stereo is not effective.

8-bit	5.5 KHz.	Mono	325 K	Don't even consider it.

At this point you should have made the decision in regard to the sound recording setting you need, Look in your File menu the New command, this will open a new file. First, lets set the sound recording format. In the Sound menu, select Sound format command to set the recording settings as presented in figure 7.4.

Figure 7.4 Sound recording format dialog box.

Recording Audio

Before you record your first audio source consider the following. There are several options that you might want to consider to record digital audio they as the following:

- Use the computer microphone - when recording be careful of ambient sounds. Usually, these microphone are quite sensitive and will record the computer fan, hard drive sound or any other sound your work area. Recording quality is acceptable for most users.

- Use a Digital Audio Tape (DAT) recorder with a professional microphone - this our choice for professional quality sound recording. It is highly recommended for recording interviews, nature sounds, ambient sounds, music, etc. Once you have captured the desired sounds with the DAT recorder, connect the sound-out port of the recorder with the microphone port in your computer, then start transferring (recording) into the computer the desired sound.

For this initial exercise, lets use the computer microphone to record your voice. Please notice in your screen the recording control panel (see figure 7.5)

Figure 7.5 Sound recording control panel.

Hold the microphone and record with a clear and voice the following sentence:
I will never be a multimedia producer.
To start recording of the above sentence point and click the Record button, when finished point and select the Stop button. Lets know listen to what you have recorded, to do this make sure that the insertion point is at the beginning of your recording, if it is located in the desired position point and click the play button.

Please note on your computer screen that a wave front was generated (see figure 7.6).

Figure 7.6 Audio wave front generated by recording "I will never be a multimedia

producer."

Figure 7.7 Identification of each of the components of the wave front.

Before we edit the audio file that you have already created lets save the file by selecting from the File menu the Save As command (see figure 7.8)

Figure 7.8 Save as dialog box.

Before you select the sound format lets review in the following section which are the options available and which one is the best for developing multimedia applications.

File Formats

If your goal is to become a successful multimedia producer, its is important to develop products that are capable to be playback in a multi platform environment. There a number of different file formats, we can classify them in two general categories: digital audio files (voice, music, or sound effected converted from analog to digital) and MIDI files (music files generated by digitally controlled musical equipment). The following are the different file formats available to store digital audio and MIDI data:

- Audio Interchange File Format (AIFF, AIF). This file format is used by Macintoshes, IBM compatibles, Commodore Amiga and Silicon Graphics machines. A large number of sampling rates (up to 32-bits) are supported

- Musical Instrument Digital Interface (MID, MDI, MFF). This is an internationally accepted file format to store MIDI data.

- Resource Interchange File Format (RIFF). This format was developed by Microsoft and can contain a variety of types of data including digital audio and MIDI.

- Sound (SND). This file format was developed by Apple and is limited to a sampling rate of 8-bits.

- Roll (ROL). This file format was developed by AdLib, Inc. for its use in their sound cards. It stores MIDI-like data and Yamaha FM synthetizer information.

- Wave (WAV). This file format is widely supported by Windows applications. It was developed by Microsoft as a subset of the RIFF format. It is capable of sampling rates of 8 and 16-bits (mono and stereo).

- Sun Audio (AU). This file format was developed and used by Sun Microsystems workstations. Sun audio is a 16-bit compressed audio format.

- Voice (VOC). This file format was developed for the Sound Blaster audio card from Creative Technology. This file format can support sampling rates of 8 and 16-bits with or without compression.

- Turtle SMP (SMP). This audio format was developed by Turtle Beach systems to be used in their audio recording and editing software.

One of the aspects that you will need to manage is what is the sound file format that will help to make your application to run in Macintoshes and on IBM compatibles machines. You must pay particular attention to two file formats: Audio Interchange File Format (AIFF) and the Musical Interface Digital Interface (MIDI). These two file formats will make your multimedia application compatible in both platforms.

In the Save As dialog box select the AIFF file format.

Editing Audio

We are now ready to edit the audio file that you have created. Remember that you recorded the following sentence:
I will never be a multimedia producer.
But we know that you want to be a multimedia producer. What about if we edit this audio file. But first, lets examine the different operations that we can execute when editing an audio file.

- Trimming: refers to deleting dead space in the front and end of the recording. Trimming of a couple of seconds can significantly decrease file size. To perform the trimming select (highlight),see figure 7.9, the area to be cut use the Cut command to delete the highlighted area.

Figure 7.9 Selection of an area to be clear, cut or deleted.

- Splicing and assembly: If when you playback the recorded audio there are some extraneous noises you might want to select them and proceed to cut.

- Fade-ins and fade-outs: In most programs this is called enveloping. With the enveloping effect you can fade-in or fade-out a highlighted section of the audio file as presented in figure 7.10.

Figure 7.10 Sound wave enveloping.

To fade-out take the handle at the end of the line and move it down to the button of the screen. To fade-in perform the opposite operation.

- Volume adjustment: To increase or decrease the volume of a sound clip or a segment of it you must first highlight an area go to the Effects menu and select the Amplify command. Figure 7.11 presents the dialog box of the Amplify command, in this box you need to indicate the percentage to be amplified.

Figure 7.11 Amplify dialog box.

- Resampling or down sampling: in a number of occasions you will probably sampled and recorded an audio file at 16-bits, but due to file size considerations or sound quality output you need down sample the file as illustrated in figure 7.12. To perform this operation select from the Sound menu the Sound Format command.

Figure 7.12 Sound Format dialogo box.

- Mixing Audio: Most sound capturing and editing software provides you with the capability of mixing two or more audio files The first step in performing audio files mixing is to use the Mix command located in the Sound menu. The Mix dialog box is presented in figure 7.13. As requested by this dialog box you are requested to determine the audio files to mix and if they if the new file will be stereo or mono.

Figure 7.13 Mix settings dialog box.

If you select stereo the audio construction window will have two audio tracks as presented in figure 7.14 . Remember that if you plan to mix two mono audio files into a mono audio files all editing must be performed prior performing the mix.

Figure 7.14 Sound files mixed in separate audio tracks.

Now that you know some of the editing capabilities of the sound editing application lets go back to edit your recording. As presented in figure 7.15 the spectrum of your each one of your words is represented in the form of wave fronts. In your spectrum, identify the word never. Once identified, highlight it and deleted. Move the insertion point to the beginning of the audio file and play it. Please note that your voice should know say “I will be a multimedia producer.”

Figure 7.15 Word “Never” is highlighted and then deleted

Saving and Exporting

If you have already finished editing your sound file now is time to save your work. In the File menu, select Save As, a dialog box like figure 7.8 will appear. It is recommended to save your work in an AIFF format. This is the best format to save audio files when you are planning to use the audio file as part of a multimedia application.

The advantages of the AIFF file format as compared to an SND file format are the following:

- AIFF format is a cross platform format, SND is only use by Macintosh computers;
- AIFF is capable of sampling up to 32-bits, SND is limited to a sampling rate of 8 bits;
- AIFF audio files will be called in by the authoring program as they are necessary, this means that they would not be imported or incorporated into the multimedia application. The SND audio file will be incorporated into the multimedia application. As a result the file size of the multimedia application will considerably increase as you import it into the application. Remember that the smaller the multimedia file the faster it

will load and the faster the application will run.

The MIDI Confines

MIDI technology was developed during the early 80's. It was developed as a standard communication protocol between musical instruments and computers. The MIDI format works regardless of the brand of the devices translating music into a digital form representing the notes to be played, the instruments that should play the notes, their loudness and their length. As seen in figure 7.16 the instrument that creates the original MIDI information is called the controller. Among some of the controller devices we can mention electronic keyboards, guitars, and drum machines.

Figure 7.16 MIDI audio system components.

A synthetizer is needed to translate the information generated by the MIDI device into sound (music). In a number of electronic keyboards, the controller and synthetizer are combined into one. What is important to keep in mind is that in digital recording the audio file contains the actual sound consisting of thousands of samples for each second of music. MIDI only defines the instruments and notes that are to be played and how they should be played. This information is transfer to the synthetizer where the information for creating the sounds is stored. As a result MIDI sound files are dramatically smaller than digital recording files.

As mentioned above, because MIDI systems does not record the actual sounds in the digital file, the resulting sound file is much smaller than digital audio. For example, on the average a minute of MIDI music requires 6K, five minutes of MIDI music requires 30K, compared to 50 MB for the same duration of CD-quality digital audio (16-bit, 44 KHz, stereo). Definitely MIDI provides considerable advantages over digital music in terms of file size.

MIDI: Pros and Cons

The use of MIDI technology as compared to digital audio has its pros and cons. Lets explore them.

- Consistency in audio quality: The quality of MIDI music playback depends on the quality and characteristics of the synthetizer, this might affect the timbre and tone of the MIDI-generated instruments. Digital audio defines all the characteristics of the music to be played in its file, this ensures the quality of the music to be played independent of the computer playing it.

- Compatibility: Digital audio is recorded at an specific sampling rate and size, if the computer to play back the audio file is not capable of playing the sounds at the recorded sampling rate and size the quality of the sound will be affected. MIDI music and sound files play back quality are not affected by these conditions (sample size and rate). They will be played back on any MIDI capable equipment only affected by the quality of the synthetizer.

- Processor speed requirements: MIDI requires lot less processor speeds as opposed to digital audio files.

- File size: As mentioned above this is a big advantage of MIDI files as compared to digital audio files.

If your production team has the capability of generating your own MIDI music files and sound effects, we recommend and encourage you to use this capability to generate music and special sound effects. Only use digital audio files (AIFF) for voice-overs. The combination of both will save you storage space and will help your multimedia application to run faster and it will require less RAM and processor speed in the play back equipment.

Pro Audio & Recording Arts Page
PRO AUDIO & MUSIC . STILL !!!!!! . My Resume . Table of Contents . Go back to Main menu . We are optimized for high graphic resolution and Netscape 1.1. . Audio Engineering Society Home Page . National Association of ...
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This is a Frequently Asked Questions list for the alt.music.4-track newsgroup, for music makers who use 4-track recording hardware. This file may be accessed with the Uniform Resource Locator (URL) http://www.winternet.com/~dfrankow/4trakfaq.txt ...
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SYNTH ZONE - Midi resources & synthesizer sounds list
Synth Zone is an attempt to ease the search for synth resources on the Internet . If you cannot find what you are looking for, wish to upload patches to my FTP area or simply want to know what Synth Zone is about, read the Synth Zone FAQ. . ...
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DIGITAL AUDIO . 16- and 8-bit selectable stereo sampling and playback . Sample and playback rates from 5kHz to 44.1 kHz . Real-time hardware compression and decompression . ADVANCED WAVEFFECTS SYNTHESIS . Pro audio sounds from E-mu ...
--- [49] http://www.creaf.com/www/products/sound/sbawe32_specs.html (4K)

AV AUDIO INPUT & OUTPUT FAQ
Copyright 1993-95 by James Wang (jwang@csua.berkeley.edu) . AUDIO INPUT & OUTPUT . Audio-in, Audio-out: hardware specifications . From the Developer Notes, identical for both the AV and Power Macs: Audio In: 8 kilo-ohm ...
--- [49] http://www.csua.berkeley.edu/~jwang/AV/AV_Audio.html (12K)

Audio, Video & Film
Last Updated: 9/1/95 . Strange Days. Just as I promised, here's some good stuff on the new James Cameron (written and produced) film. As a huge Cameron fan, I can't wait for this picture to open (October 13, 1995). Strange Days takes place ...
--- [49] http://www.empirenet.com/personal/lasernut/Main.html (5K)

Digital M&M Center
Welcome to the University of Virginia Library's Newest Electronic Center! . The Library is pleased to announce the latest development in its successful electronic centers initiative, the Digital Media and Music Center (DMMC). The DMMC, ...
--- [49] http://www.lib.virginia.edu/dmmc/dmmc.html (2K)

Eighth Nerve
, a newsletter on digital audio, computer music, and computer generated sound. This is part of the online users' group for Kyma: a visual language and multi-processor DSP mainframe for sound design, electronic music, psychoacoustics, data-driven ...
--- [49] http://www.prairienet.org/arts/symbolic/eighth.html (2K)

AUDIO FX - DTS Technical Information
An Introduction To High Definition Surround . "Surround Sound for the Millennium", the world's first phase and frequency coherent discrete

multichannel audio compact disc, clearly establishes a benchmark by which sound and music will be ...
--- [49] http://www.mother.com/~audiofx/dts/dts.htm (5K)

Sites with audio clips
This page provides links to digitized sound archives available on the Internet. . The archives listed here contain mostly sounds in U-LAW format. These sounds play directly on a Sun audio device but you might need a special software to get them ...
--- [49] http://www.eecs.nwu.edu/~jmyers/other-sounds.html (31K)

The World Wide Web Virtual Library: Audio
Virtual Library Computing Broadcasters Music . Audio . Please mail Jonathan.Bowen@comlab.ox.ac.uk if you know of relevant on-line information not included here. . This document contains some pointers to information on audio sounds available ...
--- [49] http://www.comlab.ox.ac.uk/archive/audio.html (17K)

LINKS PAGE
Links Resource Page . Return to SoundWave . Links To Publications . Pro Sound News . Audio Bits . BMI MusicWorld . C.ENT.I . Chaos Control . ConnXtion Magazine . Consumable Online . Euphony OnLine . Fuji International . HYPE Electrazine . ...
--- [49] http://soundwave.com/directories/linksindex.html (4K)

Good Sound for Cheap FAQ
WWW Version . (HTML page design by Jeff Jensen) . This page is enhanced for Netscape 1.1N . Return to: . Jeff Jensen's homepage . The Good Sound for Cheap FAQ by Marlon Feld . This FAQ was written by Marlon Feld and was recently ...
--- [49] http://www.public.iastate.edu/~jaj/goodsound.html (42K)

What is digital Audio all about?
(and Why Does It Sound So Poopy Sometimes?) . by Charles Macchia (email: St._Chuck@magic.ca) . Here's a fairly basic "Just What is Digital Audio All about and Why does it Sometimes Sound So Poopy?" fact paper I put together some time ago to ...
--- [49] http://www.mcc.ac.uk/~emagic/overview/logic/digaudio.html (10K)

37. How do I read an audio cd track as digital data?
How do I read an audio cd track as digital data? . Most CD-ROM drives cannot decode audio information. There are firmware and data path reasons why it doesn't work. . The following drives have can do digital audio extraction over the SCSI ...
--- [49] http://www.cdarchive.com/cd_rom_faq/faq_37.html (5K)

The University of Michigan NewMedia Center Program Proposal
Primary Contact: Ed Saunders, Director . Office of Instructional Technology . The University of Michigan . 610 East University . Ann Arbor, MI 48109-1259 . Phone: 313/763- . FAX: 313/763-4664 . Internet: ed.saunders@umich.edu . The ...
--- [49] http://www.oit.itd.umich.edu/NMC.proposal.html (22K)

Audio Information
One of my more recent interests is in audio equipment. This started when I inherited a partially completed Marshall Leach low-TIM amp. I figured that if I finsihed this it would be a cheap, easy way to get a good amplifier. Well, it was probably ...
--- [49] http://www.princeton.edu/~ksthorn/audio.html (6K)

About Creative
| Press Releases | Trade Shows | Employment . About Creative... . Introduction . The Company . The Founders . Products . Audio Boards . Multimedia Upgrade Kits/CD-ROM Technology . Video Products . Software . Accessories . OEM and ...
--- [49] http://www.creaf.com/www/corporate/about.html (19K)

NOSSDAV-90 Full Citation and Abstract
Designing a Workstation-Based Conferencing System Using the Real-Time Producer/Consumer Paradigm . K. Jeffay and F.D. Smith . in Proceedings of the First International Workshop on Network and Operating System Support for Digital Audio and ...
--- [49] http://www.cs.unc.edu/dirt/abstracts/NOSSDAV-90-abs.html (14K)

Astonishing good audio at very low bitrates: ISO-MPEG 1 layer 3
The "Moving Picture Experts Group" (MPEG), working under the joint direction of the International Standards Organization (ISO) and International Electro-Technical Commission (IEC), sets standards for the coding of digital moving pictures ...
--- [49] http://www.wp.com/hansbakhuizen/1_6mpeg.html (5K)

Exercise: Creating the Multimedia Presentation - Sound

In this exercise you will have to develop anther component of your interactive multimedia presentation for an imaginary client. As part of the process of planning the application you must define, identify and/or capture the sound elements of your multimedia presentation as proposed to you by the “content specialist.” At the end of this exercise you will have completed the digitized sound elements of you first multimedia application. With the support of you instructor answer the following questions.

1. What function or purpose sound will play in your application?

2. In which part of your presentation you will include sound?

3. Which will be your sound sources?

4. Are you planning to record sound? How this will be accomplished - define the settings.