

Introduction

Wave Flow is an audio editor, so it can play, record, filter and modify a waveform, using lots of different functions, always following the WAV standard. Besides, as it has been designed for a Windows environment, it is done visually, easily and intuitively.

The above characteristics are obtained by building a program that supports multiple windows or MDI documents (multiple document interface). Allowing the use of different windows simultaneously, the work that has to be done is made easier. If you have ever used a program not supporting MDI, you know that to interact between two or more waves, multiple sessions of the same program must be opened. But using a MDI program, there is no need to open more than one session of the program, because as many files as wanted can be opened from it, and they will be displayed in their respective child windows.

Once a sound file is opened, it will be displayed in a child window, showing its characteristics in the status bar of each window. Clicking with the mouse on a child window will activate it. After selecting a part of the sound (keeping the left mouse button pressed over the sound), all the functions of the main program principal can be used.

The main program

The appearance and use of Wave Flow, is very intuitive because it contains button bars, menus and other visual elements. Besides, each button has a small hint (a small help comment that appears when the mouse pointer is over a component a few seconds).

The bars that appear in the main program are the next:

- Access barbrápido
- Buttons barbopciones
- Play bar breproducción
- Selection barbselección

The menu options can be divided into:

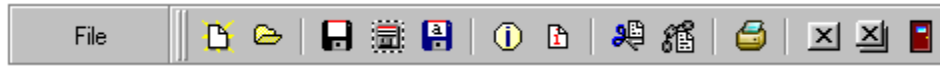
- File menumenúarchivo
- Edit menumenúedición
- Tools menumenúherramientas
- Filter menumenúfiltrar
- Miscellaneous menumenúmisc

Access Bar



The icons of this bar will let you select the buttons that will appear in the Buttons bar, to allow quick access to the functions, tools and applications. You can choose: File, Edit, Tools, Filter, Miscellaneous and Help.

Buttons Bar



This bar contains the buttons that allow quick access to the most useful functions of the program. The buttons displayed in this bar will depend on the selected option from the Access bar rápido.

It is a filter that deletes the high frequencies, but allowing the pass of the low frequencies.

It is a filter that deletes the high and low frequencies, but allowing the pass of the medium frequencies

It is a filter that deletes the low frequencies (except for the offset component), but allowing the passage of the high frequencies.

Play Bar

This bar contains the buttons that not only will let you play a part of a waveform, but also will let you pause, stop and record it.

The button with a CDROM Image (on the right of the Play Bar), shows CD player which is visual and very easy to use. It will let you play any music CD.

The button with a Telescope Image lets you Zoom into the selected part of the current waveform to fit into the window.

Selection Bar

Begin	Size	Zoom
2856	3472	14
0':0":130ms		0':0":157ms

The selection bar, has three components. The first one (titled Begin), will let you display and change the beginning of the actual window, that can scroll through the waveform. The second one (Size), will let you change the selection size in samples. The Zoom edit box, will let you see and change the scale that will be used to display the waveform.

FAQs

1.-) I like your program and I would like to register it. What do I have to do?

You can register Wave Flow using any of these ways: First of all, you can register it online using the a<Internet and a secure shareware registration service. Please visit the Wave Flow Web Site at <http://www.waveflow.com> to register this way. If you do not want to register online, you can also send me the money to my postal address. This method is not as fast as the first one, and it is recommended if you do not have a credit card. To register this way, please take a look to the Registerregister help page for more information.

2.-) I have some sound and the waveform is not displayed completely. Is there any problem with the shareware version?

No. If this happens it probably because you have recorded the sound using a program that does not follow the WAVE RIFF format correctly. This happens for example with the Windows Sound Recorder. You can correct it using a file converter or another audio editor and re-saving the waveform (so that it will be saved with the correct file format).

3.-) My sound is huge (50 Mb). What can I do to use it with Wave Flow?

Wave Flow has some problems in some systems when you are trying to use a huge file. This can be solved using a Wave Flow function called Divide into multiple waveforms

. It divides your file into multiple shorter files so you can use them in Wave Flow. After the individual edition of the files, you can use Concatenate Multiple Files to convert them all to a single file.

4.-) Where can I find the latest version of Wave Flow and some information about it?

You can visit Wave Flow web site at <http://www.waveflow.com> (European mirror) or <http://sagat.hypermart.net> (USA mirror).

5.-) I have songs in cassettes and I would like to convert them to CD. Can your software do it?

You can use my program to record those songs into .wav files, and then use the program that comes with your CD Recorder (EasyCD or whatever) to convert them to CD tracks.

6.-) During the setup process I left the option 'Use as default audio editor/CD Player' checked. How can I unset Wave Flow as default?

If you have 3.2 version or higher you can use the option 'Colors and settings' in the Miscellaneous menu. Otherwise you will have to use the regedit.exe and delete all 'waveflow.exe' keys.

7.-) What do I get if I register Wave Flow?

If you register, you will become a happier person because you will be doing the right thing (and the legal thing). You will not only have technical support, but also you will get free upgrades to all the versions of the same number (3.0, 3.2, 3.5, ...), and a special discount (60%) to all future versions (4.x, 5.x, ...). In addition, you won't have to see the annoying message recommending you to register every 5 minutes.

8.-) I have a sound file with music and voice, and I would like to remove the voice from it. How can I do it?

In audio waveforms, it is impossible to completely separate the sound of the voice from the sound of the music from a recorded waveform, because they are all mixed together in the same track. You can try to use a function called 'karaokeh12' to try to simulate it.

9.-) I need to remove the background noise of my sound. Which functions do I have to use?

It depends on the sound, so you will have to try different combinations of the following functions: STSAf10, noise gateh12 and High pass filterf2.

10.-) I want to remove the scratches from my vinyl records. What do I have to do?

It depends on the sound, so you will have to try different combinations of the following functions: Top Hat filterf6, Median filterf3 and Low pass filterf2.

11.-) I get error MMSystem # . Why?

Wave Flow uses Windows multimedia functions (low level audio controller functions) to play the sound. Check if your drivers are Ok or try to re-install them.

12.-) I would like to distribute Wave Flow with my magazine, CD, Web, ... Can I do it?

Of course. Shareware philosophy means that it is free to distribute and to try, but not to use. This means that you can distribute it, but please notify me at my email address xevi@100mbps.es . (I like to know where my programs are distributed)

13.-) I get IOERROR # when I try to open my file. Why?

Please take a look to the FAQ number 3 and check it, and check the file properties of all the files of the Wave Flow directory (they have to be read and write enabled).

File Menu

You can use the commands on the File menu to manage the audio files in the program.

The commands on the file menu are the next:

- New
- Open
- Reopen
- Close
- Device information
- File information
- Save
- Save as...
- Exit
- Divide into multiple files
- Divide file into tracks
 - Concatenate multiple files
 - CD Player
 - Save selection
 - Print
 - Print options

New

Creates a new wave (without any default format). This new wave will be represented as an empty window, where any wave can be pasted (previously cut or copied).

This option can also be called from the speedbarbrápido.

Open

This command shows a dialog box that lets you choose an already created wave file (files with extension *.WAV). Once a file is selected, the program will open it and will display it as a wave.

This option can also be called from the speedbarbrápido.

Reopen

This command shows the path and the name of the three last wave files that have been opened, putting them into a submenu. To open one of this files, select it clicking on its name, and the program will open it.

Close

Closes the waveform that is active. If the waveform has been modified in any way, the program will ask if you wish to save it. In that case the Save asa8 dialog box will appear.

Device information

When this option is selected, a dialog box is displayed, which contains the characteristics and the information about the audio devices installed on the system.

File information

When this option is selected, a dialog box is displayed, which contains the characteristics and the information about the audio file that is active. Those characteristics can also be seen in the status bar of each window, and the path and the name of the selected file can be seen on the title of the its window.

path, number of channels, bits per sample and samples per second (sample frequency).

Save

To save a waveform there are two options:

-If the waveform of the active window has a file name, the waveform is saved on the old file. The old waveform will be replaced.

-If the waveform has no name (because it is new), the Save as...a8 function will be called. You must also use this alternative function if you wish to change the name of the waveform file.

This option can also be found in the speedbarbrápido

Save as...

This command shows a dialog box where the final name of the file to be saved can be selected.

Exit

This command lets you close the actual session and exit the program allowing you to save the waveform files that have been modified .

CD Player

When this option is selected, a CD player is displayed on the bottom of the main window. This CD player can play, stop, pause, eject, move forward, rewind, move to next and last track, and shows information about the tracks and the time of the CD. It also lets you choose any track of the CD only by clicking on its button.

This option can also be found in the Playbarreproducción of the main program.

Save selection

Lets you save the piece of the waveform that is selected.

This option can also be found in the speedbarbrápido .

Print

Prints the waveform that is active with the configuration and values of the option Printer optionsa13. It doesn't print all the waveform, only the part that is displayed in the active window (including the selection, the selection cursor and the status bar of the window).

#Printer options

This command displays the dialog box of the default printer installed on your system.

Miscellaneous Menu

In this menu you will find miscellaneous functions that are not applicable to other menus.

The commands in this menu follow:

- Colors and Settingsm1
- Histogramm2
- Loopm3
- Zoom In/Outm4
- Volumem6
- View Gridm7
- Current Sample Infom8
- Audio Related Sitesm5

Colors and Settings

Colors: Lets you change the colors of the Wave Flow screen (Line, WaveForm and Background).

Settings: This option lets you change some Wave Flow settings like:

- Set Wave Flow as the default audio player/editor and as the default CD player.
- Undo Levels : Lets you change the number of undo operations permitted
- Disable Undo : Lets you disable the undo feature
- View Vumeters : Lets you show/hide the vumeters
- Confirm Exit : Lets you disable the Confirm Exit Popup.
- Vertical Scale : Lets you select the Grid's vertical scale

Histogram

Lets you see the discrete probability function of the waveform and some extra parameters (mean, variance,...), that can be of some help in many cases.

Loop

Lets you select if the play of the sound will be cyclic or it will only be played once (default).

Zoom In/Out

Lets you select the actual zoom of the waveform using hotkeys (Ctrl++/Ctrl+-) with a Zoom Step of x2. You can also change the zoom with the zoom edit box or the zoom speedbutton placed under the zoom edit box.

Register

Wave Flow is shareware. It means that it is free to try, download and distribute, but it is not free to use. Wave Flow has an evaluation period of 30 days, that you can use to test it and see if you like it. If after these 30 days you continue using Wave Flow, you must register it. Please check the Terms of Use before registering.

OK, I want to register, but what do I have to do?

You can register Wave Flow **online** using Qwerks shareware registration services and a secure server (HTTPS) from Wave Flow's web site at <http://www.waveflow.com/>. Transactions are encrypted with the option of making the purchase with a Credit Card or a U.S. toll free phone or fax.

Wave Flow has a little fee of \$25 US. Once I receive your registration notification from Qwerks, I will email you with your customized login and password, that you can use as your registration license. Please email me if you don't receive your login and password in a couple of bussines days.

You can visit Wave Flow website at <http://www.waveflow.com> and follow the instructions, or you can directly select Help Menu Register Online Registration.

If you don't have credit card, you can also send me the money or the check with your personal information to my postal address. Please print the [Registration Form](#) and send it to:

Xavier Cirac
c\ Joan Oms , 13
Canet de Mar , 08360
Barcelona
SPAIN

After receiving your registration mail, I will e-mail/mail you with your registration login and password so you can enter them to the program.

Wave Flow registered users of any previous version (2.x, 3.x or 4.x) have an special discount of 60% when purchasing the upgrade to the current 5.x versions. It means that you will pay only \$10 US instead of \$25 US. If you are one of these cases, please email me and I will tell you how to purchase this special upgrade.

I have also special prices for schools and universities (Campus licenses). Please email me if you are interested.

Thanks for registering Wave Flow.

[Registration Form](#)

Registration Form

Please Print the next form and fill in the information (if applicable) when you send me the registration letter:

Product: WAVE FLOW 5.x
Company: _____
Name: _____
E-Mail: _____
Address: _____
City: _____
State/Province: _____
Country: _____

Optional

Where did you find Wave Flow?

What are you using Wave Flow for?

Audio Related Sites (Internet)

This submenu will help you to find the most interesting audio related places (as well as some General sites) on the net. They are all rated and commented and they are perhaps the most useful sites to find software, help, tips, links, wav files...

Divide into multiple files

This option will be useful with the large wave files (>50 Mb) if Wave Flow seems to go too slow or gives you any memory error. Using this function you will be able to divide large wave files into pieces so Wave Flow can handle them.

After that, you can use the function [Concatenate multiple files](#) to concatenate all the waveforms one behind the other.

Concatenate multiple files

This option is useful when the 'Divide into multiple files' function has been used or when you need to concatenate multiple files in one target file. It takes the data of each selected file (selected with the 'Add' button), and concatenates them in one final file using the PCM format (Channels, Bits per sample,...) of the first file. It is very important to be sure that all the files are PCM waveforms and that all of them have the same format : Channels, Samples per second, Bits per sample, ...

Zero Crossing

Zero crossing is a function that lets you adjust the selection to match the zero crossings of the waveform (the samples where a change from positive to negative value is found), in order to preserve the sound phase and to get a better adjustment and behavior of the paste, repeat, mix and other functions.

In the submenu, a lot of zero crossing options can be found in order to select the directions of the selection adjustment.

Volume

This option shows the Windows default Volume control, so you can set up the configuration parameters of the input and output lines, for playing and recording .

View Grid

This option shows or hides the grid in the waveforms.

Current Sample Info

This option shows information about the current sample (Sample Number, Value and Time Value), for mono and stereo files.

Divide File into Tracks

This option is useful when you want to separate or divide a waveform, into multiple parts separated when a silence is found. For example : a large vinyl recording with many tracks recorded into a unique file. This option will let you separate the tracks automatically.

This option will be also useful with the large wave files (>50 Mb), if Wave Flow seems to go too slow or gives you any memory error. Using this function you will be able to divide large wave files into pieces so Wave Flow can handle them.

After that, you can use the function Concatenate multiple files to concatenate all the waveforms one behind the other.

Options:

- Original Waveform : lets you choose the file to divide.
- Threshold : under that value (in %), the samples of the waveform will be considered as silence. This option can be useful in Vinyl noisy recordings.
- Silence Length : lets you choose the gap or silence length that separates the tracks. If Wave Flow finds a part of the waveform which silence length is greater or equal than this value, it will consider that it has found a new track .

Edit menu

The Edit menu in this program not only has all the typical actions of the clipboard functions that Windows programs usually have in this menu (i.e.: cut, undo, copy, paste...), but also has some specific functions related to the audio processing programs (i.e.: rap, mix, insert and force silence, etc.).

The functions in this menu are:

- Undo
- Cut
- Copy
- Paste
- Paste as new
- Mix/Mix Special
- Repeat
- Delete
- Trim
- Insert silence
- Force silence
- Select all
- Go to the cursor position
- Zero Crossing

Undo

This option lets you undo the last action made to the waveform (the last modification), so there is the possibility to undo the mistakes that can be made.

Undo information is automatically saved to temporary files (~namefile.tmp) in the directory of the file being edited before you do anything that will change the waveform. Since 5.0 versions and above Wave Flow provides support to multiple undo. It means that you can undo not only the last actions, but also all the actions done before to a limit set by the "Undo Levels" option (from Colors and Settings).

Press Ctrl+Z to quickly undo the last operation.

Cut

Cut will copy the selection to a temporary file called wavecopy.tmp in the Wave Flow main directory, and remove it from the waveform being edited. Once cut, it can be Mixed or Pasted to other waveforms.

Use CTRL+X to quickly cut the selected wave.

Copy

This option realizes the same actions that the Cute2 option, but without deleting the selection. The selection will be copied to the temporary file called wavecopy.tmp to use it later with the functions Mix or Paste

Use CTRL+C to quickly copy the selected wave.

Paste

This options lets us insert the piece of wave that has been already copied or cut with the functions Copy o Cut. With this function different waveforms recorded in different moments can be added in the same waveform file. The selection will be pasted in the cursor position.

It is also accessible with the Ctrl+V shortcut.

Paste as new

This function realizes the same as the Paste4 function, but creating a new child window where the selection already copied or cut will be inserted to. With this function we get a new file (initially with blank name), where we can edit the waveform without modifying the original audio file.

Mix / Mix Special

This function realizes a union of the actual waveform and the piece of waveform that has already been copied or cut. The result is a mix (a superposition) of the samples that we have been cut or copied and the samples of the actual waveform, starting on the cursor position.

This option is also accessible using the Ctrl+M shortcut.

The Mix Special option is an smart edition option that lets you choose the relation in % between the actual waveform and the sound already copied to the wallpaper.

Repeat

This function repeats the actual selection after the selection end. If you choose this option from the menu, you can also select the number of times that the selection will be repeated.

This option is also accessible using the Ctrl+R shortcut.

Delete

This function lets us delete the actual selection of the active window. It is not the same that the Cute2 function, because now the selection will be loosed, not cut (only recoverable using the Undo1 option).

This option is also accessible using the Ctrl+Del shortcut.

Trim

This is the complementary function of Delete, because it deletes all the waveform except the actual selection.

Insert silence

This function inserts samples with a null amplitude value. This means that it inserts silence. The length of the silence inserted will be the size of the selection when this option is selected.

This silence will be inserted after the beginning of the selection, moving all the later samples after the end of the silence that has been inserted.

Force silence

This function takes the samples of the actual selection and force them to 0. This means that they will be silenced, so you will hear nothing.

Select All

This option selects all the waveform and displays the whole sound in the window, selecting it all. This means that the zoom, begin and size values of the selection bar will be modified.

You can also access to this function doubleclicking the status bar of the window that we wish to fully select.

This option is also accessible using the Ctrl+S shortcut.

Go to the cursor position

This function displays the waveform beginning in the sample that is written in the edit box called "Begin" placed in the selection bar of the main window of the program. This functions free us of having to look for the cursor all over waveform using the scrollbar manually.

This is a useful function when the zoom values are small.

Xavier Cirac



This is my name and I am the author of all you can see in this program. I have been working with some wave editors and I decided to build my own audio program, trying to get the best functions of all the other wave editors, and keeping off the useless options of all of them.

This software has been programmed using Borland Delphi © (a fantastic programming tool that gives a visual and easy way to make Windows programs).

I started programming this software in 1997 (March), and I am still working on it to get a better program. If you have any doubt about it, or find any mistakes or bugs please send me an e-mail to the address: <xevi@100mbps.es>. I will be very happy if you do so. If you wish to give me ideas for later versions, or give your opinion of something related to the program, you can mail me too.

To get a description of the program characteristics please click the next label:

[Wave Flow](#)

Drag and Drop

Wave Flow supports Drag and Drop. To use the Drag and Drop feature, just keep pressed the Ctrl key and Drag the selection. This facility lets you edit the waveforms easily and visually. You can drag the selection over 2 destinations:

1.- Over the Workspace : Wave Flow creates a new waveform that contains the information selected and dragged.

2.- Over the same or another Waveform : Wave Flow lets you choose if you want to :

- a.- Paste the selection
- b.- Mix the selection
- c.- Mix [Special] the selection
- d.- Move the selection (Cut and Paste)
- e.- Move and Mix the selection. (Cut and Mix)

Zero Crossing

This option lets you adjust the selection to the previous or next zero crossing. This adjustment can be used to improve the copy/paste effects. You can do the zero crossing selection in one of the next ways:

- Inward
- Outward
- Both sides to the left
- Both sides to the right
- Left side to the left
- Left side to the right
- Right side to the left
- Right side to the right

Filter Menu

Using this menu, you can access all the filters (time filters and frequency filters), and all the functions related to the frequency domain. The functions that you can find in this menu follow:

- Filter bank
- Advanced filter
- Median filter
- Improved Median filter
- Average filter
- Difference filter
- Top Hat filter
- Edge Enhancement
- Add noise
- Equalize
- STSA
- Wavelet Denoising Filter
- Dynamic expander

Filter bank

This option shows a dialog box where a list of some predefined filters can be found. The values of this filters are fixed but they are the typical filters that you can find in any audio editor, so if you wish to configure any of them, you should use the function Advanced filter. Those filters, will delete or increase some frequency components of the sound (low, medium or high frequencies) to get different effects.

This function eases the use of the most common filters.

The predefined filters that you can choose in the selection list of the dialog box are:

- Low pass filter 2K
- Low pass filter 5K
- Low pass filter 10 K
- High pass filter 60 Hz
- High pass filter 100 Hz
- High pass filter 1K
- Bass Boost
- Bass cut
- Treble Boost
- Treble cut
- High Boost
- High cut

You can quickly access this functions using Ctrl+B.

Advanced filter

This is, perhaps, one of the most important functions in this program. It lets us realize a personalized filter, because with this function we can configure a set of parameters that will modify the response of our filter, making it more or less selective. When this option is selected, the next dialog box will appear:

At the top of the dialog box a frequency representation of the Fourier transform (FFT) of the piece of waveform selected will appear. Using the buttons of its right, we can select if we prefer a linear-linear representation, or a semi-logarithm representation (Y axis in logarithm scale and X axis in linear scale). This frequency representation will guide us to realize our filter. The range of representation is: 0 Hz (offset component) to half the sample frequency (due to the Nyquist theorem).

Under the graphic we will find two trackbars that will let us select the low cut frequency and the high cut frequency of the filter (this response of this filter is represented with a red colored square on the frequency representation).

The selection box on the right of the dialog box, will be used to select the action that we wish to realize with the selected range of frequencies. This functions are:

- **Delete:** Deletes the frequency components included into the selected range (force them to zero).
- **Boost :** Increases the value of the frequency components included into the selected range. The ratio factor that will be used, can be selected with the small trackbar situated under the selection box.
- **Decrease:** : Decreases the value of the frequency components included into the selected range. The ratio factor that will be used, can be selected with the small trackbar situated under the selection box.
- **Band pass filter:** Using this function, all the frequency components that are **not** included into the selected range will be forced to zero. This is the default option.
- **Window Size:** You can select the size of the FFT used in the filtering transformation (>Window Size means >Spectral resolution & >Processing Time).
- **Overlap:** You can choose the overlap into transformation windows.
- **Window Type:** It shows the available windowing functions (Rectangular, Hamming, Hanning, Barlett & Blackman)

We can see that combining all the options of this function, all the filters of the option Filter bank, can be done (and many more!).

You can quickly access this function using Ctrl+F.

Median filter

This option realizes the 3x3 median filter of the selected piece of waveform.

This filter realizes the median of the actual, anterior and posterior samples and assigns it the value of the actual sample. The median of three numbers is the value that is neither the lowest nor the highest.

The median filter is used to delete the scratch noise.

Improved Median filter

This option realizes the 3x3 median filter of the selected piece of waveform. An improved median filter is a median filter with a threshold (under this threshold the signal will not be modified).

The median filter is also used to delete the scratch noise, being a little bit "cleaner" the median filter.

The scratch is a high frequency noise due to the saturation of the signal. For example, one of its causes can be the little jumps that the record player needle does when playing a record.

Average filter

This option performs a simple 3x3 average filter of the selected waveform. To do it, the arithmetic average of the actual, past and next sample is done, and the result of this operation is assigned to the actual sample. It means :

$$x[n] := (x[n] + x[n-1] + x[n-2]) / 3$$

In fact, this is a low pass filter because it deletes the high frequency changes.

Top hat filter

This option performs the 3x3 top hat filter of the selected waveform.

A top hat filter is a very useful filter to delete the scratch noise because it is a filter that only deletes this kind of noise, without modifying the signal that has no noise. It is perhaps even better than the median filter, because it is cleaner with the parts of the waveform that don't have scratch.

Add noise

This function add random noise to the selection of the actual waveform. The result that you can hear, is that a fried noise is added to the signal.

Equalize

This function shows a dialog box where an octave equalizer is displayed, whose attenuation values can be selected for each octave using a mobile trackbar. An equalizer is useful to attenuate or increase some frequency ranges, to increase the sonority of the waveform.

The mobile trackbars scale is in dB (decibels), and the frequency scale is in Hertz's (Hz).

This option is also available using the Ctrl+Q keys.

Dynamic expander

This option lets us perform an expansion of the dynamic range of our signal (number of dB of intensity variation that the emitter can generate), and in some cases it is useful to add richness to our waveform.

When this option is selected, a dialog box is shown, where the ratio of increase or decrease can be selected. This ratio is the value of the filter that will be applied to the waveform to expand it. If this value is greater than 1, this function will actuate as an expander, but if it is lower than 1, it will actuate as a compressor. If a too high value is used, the signal can be saturated, so the effect that we wished to get won't be reached.

Thanks

This program has been done thanks to the help of :

- Carmina Boter (beta tester, help file, ideas and support)
- Eloi Solà (beta tester, ideas)
- Léonard Janer (FFT)
- Màrius Flaquer (Signal Techniques)
- Rodrigo Trujillo (Wavelets)
- Juan Antonio Rubio (Wavelets support)
- Viorel Dehelean (Vumeter Component)
- Gwill Jones (Help file correction)

... and all the Wave Flow users who have sent me emails with ideas, improvements, errors and bugs.

... and all the registered users who have given me the strength enough to continue with this project and develop new versions of it.

Thanks to all of them.

STSA

This function (Short Term Spectral Attenuation) can be used to get an enhancement of musical signals and speech signals degraded by background noise. Since many old recordings suffer from an excessive background noise, it is nowadays common to use a digital noise reduction system. The principle of STSA method is to attenuate those values of the short-time Fourier spectrum of the noisy signal that are strongly corrupted by noise. Its drawback is that the noise reduction is obtained only at the cost of some amount of signal distortion. In the case of old disk recordings, the level of the background noise is generally so high that this technique can generate audible distortions, but on the other hand, playing with different configurations of the parameters of the STSA form you can get pretty good enhancement. This function is useful for sounds that suffer from background noise (low frequency) if your sound also suffers from other kind of noise (gaussian,...) you should also use other functions like Median filter, Improved median filter, Average filter, Top Hat filter, ...

You can set the next variables:

- Noise power**: It is the power of the noise. If you don't know which value to use, you can get a good estimation of it using the function "Histogram" with a piece of waveform that has not signal (I mean that it is only background noise).
- High SNR threshold**: It is the value of the SNR (signal to noise ratio) from which the signal won't be modified.
- Minimum SNR threshold**: Every frequency component which SNR is smaller than this value will be put to zero.

Edge Enhancement

This function enhances the edges of the waveform. Its result is similar to a high frequency increase.

Wavelet Denoising Filter

This function lets you clean the noisy waveforms. It is very useful in old recordings, and other audio files with background noise. It uses the Wavelet Transform Algorithm (with the Daubechies 4 function) that gives a very nice result.

This option couldn't be done without the help of **Rodrigo Trujillo** and **Juan Antonio Rubio**, who have given me the idea of this denoising algorithm and who have helped me to develop it as a Wave Flow option.

Difference filter

This option performs a simple difference filter of the selected waveform. The operation performed is :

$$x[n] := x[n] - x[n-1]$$

Tools menu

In the Tools menu you will find the general functions that will let you modify the waveform, adding lots of useful effects.

In the Tools menu you will find the following functions:

- Speed Up/Down
- Resample
- Reverse / Invert
- Normalize
- Invert channels
- Travelling stereo
- Divide Channels
- Combine Channels
- Fade In
- Fade Out
- Amplify volume
- Echo
- Reverb
- Flanger
- Effects
- Remove Offset

Speed Up/Down

This option displays a dialog box where some options can be configured, making the waveform faster or slower. This is performed resampling the waveform adding or taking off samples by interpolation. For example: If the speed is set slower, this will mean that the final number of samples will be increased. The final number of samples of the selection, can be easily selected through the edit box called 'Estimated number of samples'. This is very useful because it lets you synchronize the speed of two waveforms, only knowing the pitch or the period between two drums hits of one of them .

In this dialog box you will find as well the actual length of the selection (in samples), and the increase or decrease percent. All this information will determine the final length of the selection.

This option is also accessible with the Ctrl+Alt+V Shortcut

Resample

This option shows a dialog box that will let you change the actual format of all the active waveform.

In this dialog box you can find the actual format of the file of the active window, and three selection lists that will let you change the final format of the file. You will be able to change the number of samples per second, the number of bits per sample and the number of channels.

Once all the modifications have been done, the waveform will be shown with the new format.

Reverse

This function will let you change the order of the samples of the current selection. Once this function is called, the last sample of the selection becomes the first, and the first one becomes the last. This makes the same effect that playing a record on the inverse direction.

This option is also accessible using the Ctrl+I shortcut.

Invert

This function will let you invert the value of the selected part of the waveform. It means that the part under the zero line (negative), will be converted into the part over the zero line (positive).

Invert channels

This function is only accessible when the current waveform is stereo, because it performs an interchange between the two channels (left and right).

Travelling stereo

This function is only accessible if the current waveform is stereo.

This effect increases the volume of one channel while decreases the volume of the other one. It creates the effect that the emitter of the sound is moving from one side to the other.

By selecting this function, a dialog box will be displayed, where the direction of the movement can be selected (left to right or right to left). The percent of increase and decrease can also be configured.

Normalize

This function increases the volume of the actual selection of the active waveform, until its maximum value reaches the maximum value that the format allows. This function will increase the volume of your waveform, but without saturating it.

Fade In

Fade In will performs a progressive increase of the volume of the waveform making the initial volume lower than the final one.

This function will display a dialog box with some options to configure. First of all, there is a track bar that will let you select the percent of the initial decrease of the volume of the waveform (the final percent will be 100%). Secondly, you can also select the kind of function that will be used to increase the volume (linear, exponential or logarithm).

This option is also accessible using the Ctrl+Alt+I Shortcut.

Fade Out

Fade out is the complementary function to Fade in, because it performs a progressive decrease of the volume of the selection of the current waveform, beginning with a 100% of volume and ending with the percent that you can select using the track bar. You can also select the kind of function that will be used to increase the volume (linear, exponential or logarithm).

This option is also accessible using the Ctrl+Alt+O Shortcut.

Amplify Volume

This function is useful to change the amplitude or volume of the current selection. You can change the percent of increase or decrease using either the track bar or the manual configuration (writing a number into the edit box). A percent of 100% will leave the waveform with the same volume. Selecting a higher value, the volume will be increased, and selecting a lower value will decrease it.

This option is also accessible using the Ctrl+Alt+A Shortcut.

Echo

This function adds an echo effect to the waveform. You can choose between a simple echo (only one repetition) or a multiple echo (various repetitions). If you select "multiple echo", it can also configure the number of repetitions to perform.

This option is also accessible using the Ctrl+Alt+E Shortcut.

Reverb

This option displays a dialog box where the reverb parameters can be configured:

- *Reverb time*: Is the total delay time of the reverb. As high is this value, as big is the room you wish to simulate.
- *Initial delay*: It is the delay between the direct sound and the first reverb rebound.
- *Reverb delay*: it is the delay between the first reverb rebound and the big group of reverb components.
- *Density*: It means the number of reverb rebounds that will be generated. As high is this parameter, as dense and unintelligible will be the result sound.

This function has also some predefined options representing the most common rooms, to easy its configuration.

This function is also accessible using the Ctrl+Alt+R shortcut.

Effects (FX)

Wave Flow, has an small effects bank, that includes some curious effects and some of the effects given with the digital effects processors. They are:

- **Telephonic Line**: This effect performs a band pass filter using the telephonic bandwidth (between 300 Hz and 3400 Hz).

- **Robotic voice**: This effect simulates the voice of a robot.

- **Distortion**: This effect makes a distortion to the sound. All the samples whose value is higher than a configurable threshold are substituted by random noise added to the selected threshold. As low is the threshold you choose, as distortion you will get.

- **Compressor**: This effect compresses the dynamic range of the signal. All the samples whose value is higher than a configurable threshold are compressed by a configurable ratio. As low is the threshold you choose, as compression you will get.

- **Expander**: This effect expands the dynamic range of the signal. All the samples whose value is higher than a configurable threshold are expanded by a configurable ratio. As low is the threshold you choose, as expansion you will get. Another expander is the dynamic expander

- **Noise Gate**: This effect is used to remove the background noise (that is currently a low intensity noise). To get this effect, all the samples whose value is lower than a configurable threshold, are forced to zero. Release/Attack time option lets you choose the duration of the fade (out and in) that will be generated when a silence is found.

- **Quantifier**: This effect divides the signal in a few values, rounding the value of the samples to the nearest one. For example, if you have a 8 bits sound (255 different levels), and you can quantify it to 9 different levels (0, 32, 64, 96, 128, 160, 192, 224, 255). This effect adds a quantification error due to the loss of quantification values.

- **Karaoke**: This function attenuates the frequencies used by the human voice (300/3400 Hz) to simulate a karaoke.

- **Metallize**: This effect adds a metallic effect to the sound by periodically forcing some values to zero (this means that some high frequency components are created). Depending on the period used and the number of samples forced to zero, you will have a Soft metallization or a Hard metallization.

- **Chopper**: This function inserts periodic blank spaces into the sound (samples whose amplitude is 0).

- **Gapper**: This option shows a window that lets you add an effect that consists in inserting blank spaces (gaps) with silences into the waveform, configuring the parameters : *Gap length and Gap Interval*.

- **Groove**: This option shows a window that lets you add an effect that consists in repeating groups of samples several times into the waveform, configuring the parameters : *Groove length and Groove Number*.

This function is also accessible using the Ctrl+Alt+E shortcut.

Remove Offset

This function removes the continuous component of the selection of the active waveform. This is done by calculating the average of the selected range. It has no any audible result, but it is useful if other functions like digital filtering have to be used.

Divide Channels

This function lets you divide the two channels of a stereo waveform and save them into 2 separate files.

Combine Channels

This function lets you combine 2 mono files as if they were two channels, and convert them into an stereo file.

Flanger

Chorus/Flanger is an effect that consists in make the signal sound as if several instruments which are playing at the same time but at slightly different pitches. With vocals (**voices**) it sounds as if a chorus of people are singing.

In implementation chorus is very similar to echo. The block diagram is the same as the one for echoing. The input is mixed with a delayed version of the input to produce the output, but in chorusing the sample rate is being changed continuously (the parameter that controls this is the **Frequency**) .

The chorus is the same as Flanger and the only difference is the amount of **delay** that is used. The delay times in a chorus are larger than in a flanger, usually somewhere between 20 ms. and 30 ms. (the flanger's delay usually ranges from 1 ms. to 10 ms.)

