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File Menu

The File Menu is very similar to other Windows applications and contains the usual commands for manipulating files (New, Open, Save, Save As, and Quit). Audio Lab can load and save 8 bit resolution mono WaveAudio (.WAV extension) and Creative Labs   (.VOC extension) files.

Common Dialog boxes are used for the Open and Save As menu   items, and their operation is the same as in any other application which uses them.

Audio Lab supports Drag-and-Drop from the File Manager, and attempt to load any   .WAV or .VOC file that is dragged using the mouse from the File Manager and dropped   into Audio Lab. (See the Microsoft Windows User's Guide).

Edit Menu

The Edit Menu contains several standard Edit commands (Cut, Copy, Paste, Select All, Clear), but the rest are specific to Audio Lab. These menu items are only available during certain circumstances, described below:

Cut Unmarked Areas: When a block is marked, everything outside the block is removed using this command.

Paste Mix: After a block of samples has been cut or copied, it is possible to mix the block into a waveform at another position, with the result that both sounds can be heard simultaneously. A Dialog Box will appear asking for the proportion of sound to be 'mixed   in' to the waveform.

Paste RingMod: Multiplies samples by the samples that have previously been cut (the same as a ring modulator). This gives a 'science-fiction' or 'robotic' effect depending on what samples are used. Sine waves (or similar, such as a sampled whistle) are recommended, and the effect is often used on speech waveforms. It could also be used to make someone's voice unrecognizable. Both waveforms must be loud, or the resulting waveform will tend to be very quiet.

Repeat Marked Block: This command makes space in the waveform equivalent to the size of the marked block of samples, and then pastes the marked block of samples into that position.

Set Marked Block: Opens a Dialog Box that allows the exact edges of the marked block   to be specified. If a block has been marked before this menu item is chosen, the edges of   the current marked block will be shown in the dialog box.

Wave Menu

The Wave Menu gives control over the playback and recording of waveforms, with menu items having the same effect as their namesakes on a tape recorder, for example. The Media Controller menu item will open the Media Controller, a special window that shows   a view of what is currently being played or recorded.

Effects Menu

This menu contains options that perform special effects on the waveform.

Reverse: Reverses the order of the samples in the waveform. This has the same effects as playing a record or cassette tape backwards. Reversing a reversed sound puts the samples back in their original order.

Invert: Turns the waveform 'upside down'. Like reverse, inverting a waveform twice gives the original waveform. This is useful for stereo recordings, where it is often possible to cancel the vocals in the recording by inverting one of the channels.

Volume Ramp: This menu item creates a dialog box that allows you to specify an upper and a lower volume that will be 'faded' between. This effect is identical to turning the volume on an amplifer from one setting to another over a period of time.

Silence: Changes all sample values to zero, which represents silence. This is useful for 'silencing' background noise between sounds, such as between sentences where someone is speaking, or between musical performances.

Echo: This effect simulates an echo. The Dialog Box used to specify the echo contains 3 main controls.
1. Echo Amount - the volume of the echo, on a scale relative to the original sound   of 0 to 100.
2. Delay Time - the time before the echo is heard, in thousandths of a second. The time before the human ear can detect a distinct echo is around 20 milliseconds. Any echoes of this duration simulate effects such as making a single vocal track sound like a 'chorus'. Several echoes in the range of 20-100 milliseconds, with different amplitudes, can be used to create reverberation, to give 'dry' sounding waveforms more ambience.
3. Feedback - specifies whether the echo will occur only once, or whether the first   echo will be echoed itself repeatedly until the end of the waveform or marked   block. This is useful for creating effects where a sound keeps 'reflecting' off the   sides of a cave (for example), gradually fading away.

Ring Modulate: This effect is done by multiplying each sample by itself. The result of this is that the frequency content of the waveform is changed so that it contains the sum and difference frequencies of all the frequencies in the original waveform.
Example: If a waveform contains sine waves of frequency 800 Hz and 700 Hz, ring modulation will replace the waveform with one containing (800 - 700) = 100 Hz and (800 + 700) = 1500 Hz.

Spectrum Invert: The frequency-domain relative of the **Reverse** effect. This effect inverts the spectrum of the waveform, so that low frequencies become high frequencies, and vice-versa.
Example: A waveform of a 1 kHz sine wave sampled at 10 kHz   would be replaced by a sine wave of 9 kHz. This effect often produces odd-sounding results that are not really useful, such as the inverted spectrum of speech. However, it does have applications in creating new sound effects or instruments and the most 'interesting' results come from using these types of waveforms with this effect.

Tools Menu

This menu has options that are useful for manipulating the sound.

Sampling Rate: Changes the speed at which the sound is played back or recorded. All waveform-audio devices have a fixed upper and lower limit on the sampling rate. When the sampling rate is changed, the pitch of the waveform is changed proportionally.

Set Volume: Allows changing the volume of the waveform by multiplying each value in the waveform by a constant. Note: If the volume is increased by too great an amount, the waveform may be clipped, and hence sound distorted. Many volume changes over wide ranges will eventually distort the waveform.

Max Volume: Increases the volume of the waveform to the maximum that is possible before clipping occurs.

Noise Gate: Sets all samples below a specified volume to zero. This is an easy way of silencing all sound below a certain volume, such as background noise between words and sentences during speech. However, it will also have an effect on the 'wanted' part of the waveform which will likely contain samples below the specifed volume. Recommended values for reducing background noise are between 5 and 10 probably cause distortion, depending on the nature of the waveform.

Quantize: Reduces the dynamic range of the waveform. Each time the number of bits specified is decreased by one, the dynamic range will decrease by approximately 6 decibels. This is useful when preparing sound to be compressed - quantizing the waveform to the maximum desired level of background noise will produce the best compression.

Change Sign: Changes the waveform samples from the range -128 to + 127, to 0 to 255. This menu item is mainly useful when RAW waveform data has been loaded, but it sounds very badly distorted. Often the distortion is caused by the 'sign' of the waveform samples being incorrect.

Add Samples: Adds a number of samples to the waveform. If there is no marked block specified, they will be added to the end of the waveform. If not, the samples will be inserted at the left-most edge of the marked block.

Options Menu

This menu lets you choose input and output (recording and playback) devices that will be used by Audio Lab. The name of each waveform-audio device (as reported by its Windows driver) can be selected, and the capabilities of each device can be seen in the Dialog Box. If there are no sound drivers installed, the only option will be to choose "(none)".

Glossary

Background Noise: A low-level 'hiss' sound that is present in all digitised waveforms to some   extent, which is caused by Quantization Error. Using a higher resolution to store the file minimises   background noise at the expense of increased storage space. If the resolution is decreased by too   much, the background noise will increase until it is heard as distortion.

Clipping: Distortion caused by sample values being calculated that are too high or too low to be   stored. These are 'clipped' to the highest or lowest value, respectively, before being stored. Unlike   clipping caused by overloading an amplifier, clipping in digital audio cannot cause damage.

Digitising: See **Recording**.

Dynamic Range: See **Resolution**.

Files: A waveform stored on the hard disk of the computer. There are two methods of loading and   saving files with Audio Lab: WAV files and VOC files. The only difference is that WAV files are   structure better than VOC files, and are the standard for use with Microsoft Windows Multimedia   products. New files should generally be stored in WAV format.

Frequency: Roughly corresponds to the pitch of a sound. Low-frequency sounds have lower pitch   than high-frequency sounds. A waveform is usually made up of several frequencies combined.

Playback: Playing back each sample stored in a waveform, one after the other, at a certain sampling rate.

Quantization Error: The error introduced into a waveform when it is digitized. Higher-resolution   samples have smaller quantization error, because they have a larger range of numbers that can be   used to approximate to the original waveform.

Recording: Converting a sound into a digital waveform stored in the computer, via a Waveform-Input device such as a Soundblaster sound card attached to a microphone.

Resolution: The resolution of a sample determines the accuracy of a sample. There are two main   resolutions - 8 bit and 16 bit. 8 bit samples approximate voltages to an integer value between 0 and   255, while 16 bit samples approximate voltages to a value of between 0 and 65,535. 16 bit samples   are used to store high-quality music (e.g. Compact Disks), and are capable of storing waveforms   255 times more accurately than 8 bit samples, while only using twice the storage space.

Sample: A number that represents the voltage of a waveform at a precise instant. Samples have   resolution (the accuracy with which they can store samples) and size, which increases with   resolution.

Sampling Rate: The speed at which samples are recorded or replayed. This is measured in Hertz or   KiloHertz and typical values are between 4,000 Hz (samples per second) and 44,100Hz (the   sampling rate used by Compact Disks). Higher sampling rates correspond to higher quality and   greater storage space. Also, it is impossible for a waveform stored at a certain sampling rate to   contain a frequency of greater than half of that sampling rate.

VOC File: See **Files**.

WAV File: See **Files**.

Waveform: A sequence of samples, one after the other, that are played back or recorded at a   certain **sampling rate** to make up a sound. The higher the samping rate, the faster the waveform will be played back.

About Audio Lab

Audio Lab V1.1D
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Audio Lab is a digitised sound editing program that runs under Windows 3.1. It graphically displays waveforms representing sounds that can be recorded (with the appropriate hardware) or loaded from disk, processed, and then saved again. Using these displays, cut and paste operations can be done on the waveform and special effects such as echo and fading in/out can be applied.

Thanks to Borland International (N.Z.) Ltd for their donation of Borland C++ which was used to write this program for entry into the New Zealand Software Awards. This program won the Under-18 division.

Hardware requirements:
    A Windows 3.1 / OS/2 2.1 compatible computer, preferably running in 386 Enhanced mode
      with virtual memory enabled.
    A VGA-compatible (or better) graphics adaptor.
    Mouse or other pointing device.
    Approximately 850k of free hard disk space.
    A sound card that can support waveform audio through a Windows 3.1 driver is recommended.
    A driver is included that is compatible with the internal speaker (playback only).

Software requirements:
    Windows 3.1 or OS/2 2.1 with Win-OS/2 installed.

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