# The Art of SoundFont: A Step-by-Step Guide

By Jess Skov-Nielsen

Jess Skov-Nielsen was the Grand-Prize winner of the 1997 Creative Open MIDI Contest.

## Introduction

Are you one of the many desktop musicians who rely only on those standard General MIDI instruments supplied with your Sound Blaster AWE sound card, or those SoundFonts made by others?

Do you find these instruments a little too familiar as everyone uses them? Would you like to spend a little time making some more "personal" instruments yourself?

If your answer is yes, you are probably wondering now how you can make these customized instruments, or perhaps you do not even know you can actually make them yourself?

Well, you can!

In the next few chapters, I will reveal the secrets of Vienna SF Studio 2.1 and help you along with your first attempt at Sound Designing. Vienna SF Studio 2.1 can be rather confusing at first glance but you'll quickly learn how powerful and easy-to-use the program actually is. Even if you are an experienced user of Vienna SF Studio 2.1, I believe you will still learn something new. This article will give you a step-by-step guide on how to create your own SoundFont file, also known as the SF2 file.

Note: This is not an attempt to teach you everything there is to know about Vienna SF Studio. What we hope to do here is to show you how you can effectively create your own SoundFont file in the shortest possible time, while providing you with a better understanding of the essential basics.

We will be covering the following topics:

- Samples:
  Importing the raw samples
- Global Sample Looping:
  The art of sample looping
- Instruments:
  How to create an instrument
- Local Sample Looping:
  Local loop enabling / marking
- Keyboard and Velocity Range:
  Arranging Instrument Zones on the keyboard
- The Generator Panel Part I:
  Volume, Filter and Pitch Envelopes
- The Generator Panel Part II:
  Tremolo, Vibrato and WahWah LFOs
- The Generator Panel Part III:
  Adding effects and tuning to an Instrument Zone

- Making The Final Preset:
  Combining instruments into the final Preset
- Using The SF2:
  How to use your SoundFont in your sequencer

To follow the examples given in the articles, all you need is Creative's Sound Blaster AWE sound card (for more information, visit Creative Zone in the Americas, Europe, or Asia & the rest of the world) with at least 512KB of memory, lots of patience and the willpower to learn.

The examples in the chapters evolve around a "SawPad" synth sample (SawPad.wav <125KB>) and three percussion samples (Snare.wav <21.7KB>, Kick.wav <16.6KB>, Hihat.wav <24.2KB>) that you can download here for use with the examples. It is recommended that you use these samples as it will make the examples clearer and easier to understand. Also, a reference SoundFont file (example.sf2) can be downloaded here <191KB> to help you along. This SF2 file contains all the examples and is ready for use. But please do try and make the SoundFont yourself - don't go for the easier option which teaches you nothing.

Good luck!

**Importing the raw samples**

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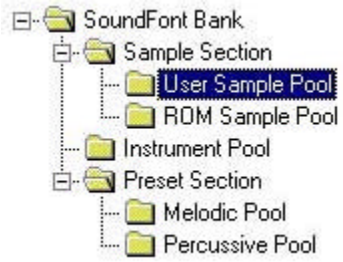
## Samples: Importing the raw samples

To make a SoundFont, you will need a sample. More likely than not, you will actually need more than one sample. So let's assume you will make one synth instrument and a percussion kit with four drums in it. To get started, you will need to load the four needed samples into the Vienna SF Studio. The file format of the samples must be Microsoft's .WAV format, Window's standard sound file format. .WAV files can be created using Sample Editors (such as Sound Forge, WaveLab or Wave Studio), dumped from sample CDs, or even downloaded from the Internet. The process of creating .WAV files will not be covered in this article. (If you encounter any problems, refer to your Sound Blaster manual.)

To get started, download the four samples needed for the examples here (ignore this if you have already downloaded these files at the Introduction page).

- SawPad.wav (125KB)
- Snare.wav (21.7KB)
- Kick.wav (16.6KB)
- Hihat.wav (24.2KB)

**The SoundFont Tree View:**
The .WAV files are first imported into Vienna SF Studio. The SoundFont Tree Window in Vienna SF Studio 2.1 looks like this:




All samples imported into Vienna SF Studio are located in the "User Sample Pool" folder in the SoundFont Tree Window. If you right-click this folder, you will get a context-sensitive menu with the options (see above).


To import your samples, click the "Import User Sample(s)" button. From here, you'll be able to navigate your drives and select the .WAV files you want to import:

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Find the four samples you downloaded from this page, mark them, and click "Import". You have now imported your .WAV files into Vienna SF Studio and should see the samples in the tree list.

**Introduction** | **The art of sample looping**

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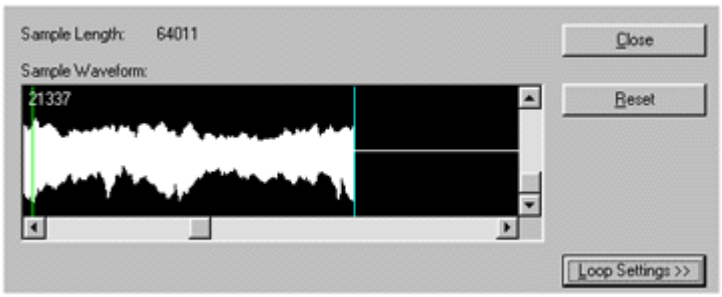
## Global Sample Looping: The art of sample looping

To perfectly make a looped sample I would recommend you use an advanced sample editor such as Sound Forge, or something similar that has a cross-fading function. Vienna will successfully import the loop-points saved with the .WAV file created by such programs.

Vienna SF Studio will also let you loop a sample but you will not be able to change the raw sample data which can only be done through a cross-fade operation. Vienna will only allow you to set the End/Start loop markers in the raw sample data which makes looping a little difficult (but it can be done anyway).

In general, looping is about making a portion of the raw sample data repeat itself again and again, resulting in a sustained sound that goes on and on.

If you enter the looping screen, you will see the following (enter the looping screen by left double-clicking the relevant sample in the Sample Pool):




The green marker is the "Global Loop-Start" marker while the cyan is the "Global Loop-End" marker.

The sample data in between these two markers is the sample data that will be repeated over and over again. The green and cyan loop markers themselves can be dragged by the mouse for coarse loop marking, while fine-tuning of the markers can be done from the extra screen accessible from "Loop Settings" (explained below). The reason the loop markers are called "Global" loop markers is explained in the section on Local Sample Looping.

Normally, the coarse view of the sample is not good enough to make a good looping. You will need to be able to see a representation of every single sampled "dot" in the sample data to make the loop perfect. To zoom in on the sample data, you can use the sliders beneath/ beside the sample data view. It would of course be best if we could actually see the "splicing" point of the End/Start loop markers. To do this, click "Loop Settings". This will open up an additional area below the sample display. The extra space will show the "splicing" point of the loop markers and also every sample as needed (1:1 view). The loop markers can be changed in actual single samples here which is essential in making a good loop. It is important that the two markers are located on two samples ("dots") that are very close to each other in value or you will hear an audible "click" as the loop repeats itself. Also, the sampled material has to be very similar in sound at the loop markers Start and End positions or the loops will not sound

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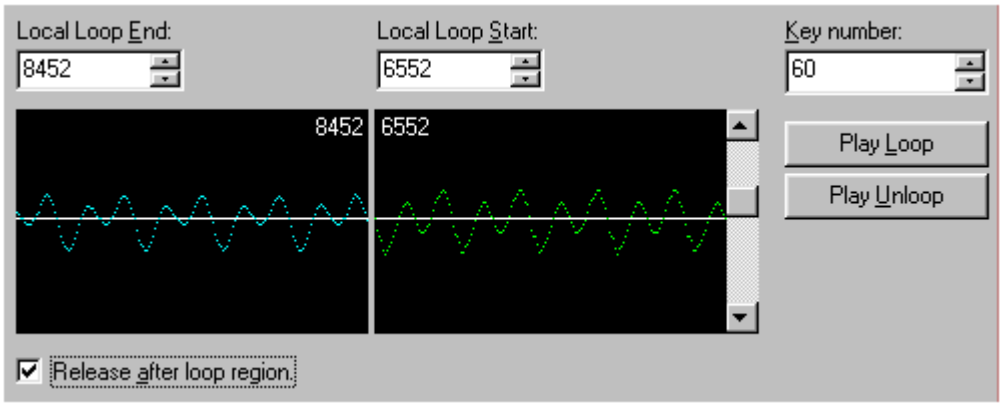
smooth. Here is how the extra space looks:




Try to change the SawPad sample's loop points and hear what happens. The SawPad sample was looped in Sound Forge using the CrossFade option which makes the loop extremely smooth (more or less perfect, actually). Don't count on your loops to be as good as the SawPad loop unless you are very lucky. The skill at making a good loop is an art in itself and requires keen analysis and experience (along with the proper tools, of course). After you have experimented with the loop markers, click "Reset" to set the markers back to their initial positions.

Remember that if you make your loops with a full featured sample editor (such as Sound Forge), you do not need to worry about looping in Vienna SF Studio 2.1. The only thing you have to do is enable the looping. Information on enabling the loop is found in the chapter on Local Sample Looping.

**Importing the raw samples** | **How to create an instrument**

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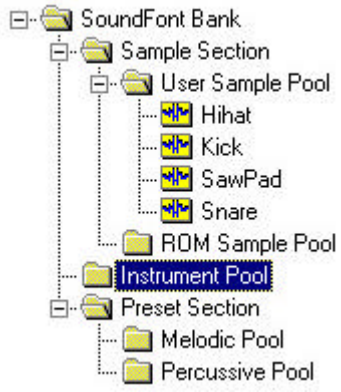
## Instruments: How to create an instrument

Once you have imported the samples you need and set their global looping (if necessary), you can now create the instrument. Let's begin with the synth sample named "SawPad", one of those you've just imported. To make an instrument of the sample, consult the SoundFont Tree window again:




The instruments are all accessed through the "Instrument Pool" folder in the SoundFont Tree View. If you right-click this folder, you will get another context-sensitive menu with the option to select "New Instrument":


Click "New Instrument" and a new screen will pop up to prompt you for the name of the instrument you are creating. For the example, type in the name "SawPad - Dry" and click "OK":


This will bring you to the actual screen that lets you choose which of the previously imported samples you would like to use in the instrument. All the samples that you have imported earlier will be shown here. You can mark several samples if you want the instrument to use more than one sample (as with a drum-kit for example), or you can mark just one sample if this is enough (as with most instruments).

The screen looks like this:

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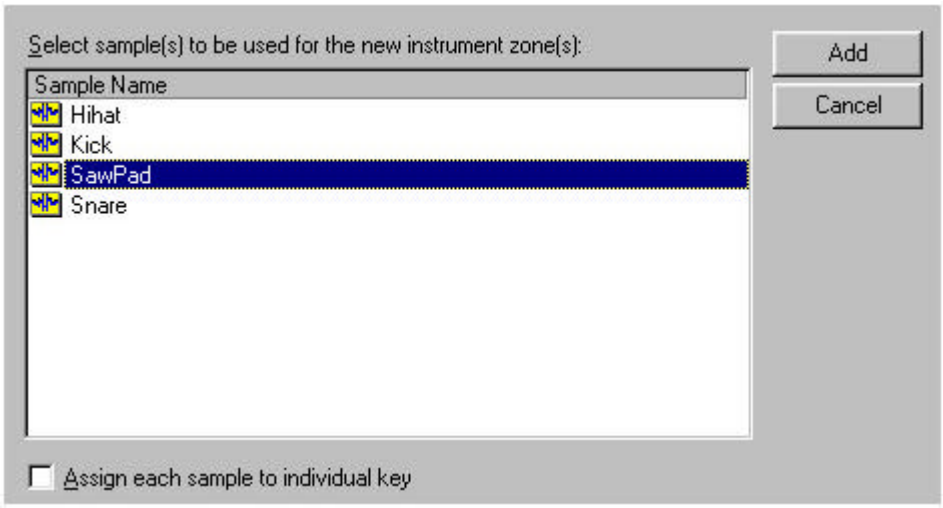
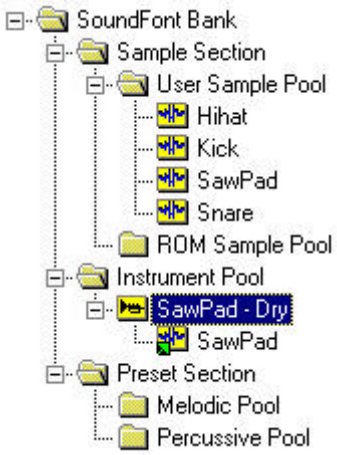



If you are making a drum-kit, you should check the "Assign each sample to individual key" box. This is a very useful feature - it opens up yet another screen that prompts you for the keyboard Key-Number of every drum sample you are adding. The Key-number can be seen at the lower-right corner of Vienna when you move the mouse pointer across the graphical keyboard of Vienna.

When you have selected the samples you want to use (in this case, only the SawPad sample), click "Add" to create the instrument. After clicking "Add", you should see the newly-created instrument in the SoundFont Tree View along with all the samples you've included in the instrument directly beneath it. Such a sample is now called an "Instrument Zone".

You should be able to play the instrument by hitting a key on your keyboard. The sound will be that of the raw unmodified "SawPad.wav" file you imported.

The SoundFont Tree View should look like this now:




If you right-click this newly created instrument (the one with the trumpet icon), you will be given the option to add additional samples to this instrument just as when you created the instrument in the beginning.

You can also add something called a "Global Zone" this way. Any parameter set in a Global Zone will be the global setting for all the samples (Instrument Zone) within the instrument. This way you could set a given parameter of all Instrument Zones by simply changing the Global Zone's parameter. Just remember that if you change the same parameter in an Instrument Zone, this will have first priority and thus cancel the Global Zone's setting (for that particular Instrument Zone only, of course).

The art of sample looping | Local loop enabling & marking

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## Local Sample Looping: Local loop enabling / marking

As explained earlier, Global looping was something you did on the samples in the Sample Pool. Local looping is instead done on the individual Instrument Zones of an Instrument. You enter the Local Loop screen by left double-clicking the Instrument Zone you wish to change Local looping for. The changing of the Local loop markers is the same as with the Global Loop markers exept that they are specific for that single Instrument Zone. Other Instrument Zones may have other Local loop points even though they use the same sample. The only thing that all Instrument Zones have in common regarding the looping is that their Local Loop markers is set to the same as the used sample's Global Loop points. This will save you from having to set up the same loop marker positions each time you create an Instrument Zone that uses the same sample.

The only difference in the layout of the Global/Local looping screens is that the Local Looping screen has two additional check boxes:


and


The first check box lets you enable looping on the sample used by the Instrument Zone you are editing. The second check box lets you enable the "Release after loop region" feature which will play the sample data beyond the Loop-End marker when the key is released on the keyboard. This feature is not often used but there will come a time when you will need to use it. Remember that the later function is not available unless you have enabled the looping for the sample in the first place.

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As you may have noticed, the instrument you created in the previous chapter (the "SawPad" synth) is abruptly stopped as it reaches the end of the raw sample data. It would be nice if the sample was in fact looped. Try and make the "SawPad" Instrument Zone loop the sample it uses. It should be possible for you to do this with the information from this chapter. The loop points have already been saved with the .WAV file so you should not need to set the Global loop markers yourself.

**How to create an instrument** | **Arranging Instrument Zones**

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# The Art of SoundFont: A Step-by-Step Guide

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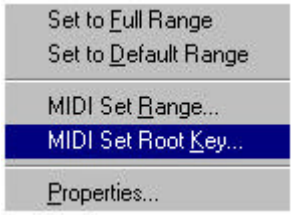
- Keyboard and Velocity Range:
  Arranging Instrument Zones on the keyboard

## The Keyboard Range

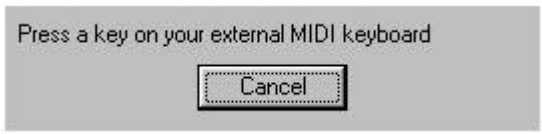
Highlighting the "SawPad" Instrument Zone in the Soundfont Tree View allows us to change its Keyboard and Velocity ranges. This can be done by dragging the low and high end of the Range markers located directly beneath the keyboard layout of Vienna SF Studio:

Note the three arrows on top of the keyboard view. The two white arrows show the location of the low and high Key-Range while the red one shows the "Root-Key" of the current Instrument Zone.

The Root-Key is the key at which the sample plays as originally sampled. The Root-Key needs to be the same as the sampled sound or the instrument will not play in tune with other instruments (that is, when you press the "C" on the keyboard the instrument should of course play a "C" too). This means that if the raw sample you recorded is in fact a musical "D" and not a "C" as the red Root-Key arrow indicates above, then the sample's root-key is wrong. To change the root-key, just right-click on the key-range marker (the one highlighted in the illustration above) and a context-sensitive menu will appear with the following options:




Select "MIDI Set Root Key" and the following screen will appear:




Now play the proper Root-Key on your external keyboard. You will see the red arrow move accordingly to the location in the Keyboard View. You can also use this feature to set the Start and End Key-Range, just choose the "MIDI Set Range" button instead. If you do not have an external keyboard to do this, change the root key using the "Properties..." button instead.

If your sample is still slightly out of tune after setting the Root-Key (the Root-Key is set in half-tone intervals) you can fine tune the Instrument Zone in the "Generator Parameters" view, but this I'll tell

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you about in a later chapter.

## The Velocity Range

Vienna SF Studio 2.1 also allows you to change the "Velocity Range" of an Instrument Zone. Velocity is a measurement of how hard you play an external MIDI keyboard. If you play softly, the keyboard sends low velocity values to your computer and if you play hard, it sends high velocity values.

Setting the Velocity Range of an Instrument Zone will allow you to make it play only if the velocity values are in between two set values. Velocity is sent in values of between 0 and 127, with 0 being the softest and 127 the hardest. If you want the Instrument Zone only to play when pressing hard you could set the Velocity Low Range marker to 64 and the Velocity High Range marker to 127. This will do the trick.

If you want to change the Velocity Range, you should switch the Keyboard View to the Velocity View by clicking the following button on the toolbar (to switch back to the Keyboard View again, click the button directly to the left of the Velocity View button):

You should now see the Velocity View instead of the Keyboard View:

Changing the Velocity Range is done in the same fashion as the Keyboard Range. Drag the Range Marker's ends to adjust the Velocity range of an Instrument Zone. The blue region shows the low Velocity values while the black region shows the high Velocity values.

How do you make use of this feature? For example, if you have an acoustic drum sampled at, let's say, four different hits: low, middle, hard and very hard. You will be able to assign the four samples to their own Velocity Range thus simulating the effect of the real instrument better. Just remember that the Keyboard Ranges of the four instruments must be set to the same range or they will not play on the same pressed key.

### Examples:

Now try and experiment a bit; Add a few Instrument Zones, remove them again and try to change the Key-Ranges, Velocity-Ranges and Root-Keys. Also try to make a drum-kit instrument with the three other samples you imported: "Kick", "Snare" and "Hihat". Every drum should be assigned to its own key on the keyboard.

After creating the drum-kit instrument, add one more sample to it (the "Hihat" sample again). When a sample has been imported into the sample pool, it is available to all instruments. In other words, the samples can be used more than once which saves a lot of memory.

*Note: the example "Sawpad.wav" sample was sampled at key "C" and a finished example of the "SawPad - Dry" instrument can be found in the "example.sf2" file you downloaded earlier for your comparison.*

**Local loop enabling & marking** | **Volume, Filter & Pitch Envelopes**

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- The Generator Panel Part I: Volume, Filter and Pitch Envelopes

Exactly what is an "Envelope Generator"? Shortly termed, it is a curve that tells how a sound is modulated over time, that is, how a sound dynamically changes over time.

## The Volume Envelope

The first Envelope we are to look at is the "Volume Envelope Generator". This envelope can change the volume of a sound as it plays. The parameters for this envelope generator is found at the bottom of Vienna's screen and looks like this (remember to highlight that particular Instrument Zone in the SoundFont Tree View that you wish to change the Volume Envelope for):

| Volume Envelope | Value | Unit |
|---|---|---|
| Delay | 0.001 | sec |
| Attack | 0.001 | sec |
| Hold | 0.001 | sec |
| Decay | 0.001 | sec |
| Sustain | 96 | dB |
| Release | 0.001 | sec |
| Initial Attenuation | 0 | dB |
| Keynum To Hold | 1 | X |
| Keynum To Decay | 1 | X |

When a sound is first initiated (by hitting a key on your keyboard), the volume always starts at "no sound" or zero, and it also ends at that value. The Volume Envelope then tells us how the volume will change over time from start to the end.

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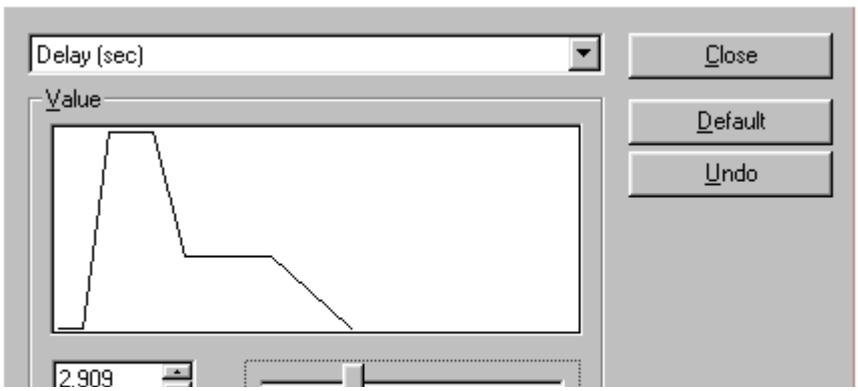
When you edit the values of the Envelope generators you will see a graphical representation of the "curve". It looks like this (it shows the curve as a "whole" including all the envelope parameters):




Notice the different envelope phases; Delay, Attack, Hold, Decay, Sustain and finally the Release phase. Here is an explanation of each parameter and phase in the Volume Envelope:

**Delay**
Before any change in volume starts, there is a delay; that is, no sound will be audible before the delay is finished (since the beginning volume is always zero). This delay can be set with the "Delay" parameter.

**Attack**
When the Delay is through, the volume starts to rise to its maximum and does so at a speed equal to the "Attack" parameter. The smaller the value, the faster the volume reaches its maximum. This is called the "Attack phase". Remember that when the attack parameter is set to anything higher or equal to 0.007, the filter cut-off frequency (to be explained later) will be strangely altered to "soften" the sound when you press a key gently. It can be used for some nice effects though.

**Hold**
When the maximum volume has been reached through the Attack phase, the volume can be held there for a given period of time equal to the setting of the "Hold" parameter.

**Sustain + Decay**
When the "Hold" period is through, the volume will fade down until it reaches the value specified by the "Sustain" parameter. The speed at which it reaches the Sustain level is determined by the "Decay" parameter. When the volume reaches the value of the Sustain value at the end of the Decay phase, it will remain there for as long as you hold the key down. When you release the key, it will proceed to the "Release Phase".

**Release**
When the key is released on the keyboard, the "Release" phase sets in. The Release Phase will take the volume from its current value (depends on when you release the key) to zero volume. This Release phase happens at a speed equal to the Release parameter.

It is important to note that the Release phase will take its starting volume level from the volume's current value the moment you release the key (which is when the Release phase will begin). This means that other Envelope parameters may be skipped (for example, if you release the key before the Attack phase has ended, you would skip both the Hold, Decay and Sustain parameters; the release phase is always started when the key is released).

**Initial Attenuation**
Initial Attenuation is a parameter that acts as the reverse of a volume knob. The higher the value, the lower the volume. If the parameter is turned all the way up, there will be no sound at all. Use this parameter to set the overall volume of the Instrument Zone you are editing.

**Key Number To Hold/ Decay**
This parameter has a specialized use. It allows you to change the value of the Hold and Decay parameter from above according to the key pressed. If you play a key above or below the key #60 (the one marked with a dot in the Keyboard View), the Hold/Decay parameters will gradually change from their initial values. If the Hold/Decay Key-num value is greater than 1, the value of the Hold/Decay parameters will fall if a key is pressed above key #60, and it will rise if a key below key #60 is pressed.

If the Hold/Decay Key-num. value is less than 1, the effect is of course reversed. A value of 1 is equal to no change of the Hold/Decay parameters (which is the default).

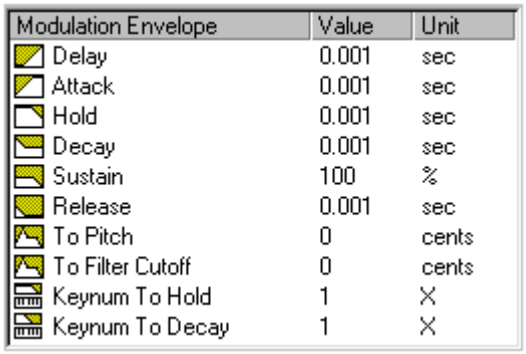
This effect can be used for many purposes - an example would be a piano. A piano-string in the high-end of a piano is physically shorter and will thus fade more quickly than a low-end piano-string. This effect can be simulated using this parameter.

The higher the values in these "Keynum" parameters, the more drastic the change will be. Experiment with them as it takes some time to get used to them.

## The Modulation Envelope
(for Filter and Pitch Envelopes)

It is also possible to change the Dynamic Filter and the Pitch of the sound being played in real-time. The way to do this is similar to the Volume Envelope. The Delay, Attack, Hold, Decay, Sustain and Release phases are exactly the same as with the Volume Envelope. You just need to know what a dynamic filter and pitch actually are in order to understand their uses. Remember that when filter enveloping is used, you cannot at the same time use pitch enveloping. The filter will somehow cancel out the pitch.

Here is the layout of the Modulation Envelope Generator:



| Modulation Envelope | Value | Unit |
|---|---|---|
| Delay | 0.001 | sec |
| Attack | 0.001 | sec |
| Hold | 0.001 | sec |
| Decay | 0.001 | sec |
| Sustain | 100 | % |
| Release | 0.001 | sec |
| To Pitch | 0 | cents |
| To Filter Cutoff | 0 | cents |
| Keynum To Hold | 1 | X |
| Keynum To Decay | 1 | X |

### The Dynamic Low-pass Filter (To Filter Cutoff)
A "Filter" is a piece of hardware that "filters" unwanted frequencies away. In short; frequencies that the human ear can hear is from about 5 to 20.000 KHz. Low frequencies is usually the deep sounds while high frequencies are the high ones. Thus a hi-hat has much high frequency material and a bass very little. The type of filter in the AWE is called a "Low-Pass" filter. It will let all frequencies below the "Cut-off Frequency" (selectable in the "Effects" Parameter section) pass through while higher frequencies will be removed. The best way for you to learn what the effect really sounds like is for you to hear it yourself.

The lower the value of the "To Filter Cut-off" parameter, the "duller" the sound will get during the Envelope phases. If the "To Filter Cut-off" value is a positive value it will get "Brighter" during the Envelope phases (but this requires that you lower the "Cut-off" parameter value in the "Effects" Parameter section as it is by default set to it's maximum of 8000 Hz, try 4000 Hz instead (the value can't exeed 8000 Hz).

Experiment a bit with the filter envelope. The filter envelope can be used to create nice bass-sounds of virtually any sample. It is also useful in combination with the "Filter Q" parameter from the "Effects" parameter section (described later) for making cool "Rubber" like sweeps for Dance and Techno music.

### Dynamic Pitch Bending (To Pitch)
The pitch of the playing sound can also be changed dynamically as you play. The pitch will start off at the normal pitch +/- the value in the "To-Pitch" parameter. The value is measured in cents. 1 cent is exactly one 100th of a half-note. Thus if you wanted the pitch to start out, lets say, an octave lower than normal you would write -1200 cents (there are 12 half-notes to an octave). When the sound sets in, the Envelope Generator will change the pitch according to the Envelope parameters. This is quite useful for sound effects and certain instruments like for example a violin. A violin always plays a bit out of tune when the bow hits the string. The pitch bending scheme here can easily make that emulation by making a fast "slide" from the "out of tune" pitch to the "normal" pitch. Experiment a little with it.

### Examples:
As a test to see if you've got the idea of the Envelope generators, try and change the "extra" drum Instrument Zone you incorporated in the drum kit earlier. The drum-kit is lacking a closed

drum instrument zone you incorporated in the drum kit earlier? The drum kit is lacking a closed hi-hat. This one could be created using the Volume Envelope on the extra copy of the open hi-hat.

You can check the effects of the Envelope Generators on the following examples found in the SF2 file. The relevant instruments are:

- SawPad - ENV.Volume
- SawPad - ENV.Filter
- SawPad - ENV.Pitch.

**Arranging Instrument Zones** | **Tremolo, Vibrato and WahWah LFOs**

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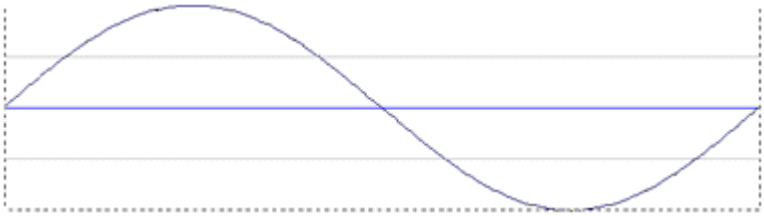
# The Art of SoundFont: A Step-by-Step Guide

By Jess Skov-Nielsen

## The Generator Panel Part II: Tremolo, Vibrato and WahWah LFOs

Now what is an LFO? An LFO stands for "Low Frequency Oscillator" and as in the case of the Sound Blaster AWE cards, a sine curve that changes very slowly over time (thus the word: Low fr..). A sine curve looks like this:



When you hit a key on the keyboard, the LFO starts to oscillate up and down according to the sine curve above. It starts out at zero, then goes positive, down to zero again, then negative and back to zero. This procedure goes on and on.

This "Oscillating" can then be applied to the Filter, Pitch and Volume of an Instrument Zone. If the oscillating is applied to the Volume, you will get a Tremolo effect. If applied to Pitch, you get a Vibrato effect and lastly, if applied to the Filter, you get a WahWah effect.

The speed at which the oscillator swings up and down can be set by the LFO parameters and so can the level at which it oscillates (the "height" of the sine curve). To help you better understand each parameter, here is a thorough explanation and a view of them:

| Modulation LFO | Value | Unit |
|---|---|---|
| Delay | 0.001 | sec |
| Frequency | 8.176 | Hz |
| To Pitch | 0 | cents |
| To Filter Cutoff | 0 | cents |
| To Volume | 0 | dB |

| Vibrato LFO | Value | Unit |
|---|---|---|
| Delay | 0.001 | sec |
| Frequency | 8.176 | Hz |
| To Pitch | 0 | cents |

As you can see, there are two LFOs available within the Sound Blaster AWE card. The Vibrato LFO (the lower one in the illustration above) is intended only for manipulating the pitch (Vibrato). The top one is meant for manipulating pitch, filter and volume. It is important to know that each of the three parameters assigned to the Modulation LFO will oscillate at the same speed (frequency). The three parameters can have their own "Level" or "Height" though.

**Delay**
This is like with the Envelope Generators. You set an initial delay before the oscillator will begin

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modulating anything.

**Frequency**
The frequency or speed at which the LFO will oscillate. Frequency is measured in Hz which lets you decide how many times the sine curve will repeat itself within one second. This means that a frequency of 1 Hz will oscillate through the sine curve in one second. A frequency of 2 Hz will oscillate through the sine curve two times a second while a frequency of 44.000 Hz will oscillate through the sine curve 44.000 times per second! Just remember that it is a Low Frequency Oscillator. The frequency setting cannot exceed more than 10 Hz (which is a fair amount anyway).

**To Pitch:**
Here you set the level of the Oscillating Pitch (Vibrato). The level measures how "wild" the vibrato will be. Normally a setting of 10 to 30 is adequate for a nice instrument vibrato; higher settings will be too wild and is intended only for wild sound effects. The parameter is measured in cents like in the Pitch Envelope. Thus, you can calculate the "swing" of the pitch in half-notes by multiplying by 100. For example, if you want the pitch to swing an octave up and down, key in "1200" in the parameter (an octave is 12 keys or half-notes long).

If the parameter is set to a negative value, the sine curve is reversed. This means that the curve does not start positive but negative instead. You may think that this does not matter but it *does* in some cases (just try and change the "To Pitch" level value in the example SF2's instrument: "SawPad - TRK.Arpeggio" and hear what I mean).

**To Filter Cutoff:**
This parameter sets the level of filter modulation as with the pitch. The higher the value, the more WahWah effect is produced. Negative values again reverse the sine curve.

**To Volume:**
This parameter is identical in function to the "To Pitch" and "To Filter Cut-off" parameters except that it changes the modulation depth of the volume instead, creating a Tremolo effect.

**Examples:**
If you want to, you can listen to the examples in the SF2 file which demonstrate the use of the LFO parameters. The relevant instruments are:

- SawPad - LFO.Pitch
- SawPad - LFO.Filter
- SawPad - LFO.Volume

Try to make some wild sound effects using these LFO parameters in combination. Some rather strange results are possible actually.

**Volume, Filter & Pitch Envelopes** | **Adding effects and tuning to an Instrument Zone**

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# The Art of SoundFont: A Step-by-Step Guide

By Jess Skov-Nielsen

## The Generator Panel Part III: Adding effects and tuning to an Instrument Zone

The "Effects" and "Pitch" parameters in the Generator Parameter section let you add Tuning, Chorus, Reverb, Cut-off Filter etc. to the Instrument Zone you are editing. The effects will be applied to the sound as it plays, allowing for rich and beautiful sound textures. The "Effects" and "Pitch" parameters look like this:

| Pitch | Value | Unit |
|---|---|---|
| Coarse Tune | 0 | semitone: |
| Fine Tune | 0 | cents |
| Scale Tune | 100 | cents |

| Effects | Value | Unit |
|---|---|---|
| Filter Q | 0 | dB |
| Filter Cutoff | 8000 | Hz |
| Reverb | 0 | % |
| Chorus | 0 | % |
| Pan | 0 | % |

### The Pitch Parameters:

*Coarse Tune, Fine Tune and Scale Tune*

The "Pitch" Parameters let you fine-tune the Instrument Zone. The "Coarse Tune" parameter tunes in half-notes, the "Fine Tune" in Cents (which is a 100th of a half-note) and the "Scale Tune" lets you decide how many cents a half-note actually is (100 by default).

### The Effects Parameters:

*FilterQ, Filter Cutoff, Reverb, Chorus and Pan*

The "Effects" parameters consist of five parameters that enable you to add dynamic effects to the sound. The five parameters are explained in depth here:


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### Filter Q:

The chosen frequency Cut-off point in the "Filter Cut-off" parameter (see below) can be enhanced with the "Filter Q" parameter. If, for example, the frequency Cut-off point is at 4000 Hz, then any frequencies in the sound at 4000 Hz will be enhanced (amplified) by the "Filter Q" parameter.

The "Filter Q" parameter can lead to interesting sounds if you dynamically change (real-time) the Filter Cut-off Frequency as the sound is playing (many Techno instruments use this feature to great extent). This feat can be done by using either a Filter Envelope or a Filter LFO modulation, or even better, by changing MIDI controllers in your sequencer real-time.

### Filter Cut-off:

This parameter lets you set a frequency point at which every frequency higher than this point will be removed. For example, if this parameter is set to 4000 Hz, then any frequencies in the playing sound that is higher than 4000 Hz will be removed. The lower the value, the duller the sound gets. In combination with the Filter Q parameter that enhances frequencies around the

Filter Cut-off point, interesting sounds can be made. This type of filter is called a "Low-pass Filter" in technical terms. It lets the low frequencies pass and remove the high ones.

**Reverb:**
The Sound Blaster AWE cards incorporate a hardware effects engine that allows you to add Reverb and Chorus effects directly to your sounds. The Reverb simulates room reflections in Halls, Rooms, etc. The Reverb type is set in the AWE Control Panel but the amount of this chosen reverb is selectable for each Instrument Zone in Vienna SF Studio 2.1. The "Reverb" parameter is the one you use to set the Reverb Depth of the Instrument Zone you are editing. A mono sample will also become a "stereo" sample when Reverb is applied to the sound.

**Chorus:**
As with the "Reverb" parameter, the "Chorus" parameter is set in the same fashion. Chorus is an effect that simulates more voices playing together. Chorus add "richness" and "warmth" to a sound. It also makes a "stereo" sound of a mono sample. Change the parameter and listen for yourself.

**Pan:**
The "Pan" parameter lets you place the Instrument Zone in the stereo perspective. A negative value places the sound more to the left while positive values will place the sound to the right. It does not matter if the sound is a mono sound; the sound will be placed in the stereo perspective anyway.

**Examples:**
If you want to check out some examples of these "Effects" parameters, then load the example SF2 bank and test these instruments:

- SawPad - FX.FilterQ
- SawPad - FX.Cutoff
- SawPad - FX.Reverb
- SawPad - FX.Chorus
- SawPad - FX.Pan

Try changing the Effects parameters yourself and see what happens.

**Tremolo, Vibrato & WahWah LFOs** | **Making the final Preset**

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# The Art of SoundFont: A Step-by-Step Guide

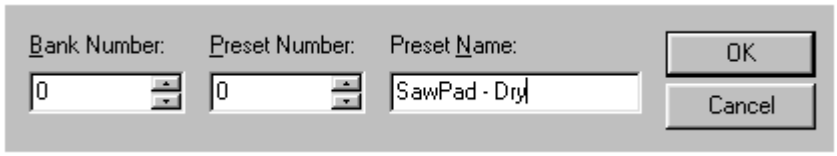
By Jess Skov-Nielsen

## Making The Final Preset: Combining instruments into the final Preset

Having created the Instrument, the final step now is to make a "Preset". Like instruments are made up of samples (all the samples in an Instrument make up an Instrument Zone), a Preset is made up of Instruments (all the instruments in a Preset make up a Preset Zone).

If you right-click the "Melodic Pool" folder in the SoundFont Tree View, you get a context-sensitive menu which allows you to select a New Melodic Preset:


Select "New Melodic Preset" and a new screen appears:




Here you can key in the name of the Preset along with its Bank and Preset number. The Bank/Preset number can be anything between 0 and 127.

The standard MIDI language does not allow for more than 128 different instruments so when more are needed, you usually apply a "Bank Change" message through MIDI to a synthesizer. This lets the synthesizer choose another "Bank" of 128 instruments thus allowing 128 Banks or 128 Presets of different instruments, or 16,384 different Presets in the case of the Sound Blaster AWE.

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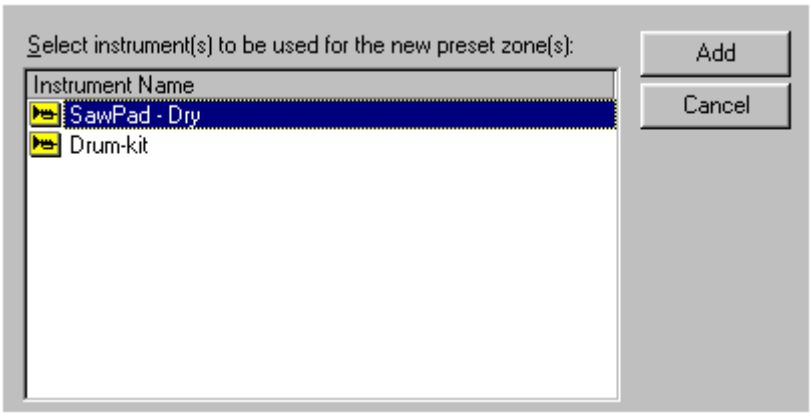
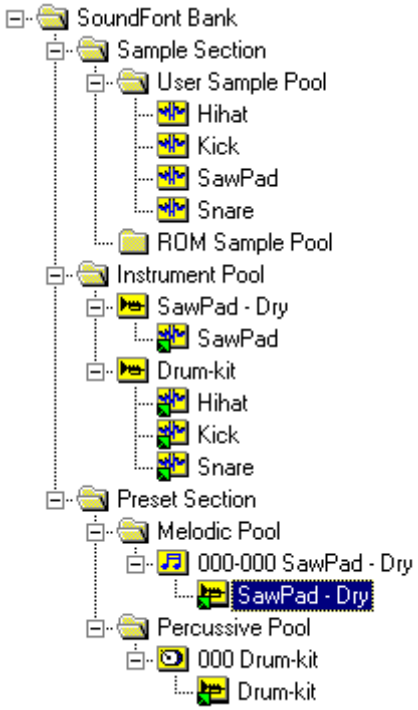
When Vienna opens the above dialog box, it always does a search for empty space in the Bank and Preset positions (that is, a space not already occupied by another Preset). It then writes this location as the default Bank/Preset number saving you from doing the search yourself (unless you want a specific Bank/Preset number for the Preset you are creating). Type in the name of the preset "SawPad - Dry" in the name field and click "OK".

Now you get a screen that allows you to choose what instruments to use in the Preset you are creating:




When you have chosen the "SawPad - Dry" Instrument, click "Add" to create the Preset. You now have the almost- finished Preset in the SoundFont Tree View, with all the used Instruments directly beneath it (this is called a "Preset Zone"):




More Preset Zones can be added just like with the Instrument Zones - just right-click the Preset's name (the one with the musical note icon) and choose "New Zone". It works just like with the Instrument Zones explained earlier. You can also add a Global Zone if you want to.

Now that you have placed the Sawpad Preset, you only need to place the Drum-kit. The Drum-kit you created should not be put in the "Melodic Pool" folder but rather in the "Percussive Pool" folder instead. It is done in exactly the same way as with the "Melodic Pool" except that you do not choose a Bank number. You only select a Preset number (Vienna finds an empty preset for you). This gives you 128 possible drum-kits in one SoundFont file which should be more than enough.

You can save your finished SoundFont file now - it's done! If you want to know how to set it up for use in your sequencer, go on to the next chapter.

**Examples:**
Check out the Presets in the example.sf2 file.

Adding effects & tuning to an Instrument Zone | Using the SoundFont File

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# The Art of SoundFont: A Step-by-Step Guide

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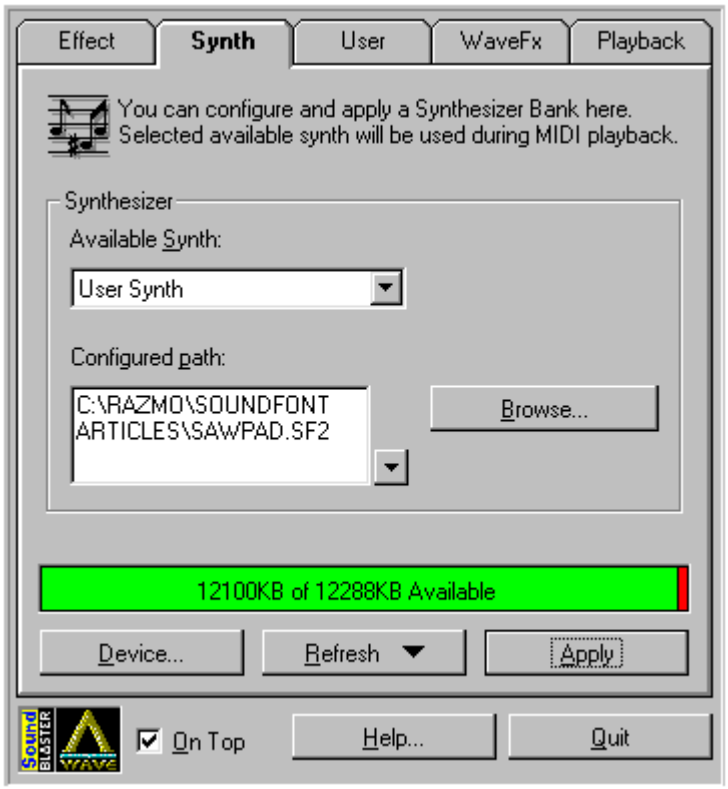
## Using The SF2: How to use your SoundFont in your sequencer

Now that you have mastered the creation of a SoundFont file, all you have to do now is to learn how to use it with your sequencer. There are many different sequencers in the market today; to go through all of them would be a daring task. Instead, I will show you how to set up your sequencer for SoundFont use.

Firstly, load the SoundFont file into the sound card's sample memory. This is done through the Control Panel supplied with your Sound Blaster AWE sound card:




Under the "Synth" panel, select "User Synth". Click "Browse", locate the SoundFont File you've created and select it.

Next, click "Apply". This will load the SoundFont file into the sound memory of the sound card. After you've done this, launch your sequencing software and start playing with your new SoundFont.

### Choosing the right Bank number in your sequencer

Most professional sequencers have a "Bank" field on every track so that you may specify the bank that you want to use with this track. In this "Bank" field, type in "0" - this was the bank number used when we were designing the Presets. If you had used another Bank number, type in that number.

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### Choosing the right Preset number in your sequencer

Choosing the right Preset is normally done in an "Instrument" or "Patch" field located on every track in a sequencer. Choose the number of instruments you want to use.

### If your sequencer does not have a field for "Bank", what do you do?

In this case, you will have to make a "Bank Change" manually. A "Bank Change" command is normally done through sending a "MIDI Controller" command to the Sound Blaster AWE sound card. This is how you should do it:

If your sequencer supports it (most sequencers do), you will enter a screen that allows you to manually edit the MIDI Controller values. (You will have to locate this feature yourself as it differs from sequencer to sequencer.) Once you're in the MIDI Controller edit screen, insert at the beginning of all the MIDI data of the chosen track, a value of either "0" or "32". These two numbers are the ones that the Sound Blaster AWE sound card understands as a "Bank Change" command. Immediately after the first number, enter the actual number of the bank you wish to use within the track. With this done, you are now able to use your new SoundFont. Just remember to click "Play" once for the sequencer to send the Bank Change command to the Sound Blaster AWE sound card. After you've done that, you will be able to hear the instruments as you play them on the keyboard.

### My sequencer has a "Bank" field but makes no bank change anyway - what's wrong?

If this happens, it is probably because the sequencer is configured incorrectly. There are many ways to make a bank change these days. Different synthesizers function differently.

Solution to this problem: Find the preferences of your sequencer and see if it allows you to change the way the sequencer sends a bank change. If you find this preference, make sure it uses either the MIDI Controller "0" or MIDI Controller "32". Cakewalk, for example, has to be configured this way if you want to be able to use the right Bank Change command.

### Final Note

If you have chosen your presets to be located in Bank number "0" when you made them in Vienna SF Studio, you normally will not need to make a Bank Change command since bank "0" is the default bank used by the Sound Blaster AWE sound card on power-up. Only if you use Presets with another bank number other than "0" will you need to make a Bank Change command. Just remember that if anyone else is to play your MIDI file and you have not set the MIDI file to initiate to bank "0", the MIDI file may be played incorrectly (if the Bank Change command in the other computer has been meddled with earlier and another bank other than number "0" may have been initiated).

Hence, REMEMBER to initialize the correct bank at the beginning of your MIDI track even if you're using only bank "0". You cannot assume that bank "0" is the one initialized for all MIDI channels except on your own computer. Just a reminder! In fact, many other MIDI controllers should be initialized at the beginning of a track to be certain it will play correctly on another system.

◀Making the final Preset | Conclusion▶

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# The Art of SoundFont: A Step-by-Step Guide

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## Conclusion

Well, is this it? Is this all there is to learn about Sound Designing?

No. Definitely not. There is still a lot to learn about Sound Designing. Not all aspects of Vienna SF Studio have been covered in this article. Explore the program further and you'll find that there's a lot more to learn. There are many clever ways of using Vienna which can lead to interesting sounds and effects.

As a bonus, I've included a few examples of some interesting effects I made. Download the example.sf2 file (if you have not already done so) and look for those labeled with a "TRK" in their preset names. Check them out and see if you can figure out how they were made.

Another hint for you: Get yourself a decent Sample Editor like Sound Forge, Cool Edit, Wavelab or something similar. One of these editors, when used with Vienna SF Studio, can sometimes create miracles. To make a good SoundFont, setting the right parameters on your Vienna SF Studio is important, but the quality of the actual raw sampled material is also equally important. Practice hard and you will be amazed at what you can do with a combination of such programs.

Are you still a little confused about how to use the Vienna SF Studio? Is the SoundFont Tree View a bit too complex to understand? Here is a short review of the structure:

- With Samples, you make an Instrument. All the Samples in an Instrument make up an "Instrument Zone".
- With Instruments, you make Presets/Drum-kits. All the Instruments in a Preset/Drum-kit make up a "Preset Zone".

I hope you enjoyed the little ride into the world of Sound Designing. After this exercise, you'll realize that creating your own SoundFont file isn't so difficult after all!

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