ubuntu studio

Audio Handbook

Peter Reppert

Preface

Peter Reppert was kind enough to donate his time and work on an audio handbook targeting musicians for Ubuntu Studio. After contacting the team, he decided to open the book to being a living document on this wiki with constant updates.
The Ubuntu Studio team would like to thank Peter for his selfless contribution to Ubuntu Studio and for providing a guide for newcomers and experts alike.
Please bear in mind that much of this handbook was written in the first-person perspective as this is Peter's personal work. Also, there are some places in this handbook that, due to inavailability of certain software, are not supported. Those items are highlighted with black text on a yellow background.

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About this book

Who this book is for

Maybe you are new to digital recording. Maybe you are curious about Linux. Maybe you have been using a Digital Audio Workstation, but are interested in getting away from the Microsoft/Apple duopoly or just want to try a new DAW. Maybe you have already been using Ubuntu Studio, but would like to explore more of it's features or could use a trusty handbook as a quick reference. This guide to home digital recording and music production with Ubuntu Studio is for the amateur or semi-professional (professionals welcome, too!) musician.

No knowledge of Ubuntu is required - this book in not an Ubuntu manual, but will cover the basics of the operating system needed to use the music software, including installation and command line operations. If you have used a PC or Mac, you already know just about everything you need to know and will be in very familiar territory.

Why use this book?

1. *For a complete overview* of native and many non-native instrument and effect plugins, multitrack recording software, touching on synthesizer programming and review how to share your recordings online while stating your intentions for use via Creative Commons.
2. *Learn advanced techniques* like synthesizer programming, creating soundfonts, turning your guitar into a MIDI controller, track automation, basic mastering, and more.
3. *Save time* - no need to wade through online forums or watch slow-paced YouTube video tutorials – go straight to the information you need.

4. *Save money* – Ubuntu Studio and all of the bundled software are free. And Ubuntu is closely tied to the kernel, meaning it runs very fast, even on older computers. If you have an old PC that could not take the Windows 10 upgrade, it could have a second life as a music workstation We cover this in detail in the next chapter.
5. *Compliment other resources* The online forums, assorted manuals, and YouTube videos are great, especially on narrow topics. Many links to these resources are provided throughout the this handbook. While there are many books about Ubuntu, they do not cover the music software, I was never able to find a book on the Ubuntu Studio distribution. My hope is that, like me, you just want to see how things work and get on with making music.

How to use this book

You might be stuck on something. This book may or may not provide the answer, but it will show that, with a little patience, you can get un-stuck from whatever the problem is. I tried everything as I wrote – demonstrating that "it really does do that". Maybe there's a buried menu, hard-to-find checkbox, or something needs to be restarted/re-installed. The point is: knowing what's possible is valuable in itself because it shows persistence will be rewarded.

1. There is no need to read this book cover-to-cover. It's fine to skip over things you know to the things you want to learn about.
2. Have a book marker at hand so you can try things out as you go. Do put the book to one side and open a new project or noodle around with presets whenever the mood strikes.
3. Callouts like the one to the right contain helpful tips.
4. Your feedback is welcome at the book web site, where you can also find a few free downloads.

Acknowledgements

My thanks goes out to the entire open source community for sharing their work. Please consider donating to any project that you find yourself using frequently.

Getting started

Gear on a Budget

When I was a teenager, I started just playing the piano. I saved up my lawn mowing, snow shoveling, and leaf raking money to buy a little combo organ, and could only dream of owning a real synthesizer. I used gig money to modify the organ with one big purchase – an Electro Harmonix Phase Shifter! Who were the lucky kids who could afford that Concertmate MG-1 (made by Moog!) on display at Radio Shack? 'Teenaged me' would be gobsmacked with capabilites of soft synthesizers. Things got a little better in the 80's, but most weekend warriors were still not going to purchase more than one or two keyboards, meaning we would never get past trying out some boards at the music store. Now there seem to be more emulators (some highly accurate, others less so) of more vintage keyboards than we'll ever have time to play. But could 'teenaged me' afford to "go digital" today? With an eye towards this question, let's have a look at the minimal gear outlay for running Ubuntu Studio.

- Laptop (requirements below) - $35 to $130
- Outboard sound card - $40 new [Behringer U-PHORIA UMC22]
- MIDI controller - $40
- USB and other cables - $15
- Headphones - $20
- Optional: sustain and volume pedals, microphone, and monitors or amplifier, stands
- Internet access – try WiFi at your local library for downloading software as-needed (free)

So the bare minimum outlay, assuming the two pricey items are purchased used, would be around $165, certainly below $200 (estimates based on web 2018 web searches). Considering what 'teen-aged me'

could charge for shoveling snow these days, I'd say that's well within anyone's grasp. Of course, you can spend $300 on the sound card alone, and certain 'designer' headphones can cost as much as $350. If you buy everything new and consumer-grade, think in the range of $700-900 to completely outfit your bedroom studio from scratch.

How to find out if your old laptop can run Ubuntu

Linux does not run on every system. Fortunately, there are convenient web sites where you can look up your hardware to see if others have successfully installed Linux. The following resources also have installation notes:

Linux on Laptops http://linux-laptop.net
Tuxmobile http://tuxmobil.org

For the first draft of this book, I used a decade-old Dell Inspiron 1420 laptop running Ubuntu Studio version 14.04.05 LTS. It has a duo 1.5 GHz processor, 2 GB of RAM, and 145GB on the hard disk. Most used laptops have more horsepower than that, and you'll need it to run a more recent version of Ubuntu Studio. If you also have an ancient relic, all or most of what follows should work for you. Whatever hardware you end up with, check that it meets the requirements on the following page. In Windows 10, you can get the information via Settings/System/About.

System Requirements

Before running the installation, you might want to check that your computer has the minimum requirements.

- 2 GHz dual core processor
- 2 GB RAM (system memory)
- 25 GB hard-drive space (Ubuntu Studio's footprint is much

smaller, but you'll need extra space)

- VGA monitor capable of 1024x768 resolution
- Either a CD/DVD drive or a USB port to install and try out the operating system

Running Ubuntu from media

By now you should have a computer and soundcard. If you're still unsure about whether Ubuntu will work on your system, or just want to give it a test drive prior to committing, it's possible to run the system from either a DVD or USB drive – this is one of the startup options on the same disc image we'll use to run the full installation.
The steps are:

- Download the Ubuntu Studio ISO file at https://ubuntustudio.org/download
- Burn it to a CD/DVD or bootable USB stick (DVD image is about 2.6 GB for version 16.04)
- Restart the computer with media in place and follow the installation instructions

ISO, stands for "International Standards Organization" and an ISO file or ISO image is a compressed copy of the contents of a CD or DVD; it's a common format for shipping large programs over the internet.

The Ubuntu Studio site has further installation instructions and details, but the process is self-explanatory save one step: changing the way your computer boots up. To boot from a DVD:

1. Back up your hard-drive. In particular, save any files you want to the cloud, USB stick, or other external drive.
2. Restart the computer. Before Windows comes up, you will need to hit one of the 'function' keys along the top of the keyboard. Usually it is F2 – check your PC manual. This will bypass the normal boot sequence and reveal a window that provides various options including where to start the boot process itself. The menu

that comes up is text-based and you navigate it using the arrow keys to make a selection, then just hit 'enter'.

3. Insert the DVD containing the Ubuntu Studio ISO image you created.
4. Restart the computer again – this time it will read from the DVD.
5. You will be presented with the choice between running Ubuntu from the DVD, a clean install or a "dual boot" which would allow you to start to either Windows or Ubuntu. Run it from DVD.
6. To do the above from a thumb drive, use Unetbootin from unetbootin.github.io to store the image, then follow all the steps, selecting "boot from USB" if that option is available.

Installing Ubuntu Studio

After having a look at your new system from media, restart again with the DVD still loaded, and pick the type of installation you prefer. A "clean install" will erase everything from the old computer, but this is recommended. We won't cover the dual-boot scenario here, other than to say you will need to know about creating disk partitions if you want to set it up that way. From here, there are not a lot of steps, but allow yourself 30 minutes or so as there are a lot of files to transfer. Here is what to expect:

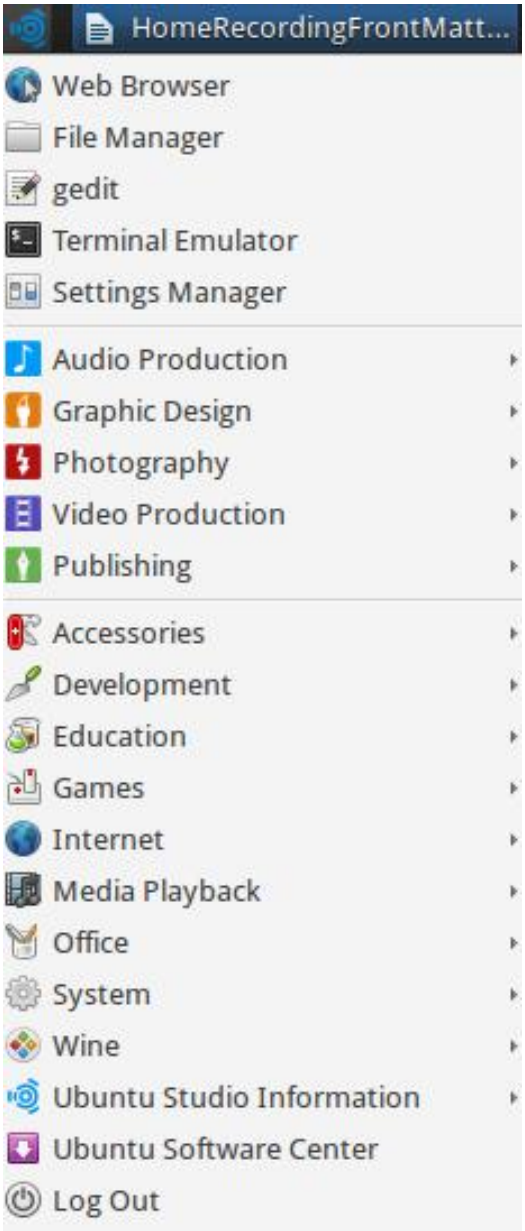
1. Select English and do download updates during the installation.
2. Unselect "install alongside Windows".
3. Select location and language for the keyboard layout.
4. Enter your personal name, and password. Note this will be the administrative password.
5. The 'computer name' is the name that will appear on any network, kind of a nickname, so accept the default or make it anything you prefer.
6. 'Encrypt my home folder' is useful for laptops in case they are lost or stolen.
7. Once the installation is complete, click 'Restart Now'.

8. Remove the DVD or thumb drive when prompted and hit 'Enter'.

Now you should take a moment and check out the non-musical software that comes with your new operating system, noting there is nothing mysterious about it. Ubuntu follows the standard concept of a launcher with icons that open assorted applications. A screenshot of the menu is on the next page. Start by opening Office. This book was written using Libre Office Writer. You'll notice it looks a bit like Word from a few years ago. Open a new document (File/New/Text Document). Enter some text in the white space and highlight it with the mouse. Guess what happens when you click the very large letter 'B' in the toolbar? I hope you can take it from there.

Before we leave this section, familiarize yourself with the Ubuntu Software Center. There you can find a library of applications by category, with user ratings – almost anything you can imagine is available, and programs self-install at the click of a mouse. Have a look, play around with your new computer, and when you're ready, we'll do the finishing touch of setting up the sound card.

First, all of the hardware connections need to be made. Connect the MIDI controller and the outboard sound card to USB ports on the laptop. For now, you can connect headphones to the sound card, being sure to set the volume level relatively low and keeping them off your ears until we're sure the levels are reasonable. If you have speakers, connect them directly or via mixer now. Many sound cards and controllers are powered via USB, so the only thing you may need to plug in is the laptop. Note that your monitors should be off or volume set to zero when powering down the laptop. If you want to record an instrument, that usually goes into the front panel of the sound card. Be sure to consult the sound card's manual for appropriate settings. In general, “Pad” is for boosting the signal from a microphone. There might be an additional switch between “Line” and “Instrument”. The latter should work for electric guitar. Pots may need to be adjusted for different input sources.



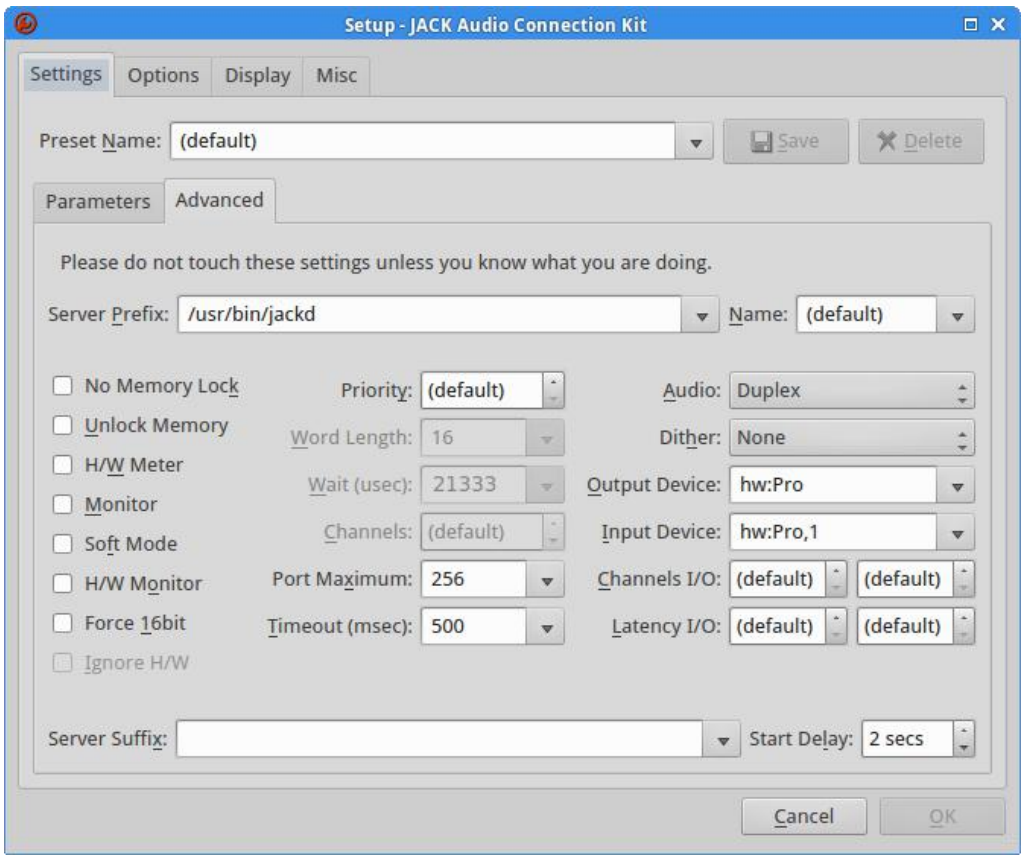
The author's launch menu contains some items such as Wine that we'll add later.

Connecting a Sound Card With JACK and Patchage

The program called JACK is Ubuntu Studio's nerve center. From the launcher, click Audio Production/QjackCtl. Click Setup/Settings/Advanced to show the window on the following page. There's good news and bad news. The good news is that the default

settings should work as-is for most sound cards. The bad news is that if they don't, it may be difficult to find specific instructions to tell you what works for your particular hardware configuration, and you may end up finding it by trial and error. On my system, there are seven options under input and output. The first time I tried to connect my sound card, using an earlier release of Ubuntu Studio, it took over an hour and some poking around the user forums. But in later releases, it was plug-and-play.

Under Parameters, I chose Alsa, Realtime, and the default Sample Rate (44100) Frames/Period (1024) and Periods/Buffer (2). Latency is grayed out at 46.4 msec, as I choose the low-latency option (recommended). Although I have a 64-bit processor, I have experienced some trouble running 64-bit programs under Windows in Ubuntu – we will come back to that point when discussing Wine and Carla in chapter 5. With luck, your system should be ready to go now.

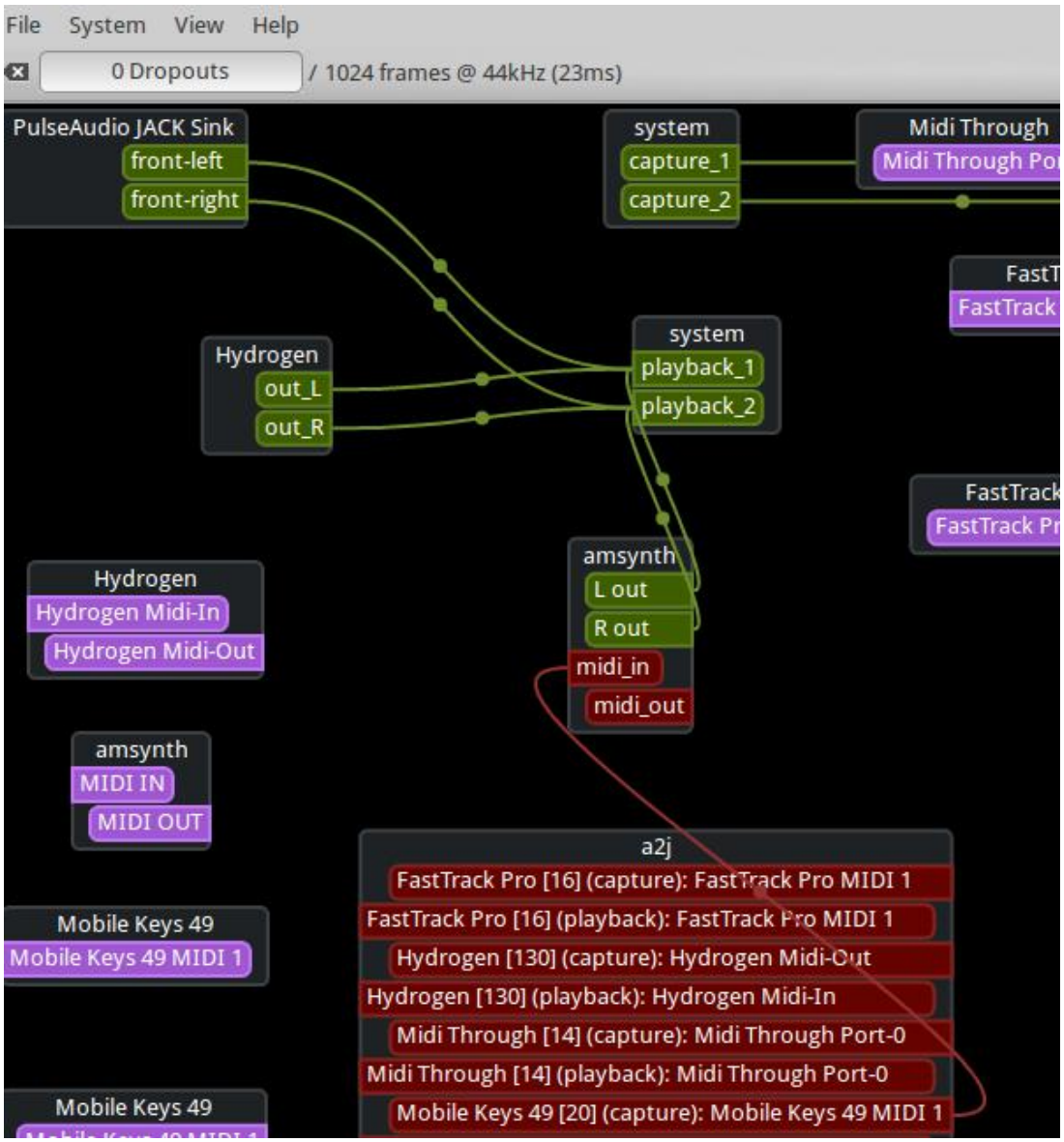


The JACK advanced settings screen – this may or may not work for a given set of hardware. Details on the rig used for this book are in the appendix.

Making connections in JACK is covered in the next chapter. For now, return to JACK's main panel and try the Connections and Patchbay buttons. A good workflow is to set up Connections, then go into Patchbay and store a given configuration that you might want to call up again when working on a particular style of music. There isn't much to do in either of these windows until we open other applications. IMPORTANT: one last preliminary step will help later - see this link: http://manual.ardour.org/setting-up-your-system/setting-up-midi/midi-on-linux/

Patchage

As we'll see momentarily, for being such a key program, JACK has a clear but somewhat dated-looking GUI. If you prefer a schematic view of your applications and how they are connected, check out Patchage. Patchage allows you to drag items around the screen to better visualize their connections. You can use it to hook things up, as well. We're not quite ready to use this, but here's a preview.



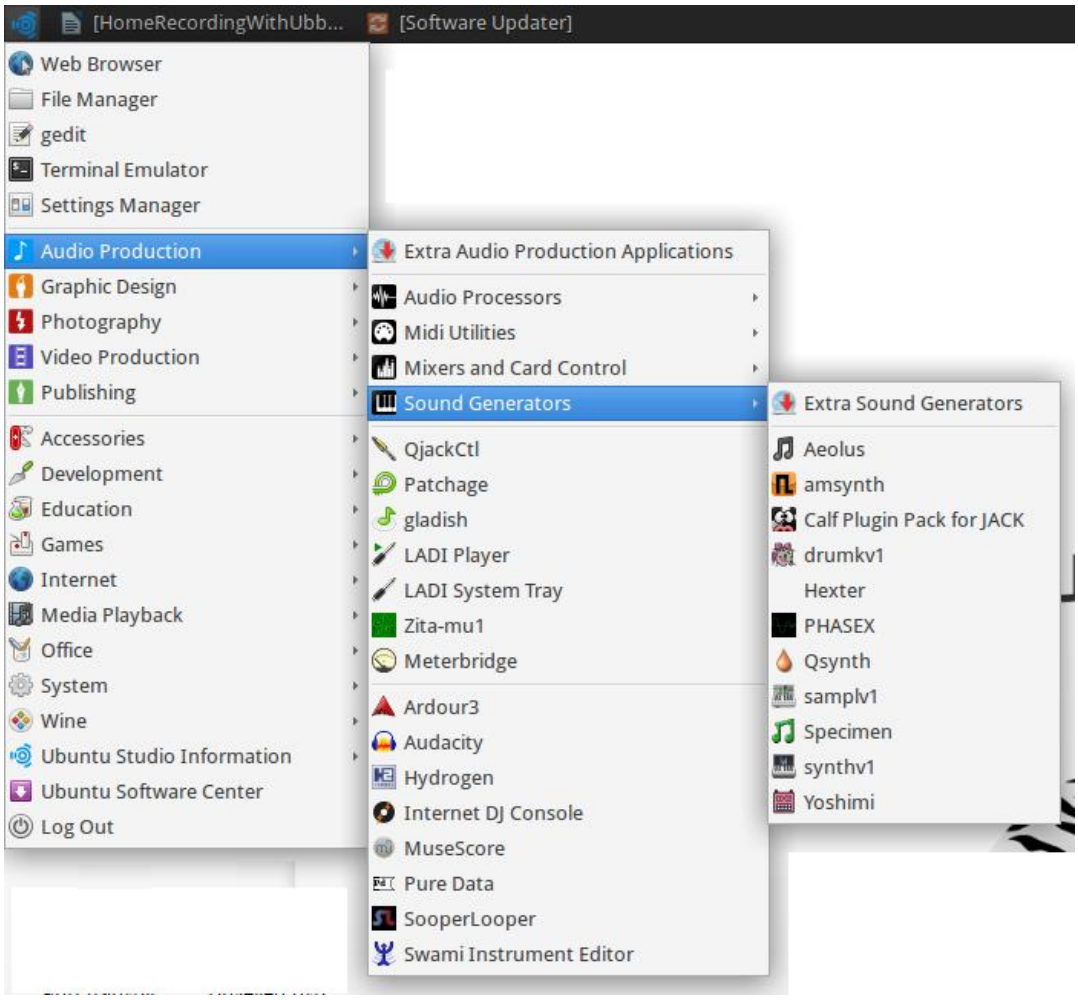
Here a MIDI controller is connected to a amsynth, a soft synthesizer's MIDI input, the Hydrogen drum machine and amsynth's audio outs go to the system output, which we've already configured in JACK to use the outboard soundcard.

The audio generators depicted above are introduced in the next chapter, so read on!

Overview of Out-of-the-box Instruments and Effect

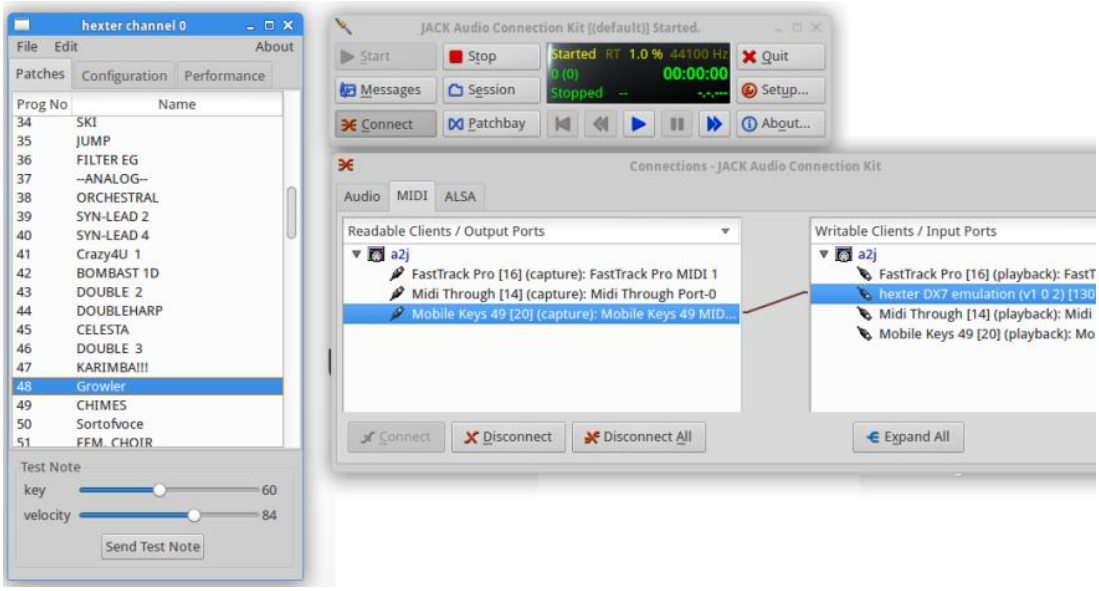
Sound Generators

Start up QjackCtrl, then from the main Ubuntu menu, select Audio Production/Sound Generators, to see a list of pre-installed virtual instruments.



A list of eleven plugins appears (far right menu), with "Extra Sound Generators" at the top. We'll start with **Hexter**, Yamaha DX7 emulator that is also reminiscent of an early eighties Casio keyboard. Click on Hexter, then in JACK, click "Connections". Go to the audio tab and

connect Hexter's audio output to System by click-dragging a line between the two (see screentshot below). Use Hexter's "Send Test Note" button to check that the audio connection is working (bottom of left panel in following screenshot). If there is a problem, check the volume levels, then review JACK's configuration. Next, use the MIDI tab, open the left and right dropdown menus (here labeled "aj2") to connect your controller's MIDI output to Hexter's MIDI in by drawing a line between them – drawing in either direction will work.



In Hexter's clean interface, it's easy to find a patch, and the patches are familiar sounds like marimba, clavinet, and synth brass. Screenshot 3.2 shows the surprisingly punchy patch, Growler, selected – be sure to give it a try along with other Hexter patches.

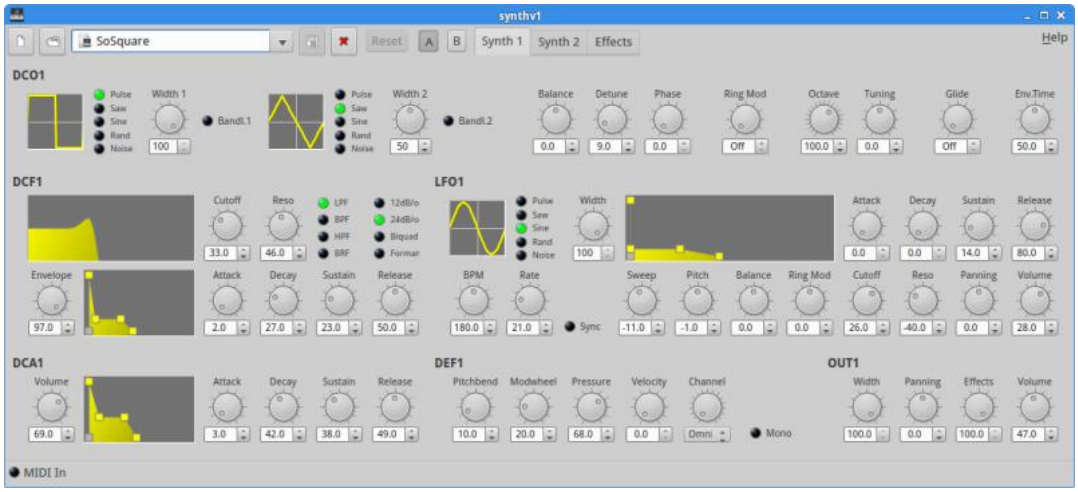
You can connect the other instruments in JACK the same way, but some of them may require additional setup, including connecting the MIDI out from your controller, which may appear in JACK's ALSA tab under the aj2 drowdown menu rather than under the MIDI tab where you would expect to find it. Let's continue the tour with an eye towards making sure everything plays.

If you select P, the Principle manual, to respond to MIDI channel 1, then it's possible to toggle the other manuals viaaeolus' buttons labeled "P+I", "P+II", and "P+III". This is helpful if you are only using a single controller and solves the problem of some stops appearing not to work.

Aeolus is a pipe organ emulator whose gorgeous sound compensates for a notably drab Graphical User Interface (GUI, pronounced “gooey”). When you launch Aeolus, all of its buttons flash in sequence. On older versions of Ubuntu Studio, it was necessary to install an additional helper program to run Aeolus. There is no default sound, and you must click “Recall” to get to the first preset. Depending how Aeolus is set up, you may notice that enabling and disabling some stops doesn't change the sound. Clicking on the MIDI button opens a grid where you can assign a different MIDI input channels to manuals P, I, II, or III. Remember to set the MIDI send channel accordingly on each controller (assuming you have more than one tier of keyboards).

For what it lacks in pizazz, the rest of Aeolus' operation is clear – use Prev and Next to page through a handful of presets. You can make fine adjustments to tuning, tremelo, and swell via the “Instrum” button, and “Audio” has sliders for volume, delay, reverb, and a few other parameters.

Pictured below is **synthv1**, an unassuming polyphonic analog synthesizer with 28 presets and a convenient waveshaping interface that allows you to sculpt the sound by clicking and dragging. It's possible to add nodes to the graphs as well. Connect it in JACK and you will see it has the classic fat analog sound. If all the knobs and initials appear daunting, please refer to chapter 10 for an introduction to creating sounds with any synthesizer.



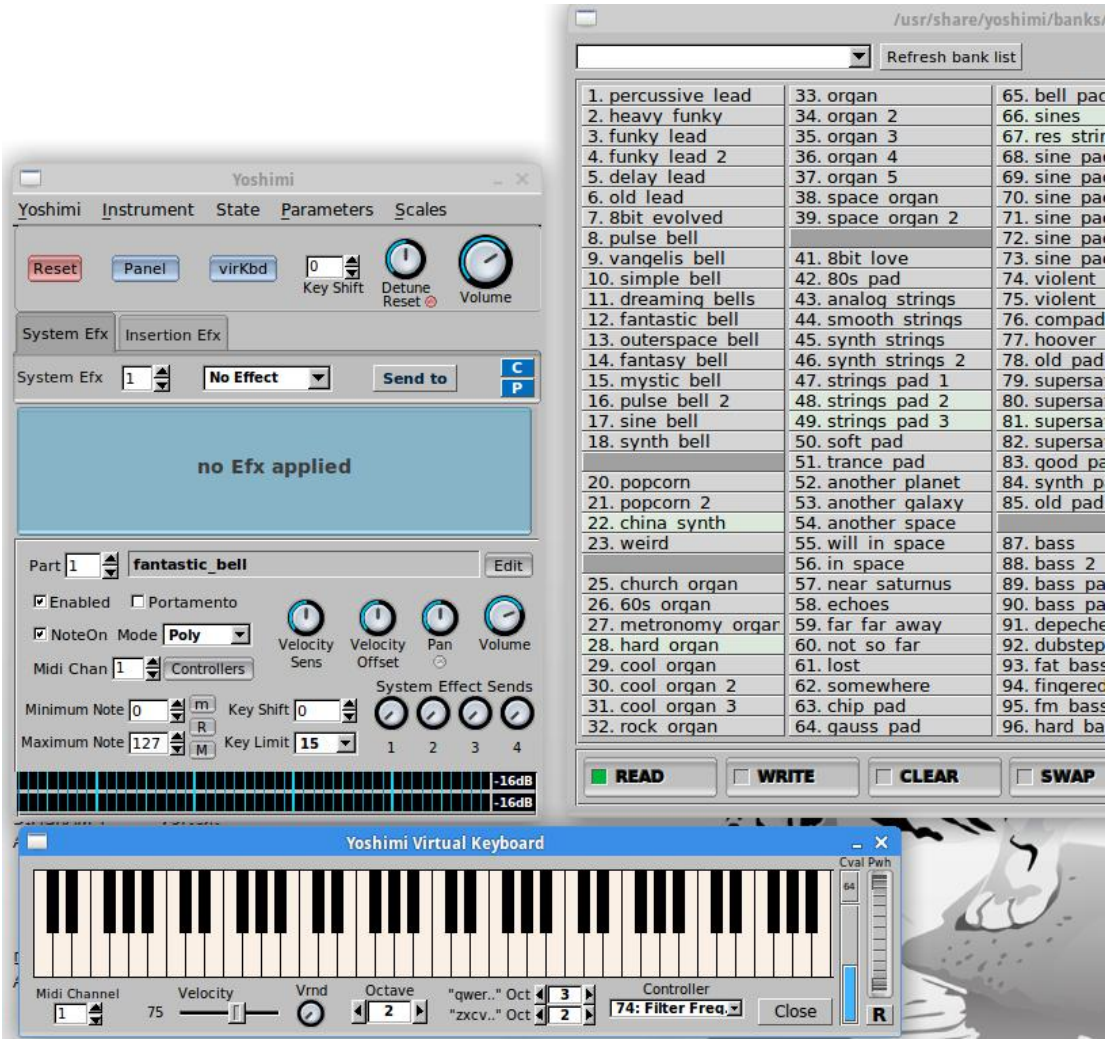
Ubuntu Studio comes with three more "gray panel" synths pre-loaded: samplev1, drumkv1, and qsynth. See following screenshot.

Drumkv1 (top left), Qsynth (top), and samplev1 (bottom) share a common look and feel with synthv1.

Qsynth is a soundfont player. Somewhat of an older format, soundfonts are a convenient way to package samples and map them to MIDI note events, effectively building your own instruments. Qsynth does not come with any preloaded soundfonts, but there are many resources for free soundfonts online. Two different patches can be loaded and triggered simultaneously to create a layered effect, using Qsynth1 and Qsynth2. **Drumkv1** and **samplev1** also require wav files to be imported. We'll look at importing sounds to Qsynth when we cover making your own soundfont. For now, let's note that samplers represent one way to get high-fidelity instruments (with some trade-off between sample size and quality) and continue the tour of out-of-the-box plugins.

Amsynth has a brighter, almost harsh sound compared to Qsynth. This one is also polyphonic and comes with over 20 banks, each containing tens of powerful presets. The virtual keyboard may crash amsynth, but other than that, it's stable and quite an analog beast.

This brings us to one my favorite native Linux synthesizers, **Yoshimi**. It boasts a simple interface and its sounds are a step up from Hexter, including some of the best bell tones you'll find. Yoshimi's virtual keyboard works without needing to enable it in JACK. To try the onboard effects, use the "Insertion Efx" tab and select "Master Out". Under "Panel" (next to the pink reset button in the screenshot below), you can set up to 16 MIDI channels with different sounds.

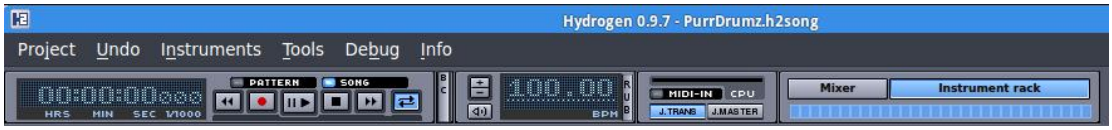


To get even more soft synths for Ubuntu Studio, first try "Audio Production/Sound Generators/Extra Sound Generators" - you should see a dropdown list of additional plugins to try out. Some of these cover similar territory to the ones we've already tried out, some may not have the best GUI. A handful more are listed in Ubuntu's Software Center – of those, don't overlook FOO, a bright red electric organ emulator. Here is a page that lists 73 synth plugins that run natively on Linux: http://linuxsynths.com/index.html. But...there are more free plugins for Windows than you could ever download, and only two programs are needed to run them (see chapter 5).

Ubuntu Studio comes with the **Hydrogen** drum machine pre-installed – it's in the main "Audio Production" menu. This is a fairly deep program, so I recommend taking the time out to review the User Manual found

under the Info tab. If a drum machine is any good, it will perforce be complex, as there are so many facets to creating a rhythm track. The good news is that most drum machines take similar strategies to addressing this complexity. You need a way to pull in sounds and organize them as a drum kit, a way to create patterns for the various parts of a song - intro, A, B, fills, coda, etc. - a way to tie these together, and, if we're lucky, save and export in multiple formats. Transport controls for real-time recording, and a grid for step recording (where events are added graphically via mouse click), and quantization (to keep individual hits where they belong), round out the basic functions to look for in any drum machine. The main distinction between programs is how user-friendly (or user-hostile) they are, and by keeping the GUI simple, Hydrogen excels in ease-of-use.

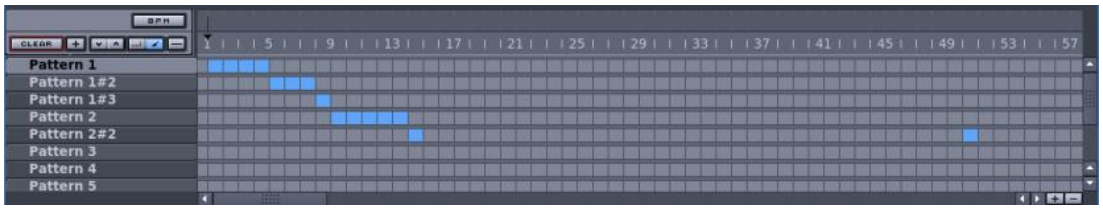
The main menu has a slick LED clock, transport buttons, tempo selector and buttons to open a mixer (used to adjust the balance between sounds in a kit, if needed) and the instrument rack. Try the [+/-] increment/decrement buttons next to the BPM readout – this is how to adjust the tempo. If you are recording in real-time, the speaker icon just below [+/-] toggles the metronome, so you can record to a click (these three buttons are stacked in the middle of the following screenshot).



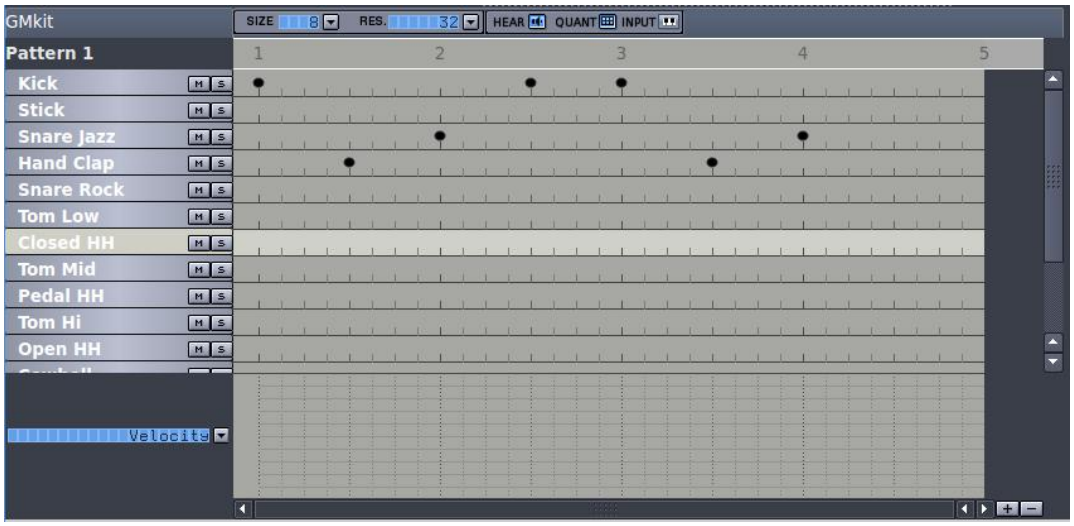
Hyrdogen's main menu

Directly beneath the main menu is the song section, where patterns can be chained together. The next screenshot shows a song that uses five distinct patterns, labeled on the left menu. Clicking a box in the grid turns it blue for a given pattern. So the four blue boxes next to pattern 1 will – you guessed it – play that pattern four times. And so on for the other patterns. Note the loop button in the transport window will keep the song playing if you have all the parts and don't feel like copy-pasting

them. This can be good for real time recording and live performance, as we'll see in the next section.



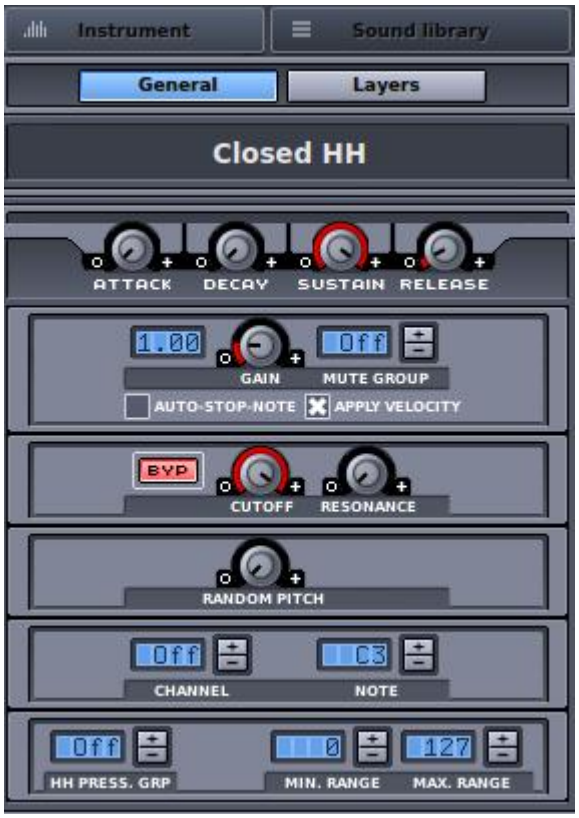
Before creating a song, you'll need to make some patterns. Open and save a new project. Clicking in the pattern grid will leave a black dot where an event should be triggered. You can work on this in real time by enabling looping and turning on the click in the main menu as mentioned earlier. Work your way up the kit adding and removing triggers by clicking. By creating a very simple pattern at first, you can then copy it to introduce additional parts. This will come in handy as you stitch the patterns together in the song editor. As you can see, I made two copies of Pattern 1, displayed as Pattern 1#2 and 1#3. Pattern 3 is this song's ending, a tom roll and cymbal crash.



Hydrogen's pattern editor. Note the mute and solo buttons next to each instrument – these button might be used with looping enabled to add variety to beats during a live performance.

The last panel has quite a few goodies in store – a way to edit the sound of individual instruments, and best of all for those of us with an insatiable appetite for sounds, a varied library of kits that can be swapped in for a

given pattern. Not only that, you can upload your own sounds. Merely changing the kit can have a profound effect on a drum pattern's sound. Hydrogen is a highly adaptable workhorse of a drum machine with a GUI that is more intuitive than most other free drum machine plugins.



Controls for editing instruments and changing out the drum kit (Sound Library).

Hopefully this overview leaves you with a song made up of a couple of patterns. Refer to the on-board user manual for more detailed information on quantization, setting the tempo via tap tempo, exporting your song as an audio file, piano mode for triggering notes, and many other features.

If you're like me, launching a new synth is like getting a new toy, and you may find yourself auditioning presets into the wee hours. So far we have analog and FM synthesis covered, which covers bass, chords, and leads (duties that can be shared with electric guitar). Our virtual band also has drums.

I recently spotted a forum comment where someone complained that Ubuntu Studio does not lend itself to “just sitting down to play the piano”. While we're only using out-of-the-box, native Linux instruments, the best answer is probably to download a piano soundfont to use with Qsynth. But as noted previously, there is a trade-off between sound quality and the size of a sample. Linux compatible Pianoteq 6 starts at $130 and has a 50MB footprint. A smaller-sized, free piano sample may loop the fade-out of a note to minimize the soundfont's overall footprint. The bottom line is that it's often best to simply record a real instrument, such as a digital or stage piano. As for the commenter who just wants to play piano and doesn't want to deal with configuring software on his computer, it sounds like he should rescue an old acoustic piano and leave it at that! Your soundcard should be able to accept microphone input. So, if you have one, your ultimate “piano patch” might well be a real piano. But don't despair: once we learn how to run Windows-only VST plugins in chapter 5, you'll have your pick of pianos - see the appendix for some links.

http://www.pianoteq.com – a native Linux piano.

Audio Processors

Ubuntu Studio comes with an insane number of effects and signal processors. I will only cover two guitar effects plugins here, and we'll see more about effects when we talk about recording.

Guitarx is labeled as a "simple mono amplifier simulation", but it is comparable to other amp models, with the ability to add rack units to your heart's content. I am not a guitar player, and have no stomp boxes or dedicated guitar amp. But even if you have a great live rig, plugins are just simpler to set up and use for digital recording. I can't say if the eighteen different "Tube" settings are dead ringers for their namesakes, or if "Twin" really sounds just like a Fender Twin Reverb amp, but I can say that it is very simple to go from a little crunch to a searing lead to a clean, slow tremolo. Click "Plugins/Plugin bar" and the entire gamut of effects is displayed. To add a rack unit from this selection, just double click. Throw the toggle switch on the left side of the unit to make it's LED light turn green, then adjust the knobs to your liking. To remove a rack unit, simply double-click one of the "screws" on its front panel.

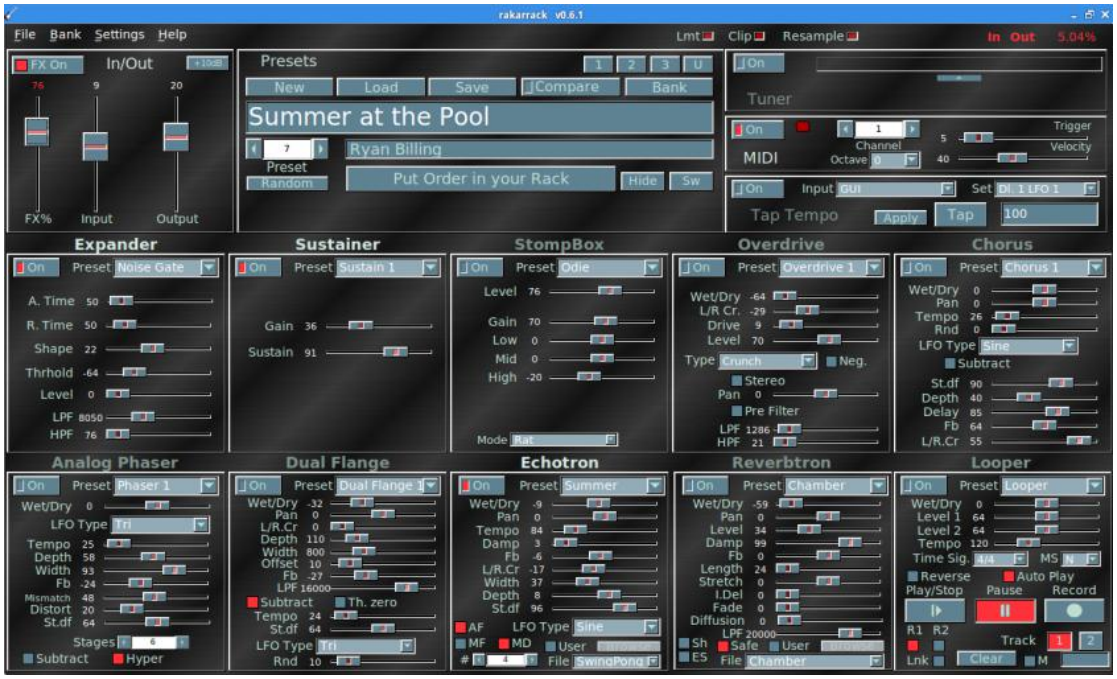
While I agree with a recent blog post complaining that skeuomorphic design – where one material, say plastic, is made to look like another, such as wood grain - has been around too long and been over- used in the world of virtual instruments, I have to admit I like the green brushed metal and chunky black knobs of guitarx. It looks - and is - unabashedly ready to rock. Set your sound card for monaural instrument input and make sure guitarx's output connects to System in JACK, then try the three banks of presets to get a feeling for guitarx's strengths.

If you like to chain effects together as in a pedal board, Rakarrak is the plugin for you. I won't try to describe it's three banks of 60 presets each (plus a user bank!) other than to say **Rakarrak** is one of my favorite things to play around with in Ubuntu Studio. You can just park it on any preset and start fiddling with parameters to radically alter the sound.

Once you load and connect it, click “FX On” so that it lights. The I/O faders default to 50-50, so you may want to adjust that balance to ensure the effect is all you hear. But first, set FX% to zero with FX On, and enable the Tuner in the top right-hand column. When you strike a note, the tuner displays it. As you work the tuning pegs on your guitar, the pitch meter will show fine tuning between sharp and flat. Even if you have another guitar tuner, this one proves very handy when recording on the computer.

Rakarrak can turn your electric guitar into a MIDI controller. If you've ever wanted to play a guitar synthesizer, now you can control virtual instruments...with no extra gear!

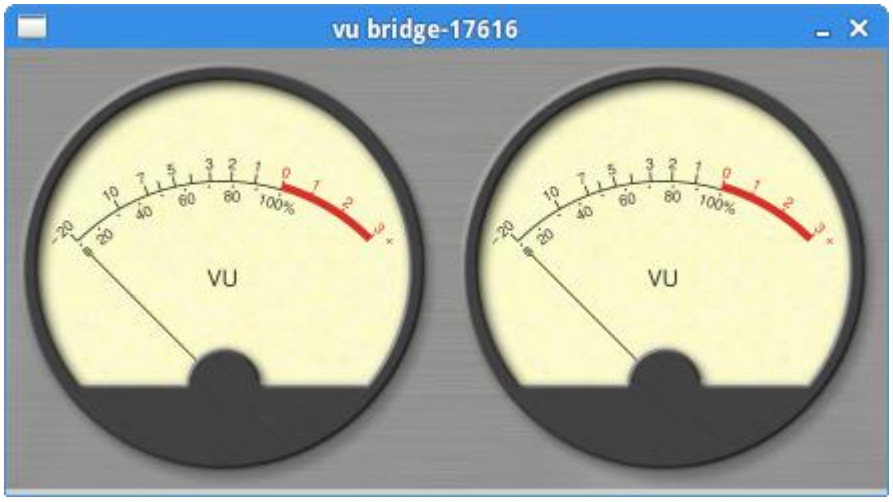
Just below the Tuner, you'll see a MIDI section, something you might overlook while browsing presets, jamming, and cooking up your own blend of effects. Open one of the synths we've tried, such as amsynth, and enable MIDI in Rakarrak. You will see Rak' as an available MIDI source in JACK – just connect it to your synth plugin as any other controller, and – voila! - guitarists now have a whole new world of crazy sounds at their disposal. You may notice a bit of latency or delay between striking a string and hearing the note played back on the synth. The degree of this issue may vary from one sound or synth to the next. A quick fix to fill out your sound is to turn the Input fader back up a bit, as long as you don't mind layering the guitar sound with the synth patch you've chosen. Another problem is unwanted ghost notes. You can try adjusting the velocity and trigger settings in Rakarrak's MIDI section, but depending on what you're after, the stray notes can take on a surprisingly convincing arpeggiator character. In general, mono, lead sounds work well, and sounds like organ can take on a more mechanical sound when controlled from a fretboard. Linux musicians tend to be experimentalists, and to that end, I highly recommend trying Rakarrak's MIDI feature. Performance issues might be better or worse depending on your hardware, the plugin, and even the particular patch.



Rakarrak set to one of the author's favorite presets. Tuner and MIDI sections are in the upper right.

Tools & Utilities

There are a few things to be aware of under the Audio Production "MIDI Utilities" and "Mixers and Card Control" menus but feel free to return to this section later and go to the next chapter if you are itching to start recording. The recording software we'll be focusing on has an excellent on-board mixer, and the standalone mixers available in Ubuntu Studio are for dedicated purposes or affect the onboard soundcard which we won't be using for recording. There's even a level meter that might prove useful – or at least look cool – if you have a widescreen monitor with a corner of available desktop space.



Major File Types

Some common file extensions in Linux music software are LADSPA, LV2, DSSI, and SO. The following definition is via https://www.ladspa.org/

> Linux Audio Developer's Simple Plugin API, **LADSPA**, is a standard that allows software audio processors and effects to be plugged into a wide range of audio synthesis and recording packages. For instance, it allows a developer to write a reverb program and bundle it into a LADSPA "plugin library." Ordinary users can then use this reverb within any LADSPA-friendly audio application. Most major audio applications on Linux support LADSPA.

And via http://lv2plug.in/

> **LV2** is the "version 2" of LADSPA. Unlike many popular audio plugin APIs, LV2 is a platform-agnostic Free Software specification with a liberal license.

Via http://dssi.sourceforge.net/

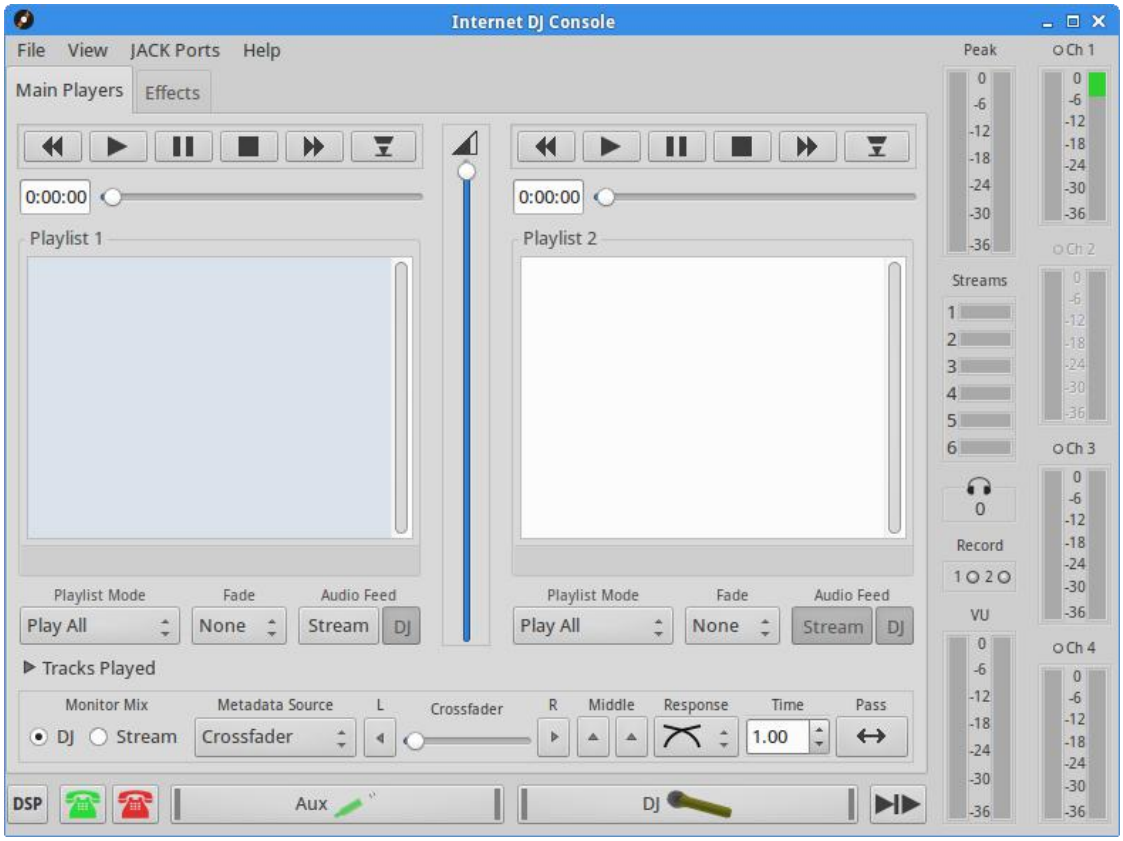
> **DSSI** (pronounced "dizzy") is an API for audio processing plugins, particularly useful for software synthesis plugins with user interfaces. DSSI is an open and well-documented specification developed for use in Linux audio applications, although portable to other platforms.

SO files are shared objects, and are not restricted to audio application. They are the equivalent of dll files in Windows.

You'll notice another acronym in these definitions – as any developers out there will know, an API is an Application Programming Interface. Remember, Ubuntu is open source, which means you have access to the code (often written in C or C++). The above open standards mean developers can create their own audio plugins, be they effects or synthesizers or whatever they've dreamed up. The ability to download and modify code has led to an explosion of innovative, colorful plugins. There is some redundancy, but if you look closely, you'll see all of the major schools of synthesizer design have been replicated, and some fascinating hybrids designs as well (see the glossary in section 10).

Tools for DJs

In the Audio Production menu, you'll notice some tools explicitly for the DJ. **Internet DJ Console** allows you to live stream over the internet. I have not tried this program myself, but it is geared towards podcasting.



I did attempt to use **SuperLooper**, and once you figure out the labyrinthine interface, it does work as promised. You can create as many overlapping loops as you like. Sessions can be saved and imported to other programs. While intended for live performance, this plugin is not restricted for DJs – if you like overdubbing on the fly, it has great musical applications, and loops in themselves can be quite useful. Some documentation for SuperLooper can be found here: http://essej.net/sooperlooper/.<
>

Note: **SuperLooper is not included in the Ubuntu repositories and is therefore not officially supported.**

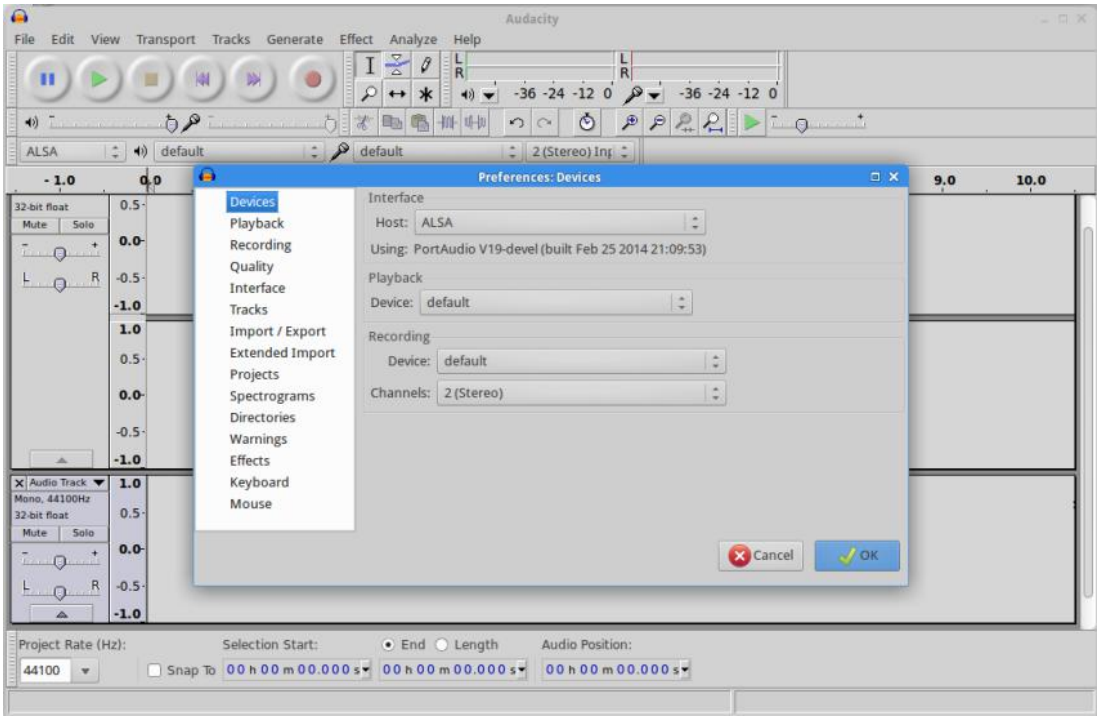
TerminatorX is an intriguing program (not bundled with Ubuntu Studio) that simulates record scratching using a digital track and a mouse. The mouse isn't the most comfortable tool for the deft handiwork exhibited by true practitioners, so in the spirit of open source, some fans of this plugin have repurposed old turntables, fitting them with a mouse to reproduce the visual and tactile experience of scratching an actual vinyl LP! https://terminatorx.org/turntables/

Basic Recording For Musicians

Audacity

A number of recording applications are available for Linux. Because this book is about multi-track recording, we will focus on two, Audacity and Ardour, both of which can be found on the main "Audio Production" menu. If you mouse over Audacity, the simpler of the two, it says "record and edit audio files", but this belies the fact that you can add as many tracks as you like. Anyone who has used a tape recorder should feel at home with Audacity once the audio input is configured.

Be sure that JACK is running and you have a soft synth like Hydrogen launched prior to opening Audacity. From Audacity's Edit/Preferences/Devices menu, configure it to record from Hydrogen as in the screenshot below.



Back in the main menu, select "Track/Add Track", click the record button, and you should see the waveform appear as you play your drum track or other synth. Assuming all went well, here are some frequently-used actions:

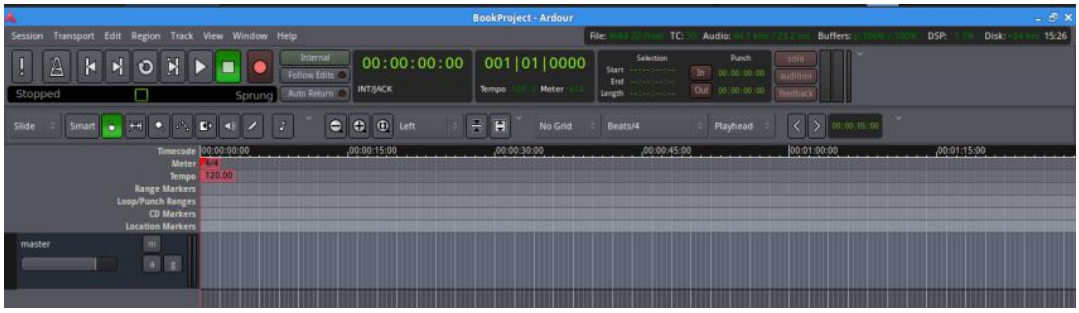
- To split a track, place the cursor where you want to make the edit, then go to "Edit/Clip Boundaries/Split" or use the Ctlr+I shortcut. You can then highlight or drag one portion of the track for further editing.
- The magnifier tool (zoom) is helpful when making fine edits.
- If a track sounds a little weak, either use Effect/Normalize or Effect/Amplify to boost the gain.
- Effect/Pitch does a good job at pitch-correction, although some guesswork and using your ears may be involved.
- To apply an effect, just highlight a track or region, then select the effect you want from the dropdown menu.
- At mixdown time, don't forget to experiment with the pan control found below the Mute and Solo buttons.

Although we are primarily concerned with making digital recordings that tend to be very clean, note that Audacity's noise reduction, also found in the Effect menu, is remarkably good for a project like cleaning up digitized cassette tapes. It works by sampling a bit of the noise, then removing those frequencies throughout the recording. It even provides a way to subtract the noise more or less aggressively, in case you start to hear the filtering encroaching on parts of the signal you want to retain. We will see other tools that can target problem frequencies when we discuss mastering, but Audacity's noise reduction is simple to use and produces impressive results. Another strength of Audacity over other recorders is that it can export to any format imaginable. It may not be your primary DAW, but Audacity has many specialized uses. The manual (under Help) covers all of Audacity's capabilities clearly and succinctly.

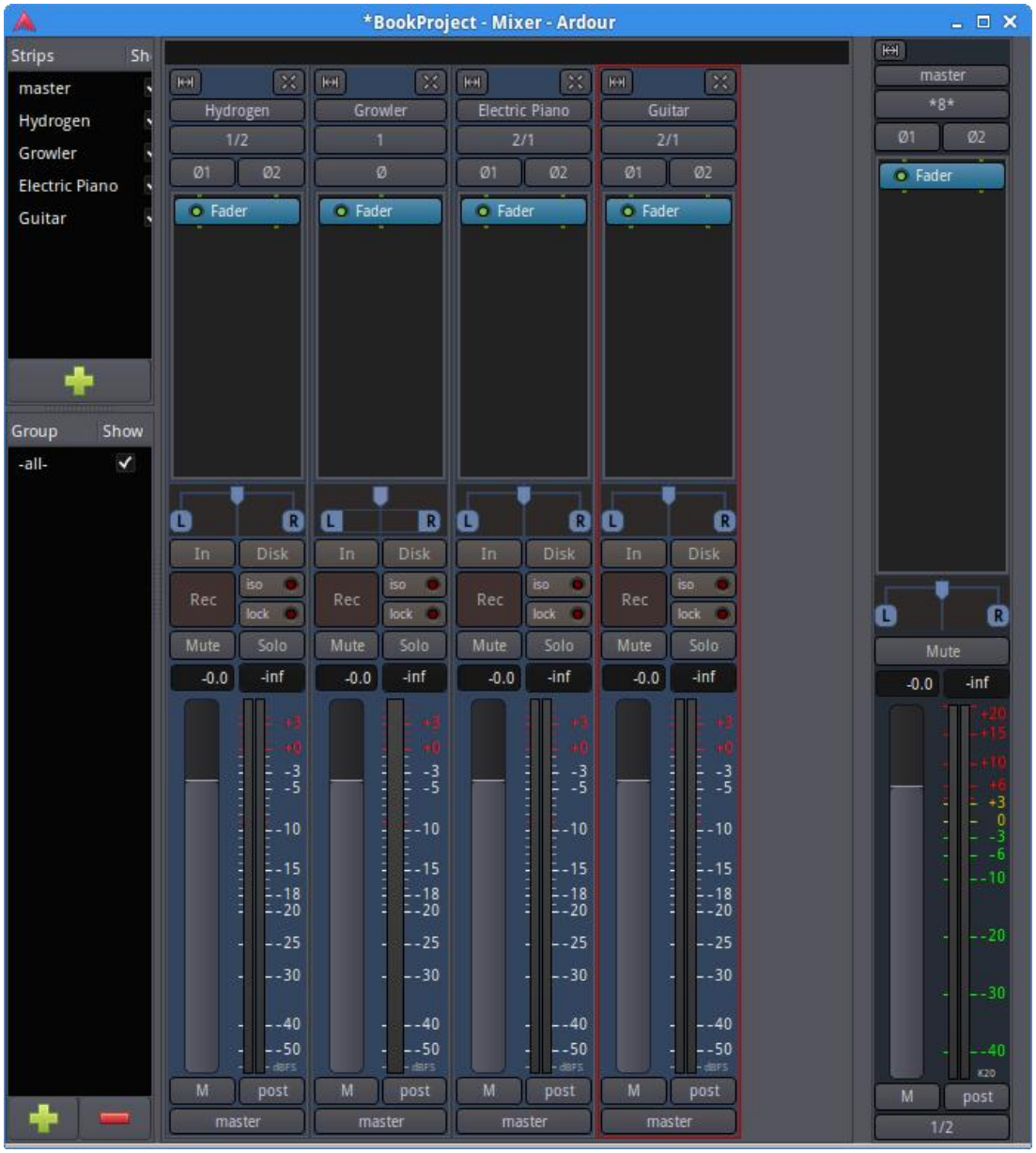
This is as good a time as any to suggest http://freesound.org for all manner of sound effects (and a fair number of loops) that you can import directly into any recording project. If you are not familiar with that site, I suggest you pop in a bookmark here and go check it out. If you are making a test recording in Audacity, take a moment to try importing a file from freesound.org into its own audio track in Audacity as an exercise

Ardour

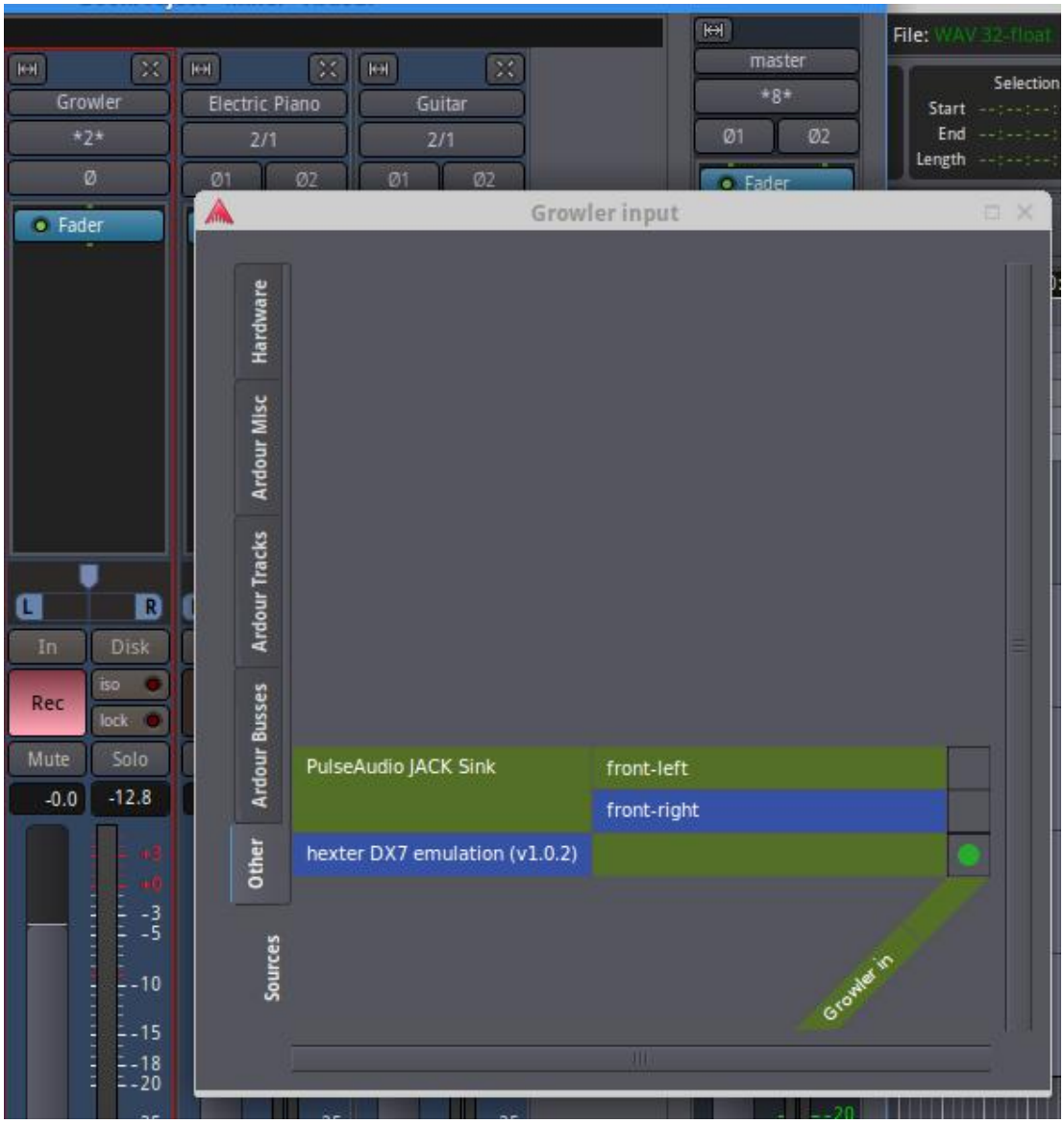
If you have used a Digital Audio Workstation (DAW) such as Ableton, Cubase, Cakewalk Sonar, Logic, Reason, or FL Studio, then you will be in familiar territory with Ardour. As with most freeware and shareware, Ardour may not have all the latest bells and whistles, but make no mistake - this is a full-featured DAW, and will give you professional-quality results. Personally, I like it that open source software evolves more slowly - it is less susceptible to feature bloat than commercial products. Ardour has two main windows, an editor and a mixer, shown below.



Ardour's track editing view has familiar features - transport and editing tools, clock and measure readouts, metronome, and a timeline where you can set the meter, tempo, and place markers. New tracks are added below "master" in the above screenshot.



Ardour's mixer window, above, not only sets individual track levels, but also allows for inserting effects pre- and post fader. Input from JACK can easily be assigned via the button just below any track's name.

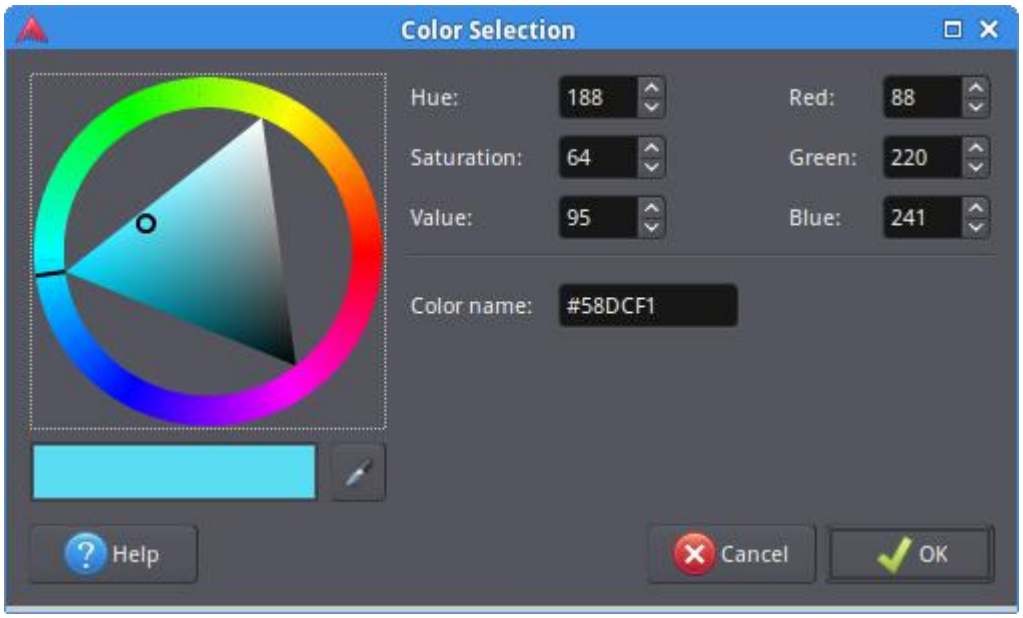


Above: the mixer button with the asterisks (top left, *2* just above Growler) was clicked to reveal the pop-up (shown) where the track input (green diagonal) can be connected to the Hexter plugin, found on the "Other" tab at bottom of the pop-up's vertical lefthand menu. Clicking the Rec button turns it pink, indicating the track is armed for recording.

Once the input is set, return to the track view tab, hit the red "record" button in the transport section, and recording will start as soon as you click the "play" arrow. On both Ardour and Audacity, the space bar can be used to start and stop playing. Ensure that Ardour's Master outs are connected to "System" in JACK, return the cursor to the start of your

recording via the left-arrow transport button, and play back your first take.

Now let's take a closer look at track settings. In either the main window or the mixer, you can change a track name by clicking on it. Ardour automatically assigns each track a color, but you can alter that and other track attributes from a menu that appears on clicking in a blank area near the track name in the editor window.



Next to the record enable button on each track are buttons for mute and solo ("m" and "s" respectively). We will discuss the bottom row of buttons in the chapter on advanced recording. The pointer tool (green button in image below), can be used to drag a region to a new location in the timeline. Clicking and holding the edge of a track with the pointer tool will resize the track. To start playback in the middle of a track, click in the area above the master track, then hit the space bar.

Ardour's toolbar includes selectors, zoom, and note editors.

To the right of the pointer icon in the toolbar is "region mode" which can be used to select/move regions with the cursor. There is also a "smart

mode" to imbue the pointer tool with this ability. I have not found myself using these alternate modes much, but you should try them out to see how they alter the cursor's behavior. It should be clear what the Grid and Beats menus do (just try them). The Playhead menu sets the starting position of the cursor to either wherever the mouse is, an active (selected) marker, or the beginning of the song. This feature can be useful when working on longer and more complex tracks. More playhead options are under the main Transport menu. Hydrogen does not play well with JACK running, but recall that you can export a Hydrogen song to a wav file. To import a wav file into Ardour, use Session/Import to navigate to the file; open it, and it will appear on a new track. It is best to learn the keyboard shortcuts as soon as possible to avoid return trips to the edit menu. Copy, paste, and undo are the same as in a typical word processor. To split a selected track, place the cursor in the desired spot (you may need to zoom in with the magnifier tool first), and hit 'S'. If a track has many isolated regions, sometimes they all need to be moved at once. This can be done by selecting the track and using Edit/Combine, which will also prevent inadvertently moving part of a track and allow for making global changes like normalization. Ctrl-up or Ctrl-down will move a selected track up or down the track list, and click-dragging the track's edge - i.e. within the list area - will adjust its height.

To export a track, first make sure the start and end markers are where you want them and return the playhead to the start marker. Then select "Session/Export to audio" from the main menu and follow the instructions from there to pick a destination directory for your file. Tracks that are muted will not be included in the export. Note that you can export the whole song or export individual "stems" (tracks). The latter is very useful when collaborating with another musician or producer/engineer.

Other DAWs for Linux

If Audacity and Ardour are not to your liking, there are other options. **LMMS** is available in the Ubuntu Software Center and is a simple install. It is somewhere between the two recorders we just looked at, and has a colorful, quirky layout. LMMS boasts native support of VSTs, and comes with some nice pre-installed plugins. It is not as full-featured as Ardour, but a bit less complicated and free. https://lmms.io

Note: **The following applications are not included in the Ubuntu repositories and are therefore not officially supported.**

Renoise has a $75 license fee. It uses a unique vertical scrolling tracker and uses QWERTY keys as the keyboard. Check out the tutorial video at: http://renoise.com/products/renoise

You can get **Reaper** for $60 (60-day free trial). It's sleek graphic design recalls, well...Ardour. Reaper also supports VST plugins. I have never used it, but there are a number of video tutorials on their site: https://www.reaper.fm

Bitwig, Computer Music's DAW of the year for 2017, will set you back $300. Always check the hardware requirements before you buy any software. The design looks modern with a lot of customization efficiently embedded in multi-purpose controls. Glancing at the video tutorials suggests a big learning curve is in store. But it is popular and it runs on Linux.

Don't forget to read the latest news about Ardour. Here is a theme pack that includes themes called "ableton-like", "blueberry-milk", and "cubase-like": https://community.ardour.org/node/13685 if you are more accustomed to one of those DAWs or just don't like the default skin. [Note - I have not tested these skins] https://ardour.org/whatsnew.html

Who knows what options will come down the pike? You can even install a DAW on a tablet (check your available space first!). It is probably a good idea to find one DAW that suits your needs and stick with it for a while. While it's true they all have things in common, as this book illustrates, there's always the buried menu item or secret command. Why learn the ins and outs of many DAWs when they all give you a similar result? Also, in making comparisons, bear in mind we have only scratched the surface of Ardour's capabilites in this chapter. Ardour's online manual is far more thorough and very well-written.

We have covered the basics of multitrack recording in Ubuntu Studio. Now let's have a look at non-native plugins to broaden our selection of sounds and instruments.

Using VST Plugins

Virtual Studio Technology (VST) is a standard for software synthesizer and effect plugins invented by Steinberg (maker of the Cubase DAW).

To get started, here is a remarkable and very popular free synth from German vendor U-He: https://u-he.com/products/zebralette/

Download the Linux version and unzip it to your ~/.vst directory. If the ~/.vst directory doesn't exist, you can create it.

One of the programs that can be used to run and manage VSTs is Carla. Here's how to get it:

Install and Run Carla

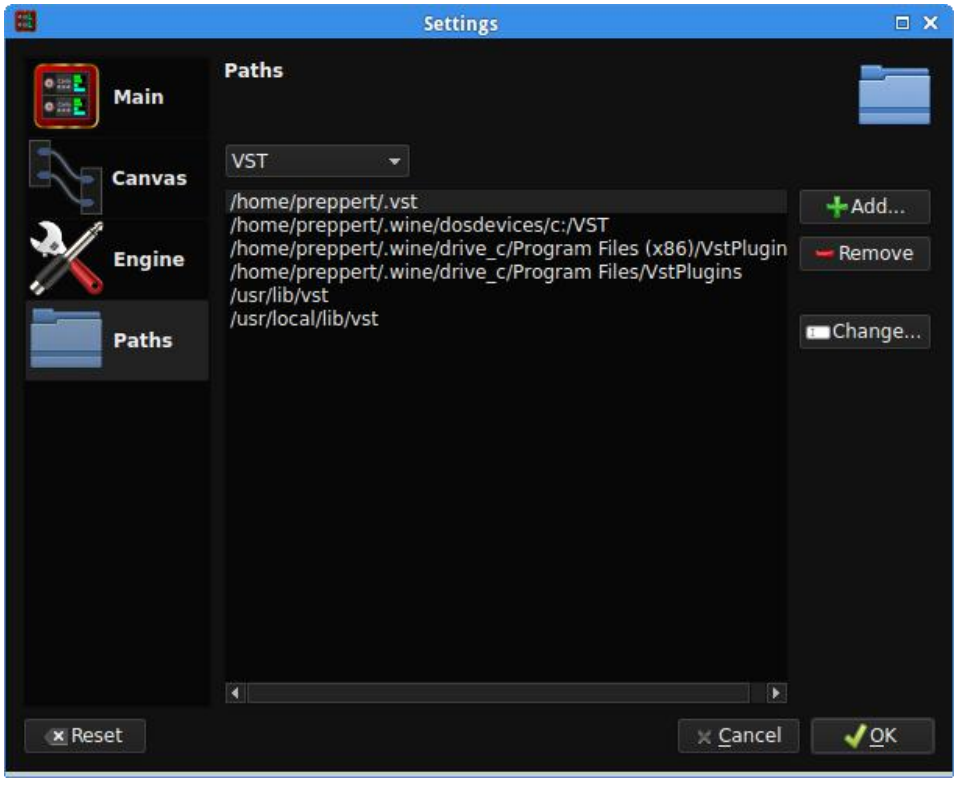
Note: **The following application is not yet included in the Ubuntu repositories and is therefore not officially supported.**

Go to http://kxstudio.linuxaudio.org/Applications:Carla and scroll down to the list of pre-compiled binaries, clicking on Linux 32bit. You should be prompted to uncompress the file; make the destination directory /usr/local/share/carla. To start the program, make sure JACK is running, then open a Terminal window (it should be on the main Ubuntu menu or under Accessories/Xterm). At the prompt enter the following command to launch Carla: /usr/local/share/carla/Carla

Configuring and Using Carla

On the far right of Carla's top menu, click "Configure Carla" to see the Settings pop-up window. Go to "Paths" and make sure "VST" is selected in the dropdown at the top center of the Settings pop-up. Add the full path to the directory you created earlier, unless it's there by default. It might look something like this: ~/.vst

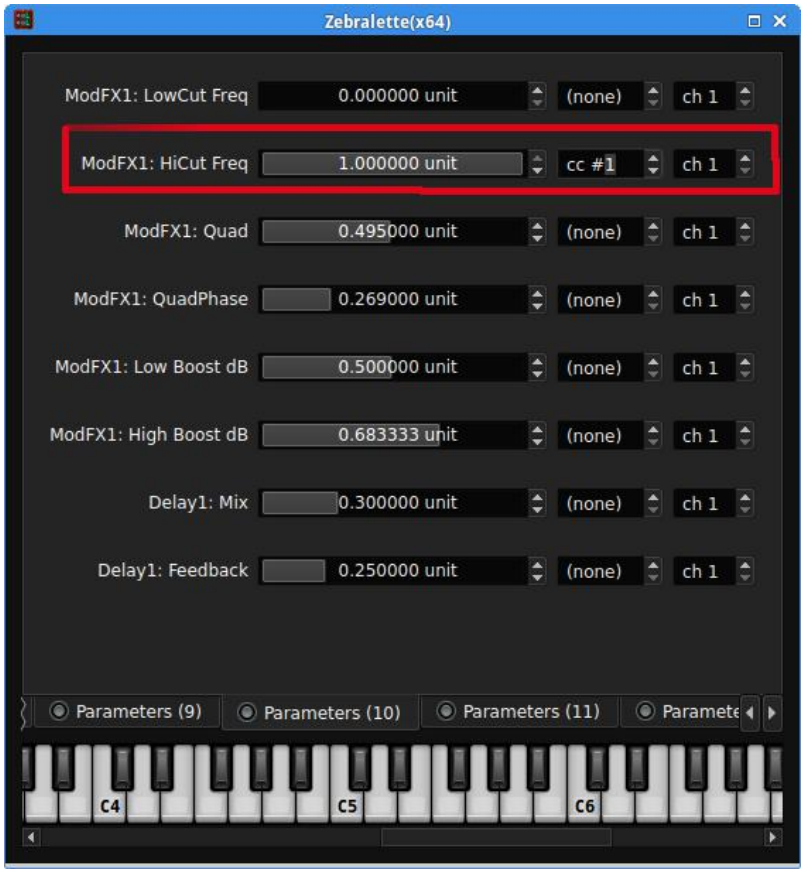
Also check the project path under Carla's "Main" tab. Click "OK" to save your changes and dismiss this window. Finally, click the "+ Add plugin" button, and click "Refresh" on the subsequent pop-up window. Carla will search for Zebralette and any other VST plugins you've installed under the VST path. These may take a while to load, during which time it will look like Carla isn't doing anything. If you get an error message, loading may have simply timed out - try it again a few times. When the plugin becomes available, it will also show up in JACK, where you can connect it to System and your MIDI controller. Check that everything works. Back in Carla, you can see the GUI for this and other VSTs by clicking the gear icon (white gear at top left the following screenshot).



Once you build up a collection of VST plugins and have a number of projects, you should take advantage of the ability to save and restore a Carla rack combination, which can load several instruments at once. Your plugin rack will be saved with a file extension of .carxp. If you have a favorite rack configuration, or used certain plugins for a project, storing a rack is a great time saver. JACK configurations can be stored, too.

Zebralette and other free VSTs may have been released a few years ago, but that doesn't mean you can't make fresh-sounding music with them. Always check out commercial offerings and/or consider a donation to the developer if you end up making heavy use of a particular plugin. Most have a PayPal tip jar. Carla's wrench icon is important because it allows you to bind synth parameters like filters or the VCA rate to knobs on your controller, such as the modulation wheel. Just find the Continuous Controller number for a given knob, and set that as the CC# for a given parameter in the wrench's pop-up window. Your controller's manual will show the CC assignments. In the following example, the modulation wheel is CC# 1, and is being used to control the Hi-cut Frequency (circled in red).

Zebralette's rich and varied sounds come from the ability to stack and draw custom waveforms. The Presets tab on this "morphing" synth is the third tab from the left on the bottom tier.



Any parameter can be bound to a given CC number. Multiple parameters cannot be assigned to the same CC number. Settings can be stored and recalled.

It's not difficult to find free VSTs, but here are two sites that have hundreds, if not thousands of free plugins: http://vst4free.com which sorts by name, rating, and last added (in addition to giving a random list when you first roll up on the site) and http://vstplanet.com. Note that not all freeware uses legally-obtained samples. Additional reviews of some VST plugins appear in the appendix.

Do know that many VSTs are built for Windows, which requires WINE and a plugin bridge. A part for that process may be added to this section at a later date.

Advanced Recording in Ardour

I hope that you have taken time out from reading this book to experiment with some of the synthesizer plugins and to make at least one short recording, not because it's necessary to move on, but for fun. Now we'll review some additional features and techniques of recording in Ardour.

Punch-ins

If you have a near-perfect take with one or two glitches, it's possible to set the track to record only a glitch region. Using the Range tool, highlight the part of the track where the glitch is. Then right-click-hold that highlighted area, and choose "Set Punch from Range" in the middle of the dropdown menu that will appear. Two Loop/Punch Range markers will appear in the marker area. Zoom in to make any fine adjustments to where the recording will start and stop. Arm the track for recording, place the cursor a few measures prior to the punch-in region, and you can safely correct the glitch without affecting the rest of the track. One limit to this technique is where there's a sustained sound like a ride cymbal along with the glitch. If there is no break in the music, and the punch-in just isn't right, try recording just the glitch passage to a new track. You can then select and cut the offending region in the original track. This new take is best done in the same session, so all the levels are the same.

Looping

Maybe that glitch is happening over a tricky part of the song? You can set a loop with the range tool to rehearse it. But let's review using the pointer tool to select a region. Place the pointer in the selected track at the beginning of the first measure you want to loop and strike the 'S' key to split the track. Repeat this at the end of the last loop measure, then

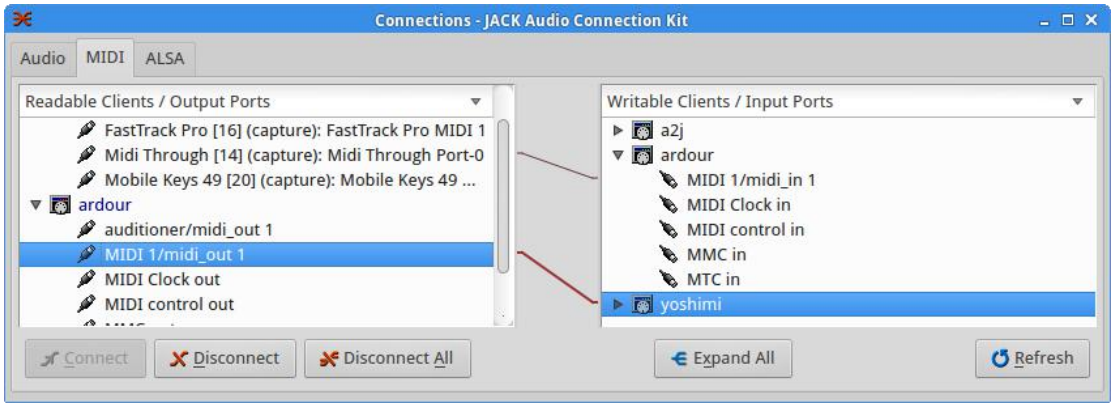
click in between the two split points to highlight the region. In the main menu, go to Region/Loop to enable looping.

MIDI Tracks

You can import a MIDI track or record one from scratch in Ardour. Keeping the note values separate from the audio is useful for a couple of reasons: quantizing percussion and auditioning different patches to play a melodic part. And it's simple to set up. Go to Track/Add Track or Bus, and use the popup's second dropdown menu to specify MIDI. The default label identifies the track as a MIDI track.

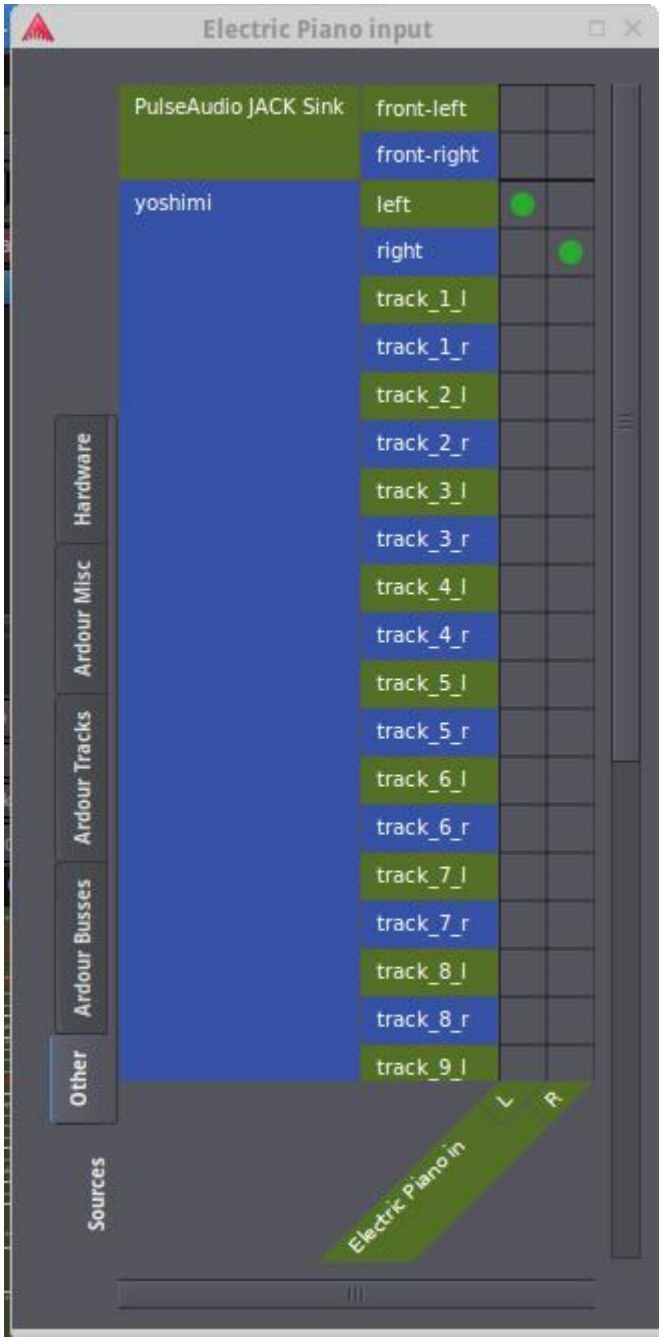
By default, this new track is connected to MID through and will use the native Reasonable Synth as a sound generator as seen in the Mixer window. In JACK, connect your controller's MIDI out to MIDI Through and you're ready to record the MIDI track.

Now you can open any virtual synth, and assign the MIDI out from the new track in Ardour to it's MIDI in, under JACK/MIDI (click ardour to display the dropdown as in the screenshot below).



Connecting Ardour's MIDI out (left) to a virtual synthesizer (right).

In the Mixer window, set the input of a new track to the output of the plugin being played by the MIDI track, and arm this new track for recording. The plugin will appear under the Other tab (see below).



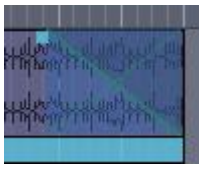
Yoshimi's output connected to EP input

A MIDI track can be imported like a wav file, and the same technique used to play it or record audio.

Fade-in and Fade-out

Mouse over the very beginning or ending of a track, then click and hold the handle in the upper corner - a curved icon should appear. Drag to

define a fade-in or fade-out zone. Note, this technique also works in Audacity.



Automation

One of the coolest features of Ardour is the ability to automate track attributes like volume, panning, trim, and muting. Automation will appear in its own "lane" associated with a track. You will create a curve made up of control points (which you can add or subtract as needed). The four modes are manual (overrides automation), play (use the curve to control the parameter during playback), write (set the automation in real-time), and touch (hand-edit only part of the automation curve, leaving the rest alone). To see all of the automation lanes, just click "a" under the track name. The parameters have dropdowns set to "manual" - changing that to "touch" for the L/R (pan) automation lane made it possible to create the curve in the following screenshot by maniputlating the slider during playback. You can read more about automation in the Ardour manual - it can even be applied to instrument parameters!

Grouping Tracks

When a song has a large number of tracks, it may be necessary to apply the same action to a subset of those tracks. As you might have guessed, the "g" button next to the "a" button lets you create and assign groups, as well as what properties the tracks will/won't share.

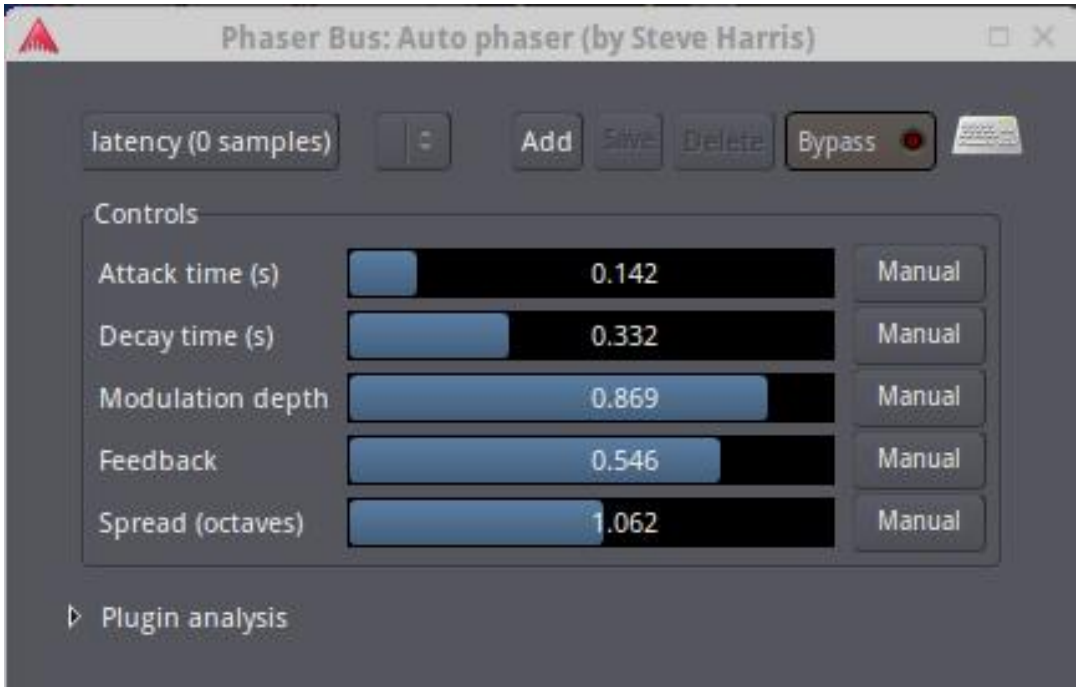
Strings and Sinnah have been assigned to the "Pad Stuff" group, which was made bright green using the color picker we saw earlier. Grouping is also possible when first creating a track.

Creating a Bus and Inserting Effects

A physical mixer has auxilliary send and return "buses" that are typically connected to a rack-mounted effects unit and can be applied to individual channels, with the amount controlled by a pot. Thus the vocalist can sound like she is singing in the shower while the guitar remains dry. Ardour carries the metaphor through, as you may have noticed under "Track/Add track or bus". Let's say you have many hand percussion instruments on five or six tracks and want to apply reverb. Instead of putting a reverb effect on each track, you could create a bus with the effect you want, adjust the sound, and then use the sends in those tracks to apply it uniformly. This can be done pre- or post-fader. Here are the steps:

1. Add a bus under Track/Add track or bus
2. In the mixer, add an effect to the new bus by right-clicking in the blank area between track controls and selecting "new plugin" from the popup. Scroll to the desired effect and click on it.

3. Still in the mixer window, at the bottom of each channel that you want to apply the effect, change the destination from "Master" to your new "Bus In".
4. With the song playing, double click the effect and use its "Bypass" button to toggle it on and off to confirm everything is hooked up correctly. For testing, you might also want to crank up that effect's parameters to make the comparison less subtle as in the screenshot below.



Setting up a bus is a little bit of work, but not bad for something so powerful. Note that effects can be added per track without using a bus.

Additional Advanced Topics

It's out of the scope of this book, but video editing is possible within Ardour. You can rip the soundtrack from a video, view it over a timeline, even frame-by-frame, and make all the moves needed to create that Hollywood movie soundtrack of your dreams.

Right-click and hold in a track's charcoal area to browse and add effects. Here a flanger was added to the EP track.

LinVST

In the course of writing this book, I came across a relatively new way of using Windows-only .dll VST plugins in Linux. It looks like the setup is fairly involved, but the general principle is that a program is used to copy the Windows .dll file to a .so file, and they are stored together. A Linux DAW can then read the .so file. No need for Wine or Carla. You can read more about it here: https://github.com/osxmidi/LinVst

Mixing and Mastering

You've already been mixing - adding effects to tracks, adjusting faders with relation to one another, and so forth. Mastering is the final touch that helps make all tracks on a CD sound uniformly clean and balanced. Mastering includes frequency analysis to boost some parts of the spectrum that may be getting swamped, and notch out frequency spikes. It's an art unto itself. In fact, top musicians with years of studio experience tend to leave mastering to professionals. It can't hurt to at least understand what mastering is and how it differs from mixing, though. For the purposes of most people reading this book, an excellent mix may not require much mastering work, if any.

Earlier, I suggested normalizing a track that had a small waveform. Now I will take that back because normalizing tends to leave little to no "headroom" - the track is now very loud, so loud that if you apply compression, it will clip. Clipping is when the level meter goes into the red, and can result in horrid distortion on playback. Compression narrows the difference between loud and soft sounds in a track, hence allowing more room to increase the gain before the track clips (because the peak volume is lowered). This leveling has the effect of adding crystal clarity and presence to just about everything. Once you apply it, you may find yourself wanting to trim back those faders below zero Db! But that's a good thing, because it shows the signal-to-noise ratio is improved.

You will also see limiters in the list of audio processors - these do essentially the same thing as compressors, only with a high ratio and faster attack time. Sometimes applying a low- or high-pass filter can quickly eliminate frequencies you just know are irrelevant and possibly muddying a track - think piccolo or bass drum. While the timbre of some sounds such as the human voice can rely on harmonics over a broad frequency range, for other sounds a filter might be the right tool, especially if there is a glaring artifact showing up. These processors can

be applied to individual tracks and/or to the whole song. In the Mixer, click on that blank region above the fader of any track or the Master track and select plugins/plugin manager. There you will see dozens of pre-installed effects and processors, many of which are frankly redundant. Notice the ability to favorite - checking that off will add the current effect to a short list under 'favorite' plugins the next time you add effects. I recommend starting with Calf Analyzer to get a view of levels across the spectrum. You can then deploy an equalizer or other tools to tweak those levels, but some caution is warranted. If you just go by your ears, you may be deceived by whatever monitors you are using, especially headphones where one is tempted to overcompensate the low end. A conventional piece of advice is to play back over a few different speaker systems. Also, trust the 'scope! The best way to understand mastering is to see it done live. Here is a great video on the topic from YouTube channel Mastering Monday, that includes a list of gorgeous free processors to try out:
https://www.youtube.com/watch?v=FzNweEPg-2U

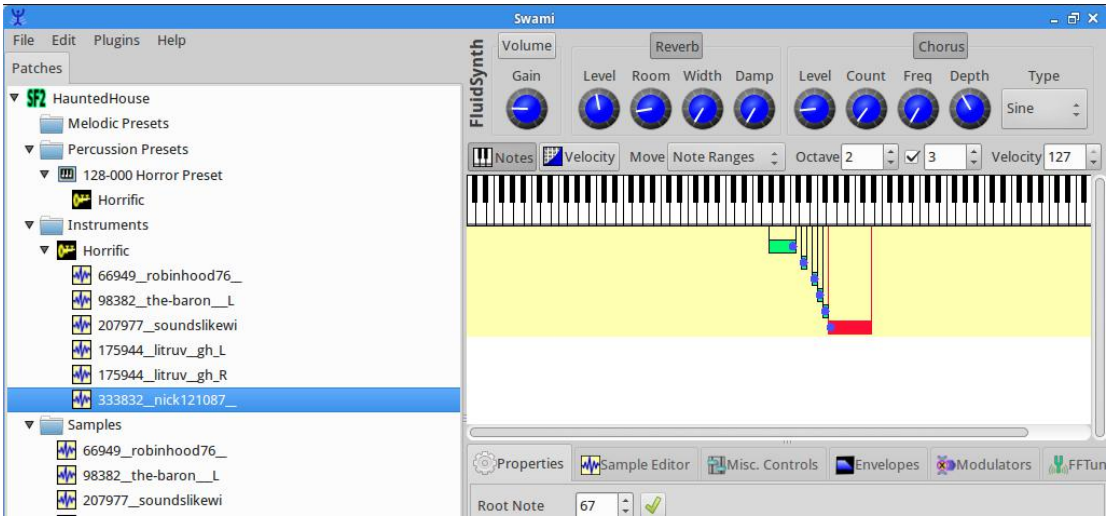
These did not all run on my system, but I liked Bluecat Audio's FreqAnalyst, and Tokyo Dawn Productions' Slick EQ, which includes saturation, a way to add a bit of warmth to digital recordings. Having tried out a few of these tools, my favorites list ended up with mostly standard Calf plugins. They come with an intuitive GUI and get the job done.

Mastering is an art, and getting the mix just right on a complex recording can be vexing. Really doing the subject justice is beyond the scope of this book. Please check the library, online resources, and the electronic music section of your local bookstore for more information on this very deep topic.

Creating Your Own SoundFont with Swami

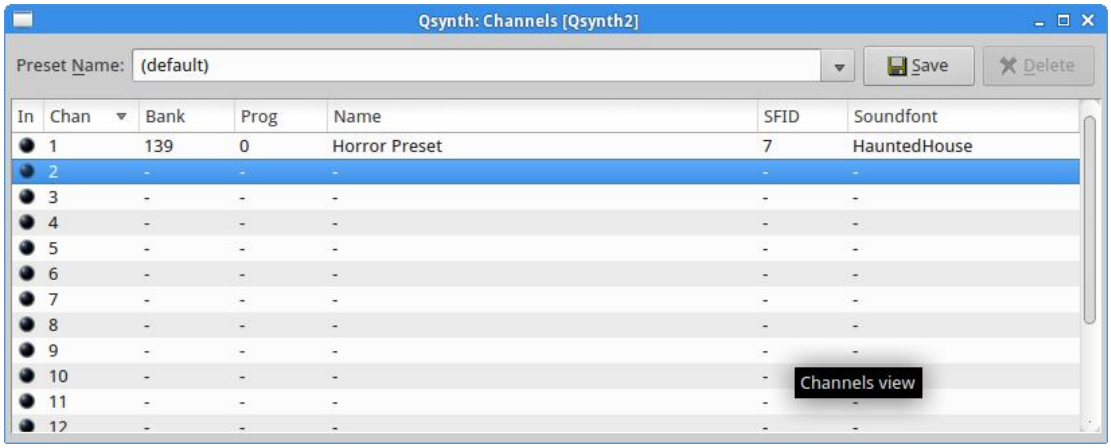
Swami is available in the Ubuntu Software Center. But first, you will need some samples to import. Hook up a mic to your soundcard, and record individual notes, percussion hits, or sound effects using Ardour and save in wav format. If you are recording individual notes on an instrument, be sure to include the corresponding keyboard note value in the file name for ease in mapping later. Of course, it's not necessary to make new samples - for the purposes of learning to use Swami, any short wav file will do. In the example below, I used sound effects from freesound.org.

Now install and open Swami. Select File/New soundfont, name it, and click the arrow next to the green SF2 icon to see the soundfont's folders. Right-click the Samples folder and upload the wav files you gathered via "Load Samples" menu option. Once the samples are in the folder, highlight them one-by-one, and assign them a Root note in the Properties tab (bottom center of window). If these are tuned samples, make sure the root note corresponds to the pitch of the sample. Now right-click the Instruments folder and create a new instrument. Then simply drag the samples you want into that instrument. At this point, if you press the keys on Swami's virtual keyboard, things won't sound right because all samples default to play over the entire range of the keyboard. Click on the samples within the instrument and narrow the corresponding green bar to agree with the range of keys over which it should sound.



Finally, create a new Preset, and drag the instrument into that Preset. A Preset can have multiple instruments, but at this point, the soundfont is ready to play. Just save it in a dedicated soundfont directory with the .sf2 extension. Note that Swami has a wave editor that can help find the loop point for samples you want to play continuously as long as a controller key is depressed.

Open Qsynth to test the soundfont as an instrument. First import the soundfont to Q1 or Q2 via "Setup/Soundfonts/Open" - navigate to the soundfont folder you created and import the new soundfont. In the Channels tab, double-click next to the MIDI channel you wish to assign to your soundfont, and pick the soundfont from the pop-up list (since this is your first soundfont, it should be the only one on the list!) Make sure all connections are correct in JACK, with the keyboard MIDI going to Qsynth and Qsynth connected to Audio/System.



A soundfont comprised of horror movie sound effects loaded to Qsynth2, set to MIDI channel 1.

For a video tutorial of Swami with a few more details, such as making your soundfont velocity-sensitive, see: https://www.youtube.com/watch?v=8a3kS9b9gRg

General MIDI

There is a standard mapping of sound banks in MIDI, so that someone composing for, say, a computer game could create a MIDI track and know that the bass line would be played back as a bass sound. If your soundfont has multiple instruments, this could prove a good way to arrange them. You can find the list in the back of this book or here: https://www.midi.org/specifications/item/gm-level-1-sound-set.

Sharing Your Music

It's remarkable how many creative people know little to nothing about intellectual property. That's why, even in a book about open source shareware, it's important to discuss.

Creative Commons

Unless you have a million dollar marketing campaign behind you, you're probably going to want to just post your music to a blog or some streaming sites and be done with it. Downloads don't make up a very large percentage of revenue, even for most established acts. And physical recordings, while nice to have at gigs, are considered a loss leader by many. Can't someone just rip your CD and file share it? Still, you might want to take some basic steps towards controlling how your music gets used. With a Creative Commons license, you can, at the very least, clearly express your intent - for example, a song might be in the public domain for personal, non-commercial use, but you retain rights in the song if someone wants to use it for a TV commercial. Just go to the web site, fill out a very short form and you will get a link and code you can embed that shows at a glance how the song can be used, including permission to create derivative material and whether the work should be attributed to you. Creative Commons is a reaction to what some feel are overly-restrictive copyright rules, extended by the 1998 Sonny Bono Copyright Act to 70 years after the holder dies. The whole point is to allow artists to expand the public domain without putting themselves in a position with no recourse should someone else commercialize their work. I believe this fits well with the ethos behind open source software. There is an example of a CC license in the frontispiece of this book.

https://creativecommons.org/choose/

Copyright Registration

The next step up from Creative Commons is to register your music for copyright with the Library Of Congress. If you read their FAQ (link is below), you'll see that as soon as a creative work is put down in a "fixed medium", you own the copyright. From there, it's a matter of building up evidence that you created the work - this can include performing the piece, and of course the registration counts (mailing your song to yourself does not hold up in a court of law). The price for online registration is $35 per song (not work made for hire, and you are the only author), so you might want to consider how many registration forms you want to submit.

https://www.copyright.gov/help/faq/faq-register.html

Royalty Collection Agencies

Publishers get half of the royalties for songs they sell on their client's behalf. This is why most professional songwriters establish themselves as publishers! The problem is, as individuals, we don't have the same connections and distribution capabilities as a true publishing operation, and should you be so lucky as to get a deal, that will almost certainly involve giving up the publishing, at least for some period of time. Some artists are hoping the blockchain method of payment and distribution cuts out the middleman and can help enforce CC-like licenses. Still, you might want to join ASCAP or BMI to list your original music with them, in case there are ever royalties to collect. Your membership could also prove useful in getting paid on collaborations and other projects. There is a lot more to the subject of intellectual property and business models in the internet age. It should go without saying that you should consult an entertainment lawyer before signing anything.

Making a CD

Despite the decline of the need for physical discs, surprisingly many people cannot deal with MP3 or other digital formats and prefer old school audio CDs. It's also good to have CDs at gigs. The simplest way to make a few CDs is to burn copies on your computer and bust out the Sharpie pen. Under the main menu in Ubuntu Studio, navigate to Media Playback/Brasero to find a no-frills CD burner. You can just drag your wav files into Brasero's file list. Click and drag .wav files to change the playing order. Click individual files to set the properties such as Title and Artist. When the song list looks good, if you have not already done so, insert a blank CD, and be sure to select it as the destination. Press the "Burn" button - accept or edit the default settings on the subsequent pop-up, and presto - the CD will write. You can elect to make more than one copy, but definitely check the first copy before inserting more discs.

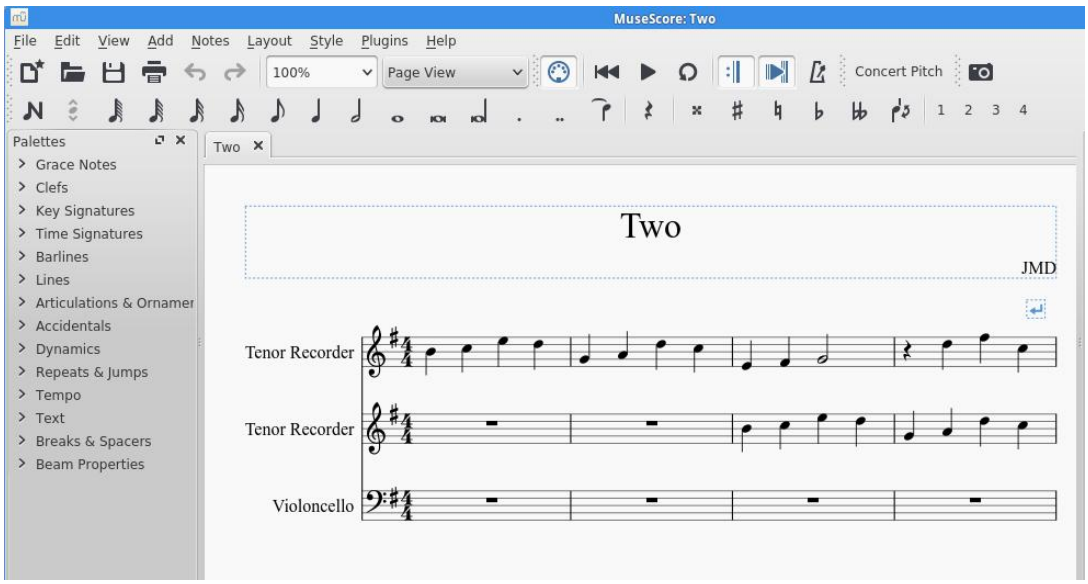
As for that Sharpie pen, there are a couple of options to make better-looking CDs. One is to get Avery CD labels. There is a PDF template that will help you line up your artwork so you can print these sticky-backed labels on your home printer. Ubuntu Studio comes with Gimp image editor pre-installed, and Gimp can edit and save the PDF template. Adhesive labels fell out of favor some time ago for getting stuck in some CD trays. If you go this route, use a label pressing device to assure the label goes on evenly with no creases or bubbles.

There are dedicated CD printers that use special blank media, but such printers are costly. Having your CD professionally printed in small lots turns out to be relatively affordable and the end result will look terrific. They will also provide a handy template that provides a printable preview, if you want to make the cover yourself. You can easily find graphic designers to do this online. If you are having CDs made up for a gig or special occasion, be sure to allow ample time for production, mailing, etc.

I will assume you are already familiar with the many streaming sites where you can post your music for downloading. For podcasts, don't forget the Internet DJ Console (screenshot in chapter 3).

Sheet Music With MuseScore

Of course you can make ditigal music without ever touching an instrument. Platforms like Ubuntu Studio have democratized music and let's face it - learning to play an instrument well takes dedication. But musical notation, evolved over hundreds of years, is how we communicate ideas with other musicians. The beautiful clef signs, brackets, and rests no doubt took their form in part because they lend themselves to the quill pen. No discussion on sharing your music would be complete without mentioning MuseScore, which can produce very complex music charts entered by hand or imported MIDI file - no quill pen required. I will leave you with a screenshot of a user-submitted file and refer you to the online manual (see Help) for further information.



Musescore's notation is both comprehensive and elegant.

Sound Synthesis 101

By now you have seen quite a few virtual synthesizers with a bewildering array of GUIs. In this section, we will try to see what they all have in common with the goal of being able to modify and create patches.

In the most general terms, a synthesizer is an electronic instrument that sends one or more pure waveforms through a pipeline of filters and other processors to modify and mangle that waveform. The classic starting points are the sine, the square, the sawtooth, and noise. Pulse and triangle are also fairly common. Some hybrid waveforms are not unusual, and as we saw in Zebralette, some instruments let you draw and stack waves to produce very rich sounds. These geometric names are derived from how the sounds appear on an oscilloscope, which shows voltage over time, allowing analysis of things like frequency and amplitude of a signal. The pure tone is a single frequency sine wave (note that the other wave shapes can be constructed from sine and cosine waves). In theory, by crafting sounds the right way, it should be possible to recreate sounds of real instruments and nature. In practice, with a few exceptions, analog synthesizers can only approximate "real" instruments. Highly convincing, realistic patches were brought about in the 1980's by sampling synthesizers, which could be argued as cheating, since a sample, as we've seen, is just a little digital recording (and having a precise clarinet sound only showed how the keyboard could not convey all the subtleties of the human mouth tooting on a slobbery reed). In any case, it helps to listen to the unmodified waveforms to get a feeling for the starting point - many plugins have a plain vanilla initial patch that is a pure tone. A sine wave sounds like whistling or blowing across the top of a bottle, a sawtooth wave sounds a bit like it looks - like a buzzer. White noise is static and can be used for sound effects like wind or ocean waves and percussion sounds.

The short explanation for a 1970's analog synth's inability to recreate natural sounds is that those sounds are composed of many overlapping

waves, not just one or two. The long answer involves complex Fourier analysis of sound waves. But synthesizers opened up a whole new world of strange and novel sounds that gave birth to electronic music as we know it today (with proper credit to early studio pioneers who were happily making what can only be called electronic music well before the invention of the modular synthesizer).

The timbre of a patch is comprised of its spectra (those waveforms) and its envelope (fast or slow attack, ringing or abrupt ending (decay), etc - drum hit versus a bell versus a slow violin crescendo). So creating your own sound is just a question of figuring out how to mess around with those two elements of timbre on any given synthesizer. A perfectly valid approach to this is to stop here, and just start "knob twisting" at random, hitting "save" when you get a pleasing result. You will soon learn what "LFO" does, even if you don't know that it means "Low Frequency Oscillator" - and after all, does knowing what the initials stand for help much?

Here are ten quick ways to modify the basic waveforms on any synthesizer. These won't make you an expert sound designer, but hopefully will de-mystify all those crazy knobs and initials. Not every synth has all of these capabilities.

Knob acronyms

VCO Voltage Controlled Oscillator: created the raw waveform, so this is our starting point.

LFO Low Frequency Oscillator: add tremolo or vibrato.

VCF Voltage Controlled Filter: add sweeping wah effects.

VCA Voltage Controlled Amplifier: gain (note - this is probably post-ADSR section)

HPF High Pass Filter: knocks out low frequencies

Ten things to try on any synthesizer

1. Go straight to the cutoff filter or VCF to smooth out the sound. This is kind of skipping some steps, but it's one of the most noticeable things you can do to affect the sound on any synth. You'll notice that slowly modifying the cutoff frequency makes the classic "sweep" sound, and it should be possible to use another control, such as the LFO, to automate that sweeping as the note is held down. Early modular synthesizers allowed you to connect anything to anything and see what happens. In the same spirit, most plugins have a way to route a controlling signal from here to an oscillator over there. Take a moment to look at the panel and break down the various sections and the signal flow.
2. The most understandable and quickest way to modify a sound is to play with the envelope, which will be labeled "ADSR" for "Attack, Decay, Sustain, Release". Let's say you pluck a guitar string. The attack is the ramp up, which is pretty abrupt, the decay is the other side of that initial pluck - the time it takes to reach the sustain time (the remaining time the note remains level). The release is what happens when you let go (or lift your finger from the key). In the case of a real guitar, the sustain would be about three or four seconds and the release would be around zero. It's fun to give a sound a very long release so you can just tap a key and listen to it slowly fade. Some sounds lend themselves to a gradual attack, although if it's too slow, it may feel out of tempo in the context of a particular recording. Smaller changes to the attack come closer to emulating real-world differences which are in the millisecond range. A snare hit is instantaneous, a tuba or french horn is less precise, and the sound of a gong may peak well after it is struck. Organ notes play at one volume and stop the second you release the key. All of these aspects to sound are governed by the ADSR section, and changes to the sound from the other sections

generally happen over time, so the ADSR is indirectly affecting those, too. Note that some plugins will also have a "hold" (H) parameter that may be used to set a fixed duration for sustain or the full volume of the attack, ans have "ADSHR" or "AHDSR" sections.

3. Try creating a cymbal crash by using only white noise, then tweaking the ADSR. What happens when you make that cymbal a very short blip?
4. Another instant alteration of a waveform is ring modulation, if it's available. This gives a harsh bite to your sound, almost the equivalent of adding overdrive and a little distortion to an electric guitar (those sorts of patches very likely use ring mod or resonance). Usually you only need to enable it, but try tweaking it to be more or less subtle.
5. Just jumping the octave can alter a patch in unexpected ways. Does that "Killer Bass" also work as a lead patch when played in a higher register? What if you knock it upstairs then tweak the envelope a little? Many synths have a button to transpose an octave at a time (and another way to change properties of a note, including pitch).
6. Try the LFO to chop up a sound or add wobble to a sound.
7. Portamento, anyone? This is another parameter where a little goes a long way. Overdo it and you're left with a cartoony slide whistle that is only any good for a special effect. But adding just a touch can juice up a lead sound nicely. You'll notice a fair number of presets use it that way.
8. If there is an effects panel, slapping on some delay can high a high impact. Put another way, I have noticed removing the delay from certain rompler (sample-based plugin) patches (I won't name names) reveals the underlying sound to be less than inspiring. Re-enable the delay and it's ready to go to Mars.
9. Many synths have multiple oscillators. A quick way to get a more sophisticated sound is to detune one or more waves just a tiny bit.

So look out for a knob that says "detune". That is a quick way to get a fat, hovering sound.

10. One last section that is not on nearly enough synthesizers is the arpeggiator. This will automatically play notes you hold down, and often you can choose in what sequence - up and down, only up, only down, random, or in the order in which you play them. This classic synth trick can be the basis for a whole song!

So far, this discussion has focused on analog synths because a lot of free VSTs are analog emulators. There are many different approaches to sound synthesis, and the description for each plugin will say which type of synthesis it is are using. Some instruments purposely take a radically different approach to either the interface or to sound generation or both. For me, the more quirky and experimental, the better. But occasionally, a plugin is just impenetrable. In that case, just go with the presets or move on. You should not have to battle a synth just to tweak a patch. On the other hand, it is only fair to read the manual. I mostly stick with presets, but still feel a passing familiarity with the history of how synthesizers have evolved, the lingo, and the capabilities is important - a short list of resources appears in the appendix. Go forth and knob-twist!

Approaches to Sound Synthesis

Here are very brief descriptions of some of the major types of synthesizers that you will see recreated as plugins. Between other methods not mentioned and hybrids, this is just scratching the surface.

Subtractive

- Applies filters to complex waveforms. Can employ Pulse Width Modulation, which sounds like a chorus or detuning effect.

Formant

- A subset of the subtractive approach that pays attention to the formant or characteristic frequency peaks associated with the resonant cavity of the instrument being modeled.

Modular

- Early 1960's synthesizers such as the Moog and Buchla were massive component racks; individual components were connected by patch cords. These analog synthesizers were bulky and expensive. In recent years, there has been a resurgence of interest in modular synthesis, and there are emulators that let you draw a "cable" between inputs. It's still expensive to build a "eurorack", so a plugin is a great way to test the waters, if you aren't sure it's for you.

Additive

- Adding waveforms results in more harmonic overtones - the components of natural sounds mentioned before.

Frequency Modulation (FM)

- Through multiple oscillators and a more graduated voltage control scheme, digital synthesizers like the Yamaha DX7 (1983-1989) offered sophisticated sounds at an affordable price.

Wavetable

- Uses random waveforms as the tone generator.

Phase distortion

- Starts with more complex digital waveforms In the Casio CZ series, which also emerged in the 80's, the digital filtering and amplification also went through an eight stage envelope, allowing

for sounds that evolved over time more than could be achieved with the usual ADSR.

Physical modeling

- Ever greater processing power allowed for mathematically modeling not only the detailed harmonics of an instrument, but other parameters such as the resonance of the body.

Sampling

- As we've seen, samplers are digital recordings of individual notes that can be played back at different pitches. ROMplers are plugins that rely on sample presets - both keyboards and plugins can apply additional filters and effects to samples, layer them, etc.

Granular

- A sample is chopped into millisecond bits which can then be layered, played back at different speeds, and processed.

Patch Tutorials - Funk Bass

Let's apply some of the above ideas to make a simple funky bass, a classic analog synth sound. This need not be polyphonic, and it will have a very short, almost clipped envelope. It needs to be thick and needs to go "BOW-BOW-BOW", which effect will be achieved with a filter. We'll use the highly-rated Synth1, modeled after the Nord Lead Red. Download it to your VST directory from here (note 32 bit versions often work better than 64 bit):

http://www.vst4free.com/free_vst.php?plugin=Synth1&id=245

Start Synth1

Note: **CARLA is not yet included in the Ubuntu repositories and is therefore not officially supported.**

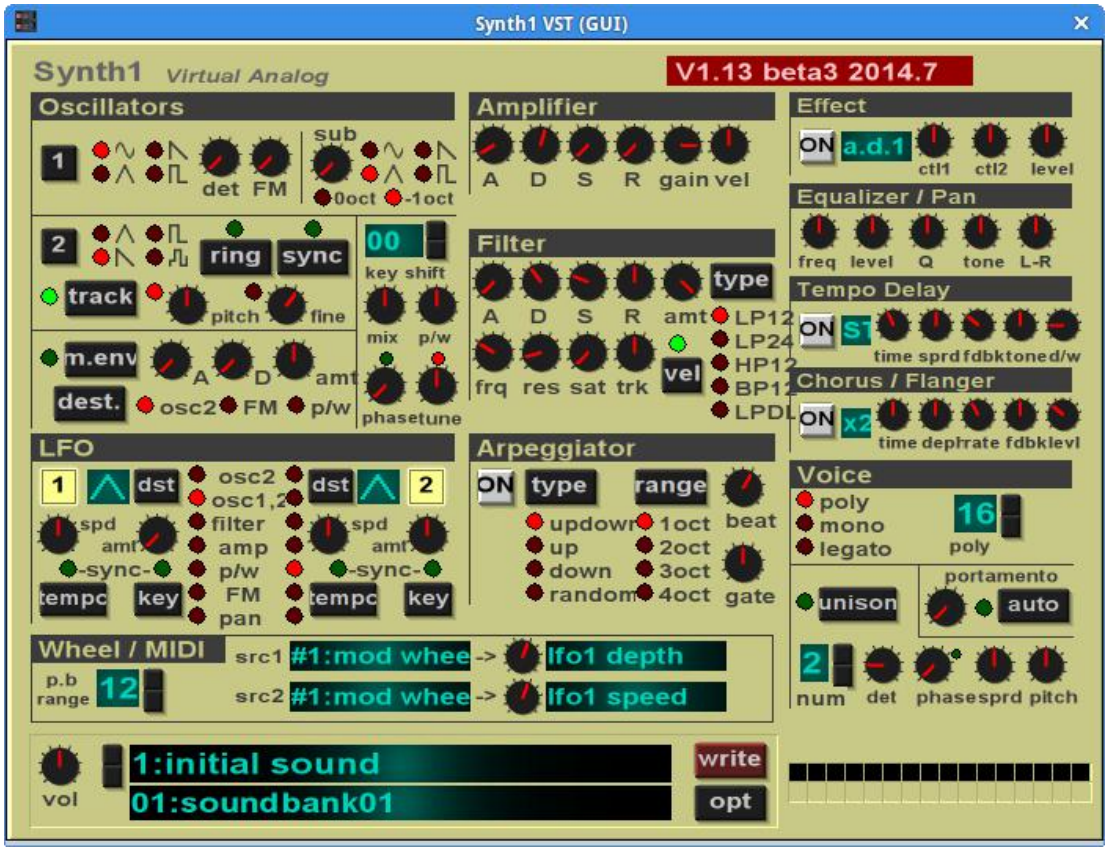
1. Open the terminal window and change directory to where you installed Carla, for example:

```
$ cd /usr/local/share/Carla
```

2. Launch Carla:

```
/usr/local/share/carla$ Carla
```

3. In Carla's window, click the green '+' sign (Add Plugin), and select Synth1.
4. Click the gear icon on the Synth1 rack unit. You should see the GUI.
5. At the bottom of the GUI, click soundbank. A popup window will appear. Select the "All" dropdown menu and navigate to 01:soundbank01(0) - this is a completely empty soundbank.
6. Load the first sound by selecting it, then close the soundbank window.
7. Now set the parameters to match the following screenshot.



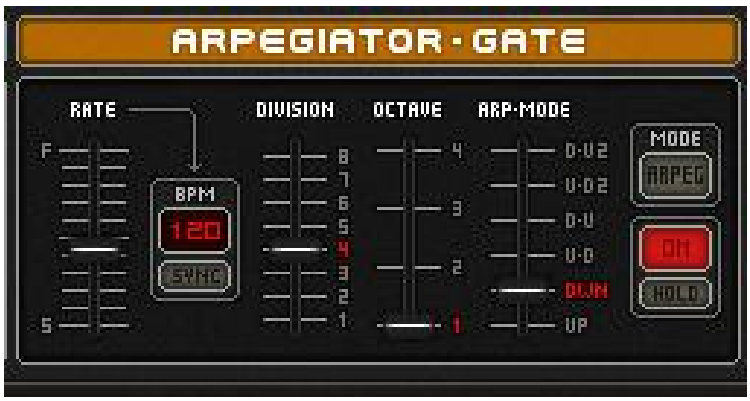
Notes on the Funk Bass setup:

1. In the far right panel, disable any effects by clicking the "ON" button until it goes gray.
2. To get the clipped envelope we're after, turn everything down on the ADSR control but the decay.
3. Choose the sine wave for oscillator 1.
4. Now just tweak the filter settings in the middle of Synth1's middle panel until you get somehting you like. For more wah, open the attack filter.
5. You can go back to Oscillator 1 and try different waveforms. Recall that sawtooth has more "bite"? Now you can hear that for yourself. Play with other parameters one at a time to see what effect they have on your patch.
6. If you like this patch, use the dark red "write" button at the middle bottom of the GUI. A popup will let you name the patch and save it to the empty bank for your next session.

Arpeggiator

To try out tip #10 above, download Poly 2106, a well-executed Juno 106 emulator, from here:
http://www.vst4free.com/free_vst.php?plugin=Poly_2106&id=1329

This plugin has very clearly marked "Arpegiator [sic] Gate" section at bottom right. Just click the "OFF" button so it changes to "ON" and turns red. Then play around with the controls in that section. Note that "HOLD" will keep the pattern playing even after you release the keys. Experiment with the other controls to vary the tempo and direction of the arpeggio. TR-GT mode lets you space chordal hits on a timeline, and they can be more or less legato.



Crafting Noise

Note: **The following application is not included in the Ubuntu repositories and is therefore not officially supported.**

Install TAL-Noisemaker from here:
https://tal-software.com/products/tal-noisemaker

The following setup modifies a noise signal. The envelope is set something like a crash cymbal, but instead of a static filter setting, LFO1 and LFO2 are controlling the filter. Adjust the rate on the LFOs to your

liking, or click the dropdown that says "Filter" to disable them. Note that Master/Sub is turned all the way down.

Disabling LFO1 and 2, slightly raising the Cutoff and Resonance, and shortening the envelope turns our wavy crash cymbal into something more akin to a hand-clap.

And what discussion of noise patches would be complete without the Helicopter sound effect? This one fades into the distance when you release the key.

Minor modifications to the envelope and other controls can change plain noise into different percussion sounds or sound effects.

Siren

Here is an example of controlling the pitch of an oscillator with the LFO. Install Pure Pone from here:
http://www.vst4free.com/free_vst.php?plugin=Pure-Pone&id=877

Certainly not the most musical setting, but a good demonstration of how to modify a parameter from another parameter, the essence of synthesizer programming.

1. Call up the patch called Analog 6 (because it is a relatively plain vanilla patch).
2. Turn off Modulation Bus 2, we don't need it.
3. Set Modulation Bus 1 source to LFO, it's destination to OSZ1-3, and the amount to MOUNT.
4. Crank up the Amount to about 6.
5. I set the LFO to use a Sine wave and the rate of this oscillator to about 3.
6. After playing around with the Oscillators, it sounds best with OSZ1 turned off, so toggle that switch.
7. Set the waveform for OSZ2 to triangle a sawtooth and octave to 0.

8. Set the waveform for OSZ3 to the triangle in the opposite direction of OSZ2's, and octave to 1.
9. Make sure any effects are disabled.

You should hear a slow rising and falling pitch.

- To make it go faster, increase the LFO frequency.
- To make it see-saw like a European police siren, change the LFO waveform to a square wave.
- To change the pitch range, adjust Mod Bus 1's Amount.
- Hear what happens to the timbre as you modify the waveforms of OSZ2 and 3.

I had a little trouble finding a plugin where it was simple to make the Siren patch, but I hope these examples were enough to illustrate that there is a lot in common from one plugin to the next in editing and creating patches. One or more sources (oscillators) is modified by various signal processors and effects, some of which may themselves be waves, some will be filters. Once the wave is shaped, it goes through the ADSR envelope, the the master volume control. Usually, these controls are in some kind of sectional arrangement. It just becomes a question of figuring out how to assign them. With a little practice, you will be able to imagine a sound and have a rough idea of how to build that patch from scratch. While there is nothing wrong with using presets, as you can see, a tiny twist of a single knob can dramatically alter what you get from a given patch. Presets are intended to demonstrate the capabilities of a plugin, so don't be afraid to mess around with the controls. Any synth developer would tell you "that's what they're there for!"

The opening preset of Osiris-6, "Delay Pad" is a perfect example of a sweep effect with a slow attack.

Osiris packs a lot of sound editing capability into a relatively easy-to-follow layout. Two oscillators are on the left. The yellow buttons rotate through all available options. You can pick filter 1, 2, or both. And the panel outline suggests that the filters have their own ADSR, which is above the ADSR for the gain. To the left of the keyboard is the mono on/off and portamento control. Tucked to the right of the keyboard is the arpeggiator. Effects are front and center. It is very easy to page through the options for LFO1 and LFO2 as you listen to how the sound is affected in real time. This is truly one of the best designed front panel layouts. Osiris shines in the pad department, but the cutoff and resonance knobs do not seem to alter those sorts of sounds much. One drawback of this plugin is that it appears to take up a lot of memory - it failed to load four times on my old laptop. Download it here: http://www.vst4free.com/free_vst.php?plugin=Osiris-6&id=741

Appendix

Troubleshooting

A lot is going on under the hood while making music on a computer, and so countless things can go wrong. There can be hardware idiosyncrasies, software updates that cause trouble, and any number of other glitches that would be impossible to cover in a single book. The good news is that someone else has probably encountered the same issue, posted it to the Ubutnu Forums, and already got one or more replies. https://ubuntuforums.org The Ardour manual is and extremely good resource as well: http://manual.ardour.org

No sound.	Check that all cables are secure. Check the master fader. And the other volume knobs! Sometimes a JACK connection goes to the wrong place - check that you drew the line from VST to playback.
No/low guitar sound in Rakarrak.	Make sure 'FX On' is checked. Check the volume levels in Rakarrak and on your axe.
Carla won't load a VST.	It can take a minute to add some plugins. Some may load after multiple tries. If it still won't load, try the 32 bit version. Some free plugins also may run slow or crash, after finally loading. At that point, you should cut bait and try another plugin.
What's this scary-looking pop-up error message?	Sometimes you will get a spurious pop-up window. Read it, following the instructions if possible. Otherwise, dismiss it and see if you can't carry on working. Closing a pop-up is a small price to pay for otherwise flawless freeware.
Ardour didn't record.	Was recording enabled and the track armed? Is the track input set? Is the source/playboack volume up?
My exported	In the Marker lane (above the tracks) be sure the Start

Ardour song is blank or has a long dead space after the ending.	and End markers are positioned where you want the export to begin and end.
A plugin is not appearing under Audio Production/Sound Generators.	Check Media Playback under Ubuntu's launch menu. A very few plugins must be started from the command line - see the README file that came with the plugin.
All else has failed.	Try restarting. If things had been working, re-installing or downgrading Ubuntu Studio may be necessary, but that should be a last resort. If you decide to try this, remember to back up your projects.

Using the command line

When installing a program or troubleshooting in Ubuntu, it is common to run a command or series of commands by hand. You won't need to know what the commands mean, you'll just need to copy-paste them, one at a time (watching out for line breaks), then hit 'Enter'. But...first you need somewhere to type those commands! This is where the Terminal Emulator (know as Xterm on some systems) comes in. In the old days, a text-based "dumb terminal" was connected to a "mainframe" which is where the processing power was. When you open the Terminal window, you will be issuing Linux (UNIX) commands at a prompt - this is called a "command line operation". The prompt is usually the name of your computer or the current directory followed by a '$'. Instructions often include the $ to indicate the prompt, but should remind you to omit it when copy-pasting the command into the command line. To be sure you'll have "write permission", you should be logged in as the administrative user - the one you set up during the installation process. That's really all you need to know for the purposes of troubleshooting, but here are some common commands that might prove helpful, shown

in courier font. Notice they are descriptive abbreviations (italcs). Square brackets [] indicated an option.

- **pwd** - print working directoy. Shows where you are in the file system.
- **ls** - list the contents of the current directory
- **ls -ls** - long listing with more details on the files
- **ls -lsa** - long listing including all "hidden" files (which start with a '.')
- **cd [path]** - change directory to my home or a specified path (e.g. '$ cd /usr/local/bin')
- **rm [filename]** - remove a file (substitute the target for 'filename')
- **rmdir [dirname]** - remove named directory
- **mkdir dirname** - make a directory called 'dirname'
- **sudo command** - run 'command' as super user. You will see this in most instructions.
- **chown [user]:[group] [filename]** - change ownership of a file to a given user.
- **chmod a+rwx [filename]** - change "mode", i.e. give read, write, and execute priviledges to all users. Use with caution! This command gives univeral access to your file, making it unsecure. The chmod command takes many different arguments that can set permissions for everyone, just a particular group or users, or just the owner of the file. Also note: '.' is shorthand for "the current directory" and '..' means "the parent directory". '*' is the wildcard symbol - also use this with caution and make sure you understand what a command will do before using it.

It is also possible to edit files on your file system from the Terminal window using a text editor called "vi". I mention this because some help pages may instruct you to use vi. If you're not comfortable with vi, any text editing application will do.

Additional Resources

Linux forums https://linuxmusicians.com "Our mission is to facilitate discussion, learning, and discovery of music making on the Linux platform." https://unix.stackexchange.com "Unix & Linux Stack Exchange is a question and answer site for users of Linux, FreeBSD and other Un*x-like operating systems." https://itsfoss.com "It's FOSS is an award-winning web-portal that focuses on Open source in general and Linux in particular. While there are several other Linux websites on the internet, It's FOSS specifically focuses on beginners to the Linux world."

Plugin Mania I love quirky VST plugins. One of the all-time champions is HG Fortune, whose left all of his creations on Archive for free use. Here is the "Nearly Forgotten Gems" archive (32 bundled plugins, multiple versions of some): https://archive.org/details/HGFortuneNFG

The following are not included in the bundle, but are worth checking out:

- **The Tyger Synth**: https://archive.org/details/HgfortuneTheTygerSynth<
>
- **Fortune Cookie**: https://archive.org/details/HGFortune-FortuneCookie-2012<
>
- **Avatar**: http://www.vst4free.com/free_vst.php?id=1036<
>
- **The Dream Machine**: http://www.vst4free.com/free_vst.php?plugin=The_Dreammachine&id=1042

These synthesizers tend towards dark ambiance - some notes to help distinguish some of the HG Fortune plugins from one another appear at the end of this section.

Someone asked for links to the strangest VST plugins on Reddit (WARNING: foul language): https://www.reddit.com/r/edmproduction/comments/2qsh4d/whats_the_weirdest_vstau_you_know_of/

While we're talking about novelty synths, the PAL-9000 is hilarious: http://www.vst4free.com/free_vst.php?plugin=PAL-9000&id=2288

Some of my personal favorites are sampled instruments like Chau Gongs, Redtron (Mellotron M400S strings), Revitar, and OMB1 (bass). A couple of keyboard plugins to check out: MrTramp2 (everyone agrees it really sounds like the keys on Supertramp's "The Logical Song" - definitely adjust the settings to taste). Looking for an old-fashioned pump organ? Try Harmonium. Maybe you are into EDM? Firebird is loaded with contemporary patches and a bright, enticing interface (follwong page, top). All of the above are available on http://vst4free.com which has a Keywords search (top text menu, third link).

Super Spook Keys (groan) is a great example of the diversity and specialization of plugins. This Theremin by Simple Media has a lot more of the subtlety of the real thing than your typical keyboard Theremin patch. Hear it in action along with its other presets at the following link: http://www.vstplanet.com/News/2011/Super_Spook_Keys.htm

Simple Media's page is worth a visit (paid and free VST instruments, with an emphasis on strings): http://www.simple-media.co.uk/vsti.htm

Simple Media's plugins have gorgeous, unique graphics.

Pianos

As promised, some piano resources. The free **Piano One** is a good example of the trade-offs in sampling versus file size mentioned earlier. It's got shorter, 16 Bit samples in contrast to the 32 Bit notes of it's commercial version, **NeoPiano**, whose 32 Bit notes that capture the full note decay. Other features of the paid product are omitted. All of this adds up to a noticeable difference in sound quality; it may not sound exactly like the Yamaha C7 concert grand used for its samples, but it's still a serviceable piano that will run on older systems:

http://www.supremepiano.com/product/piano1.html

I've had some luck with **Upright 1** from Versilian Studios. This piano is warmer than some real uprights. It might have a little latency on older systems, the GUI may crash, and it might not pick up the sustain pedal signal - but the 64 Bit sound is quite good, offering a distinctive upright sound.

http://vis.versilstudios.net/upright-1.html

A slew of different free pianos is available from Big Cat Instruments:

http://bigcatinstruments.blogspot.com/2015/09/all-keyboard-instruments.html

Some of the greatest pianists loved Baldwin pianos. I really like the sampled Baldwin baby grand of Big Cat's **City Piano** available at the following link with this cool blue skin.

http://vst4free.com/free_vst.php?plugin=City_Piano&id=2293

Free Piano from RDGAudio is more recent (2017) and has some layered sounds along with other controls (requires 64 Bit Windows 7). The KVR Audio site has many other free and paid plugins to browse.

https://www.krvaudio.com/product/free-piano-by-rdgaudio.

Continuous Velocity Piano by recording gear giant TASCAM is highly rated, and represents a clever approach to the size problem, spectral morphing. It runs a single sample through assorted filters to provide a

great range of timbre. This is similar to Free Piano, but with far more options. The installer failed to run for me with an error message saying it requires Windows XP Service Pack 2. Maybe try running the standalone version. Once installed, there are some additional steps to get it to make any sound. Open the edit window and note the progress bar at bottom right - that shows the sample library is loading. Note - the dll file will load in Carla, but it will fail to load the sample library if you haven't run the installer. Make sure either Out or 'FX 1,2' is selected, and the leftmost dropdown should show CVPiano normal. You may need to "click to load" the first channel, then select a library from the dropdown. The CVPiano is a 7'4" KAWAI grand.

http://www.vst4free.com/free_vst.php?plugin=CVPiano&id=382

I hope this illustrates that results may vary widely when it comes to plugins in general and pianos in particular depending on your system and the instrument itself. The good news is there are many more available than covered in this short overview.

Still more plugins!
http://vstmuseum.com/index/

Review of HG Fortune Snythesizers

Many synthesizers try to be all things to all people. And many VST plugins are emulators or "romplers" (sample players) of "vintage" synths. While it's amazing that every pre-existing type of synthesis is represented in one or another virtual instrument, often for free, after a point, there is some inevitable overlap. Even the GUIs generally follow a familiar hardware paradigm however artfully (or confusingly) masked by

a GUI. By creating a suite of more narrowly-purposed plugins, no two of which look or sound alike, H G Fortune's instruments stand apart from the crowd. Unusual control interfaces that could not even exist in the physical world, randomizing buttons and ways to rapidly modify a sound all combine to encourage us to think outside the box.

By the time he passed away in 2014, he left behind an overwhelming 40 plugins. Here I review 16 of them, with an eye towards discovering just what each synth is "about". In many cases, there were two versions of the same synthesizer, which means this review covers more than it appears to (although the revamped version of a given synth may in fact be almost unrecognizable from its progenitor ' feel free to make the comparisons yourself). While there is some redundancy, it is the case that these plugins constitute a suite serving distinct functions.

Alienoctis

Numinous ambient presets. The manual notes that dozens of "waveforms" are used for this synth, and it appears these are soundfonts, with an almost game-like GUI featuring three balls that you click and drag to alter the sound (or knob twist if you prefer). The presets are highly similar to one another ' don't come here looking for lead synth sounds or anything percussive. HGF synths encourage play in the purest sense of the word, and the toy-like interface is a good example of this. Knowing what's to come, instruments that also have soft ambient sounds but are somewhat more versatile, I decided not to keep this one unzipped as redundant. That said, there were a handful of patches that got me started down the path of composing. HGF sounds are so rich that often a few notes that would sound uninteresting on, say, a piano, take on significance and could easily form a compositional starting point.

== Alphatron ===

Interface looks like a traditional keyboard and panel synthesizer, and the sounds have plenty of analog punch allowing for strong lead and bass

patches missing from most HGF concoctions. But you can find that with many other virtual synths. What sets Alphatron apart is an onboard sequencer. If the unusual control layout of the sequencer boggles you, fear not ' call up any patch and hit "start" - that's right, the presets have built-in sequences, many of which are great for quick inspiration. Recommended. Altair

This "SciFi Sounds Lab" is exactly that. Use it if you are making a science fiction movie. It's all here ' computer sounds, UFOs, spooky organs, theramin sounds, an more modern effects with names harkening Blade Runner, Jean Michel Jarre, and more. Very much a SFX generator, and the presets are wonderful even with no knob twisting. The glowing blue and orange interface looks like a mad scientist's lab video game. Because it is not very musical, I decided to uninstall and leave it zipped.

Anvilla Pro

The H G Fortune paradigm of the ability to mix and match 'then tweak' two canned waveforms with a twist. A handful of "Lazy" buttons will alter any patch by doing the knob twisting for you. A quick tour of these settings with a plain vanilla (possible origin of "Anvilla?") patch shows that this paradigm is a clever way to get infinite never-before-heard sounds, as touted for all but the most preset-oriented synths, but sounds with some depth owing to effects and the waveforms themselves. Changing any one of the two source sounds has an even more profound effect on the overall layered sound, as might be expected. This is like cooking by matching flavors' lime and coconut, peanut butter and chocolate, etc.

The results are still often more akin to sound effects, and less "musical" in the sense that they do not lend themselves to playing a chord or a melodic line ' many of the presets are not intended for those purposes. The few available lead sounds are uninspiring; likewise some of the organ sounds are perhaps serviceable, but I would first call up a typical

tonewheel patch easily found elsewhere. Pads are good on this synth, but otherwise, it seems to be a bit of a pastiche of what you get from other HGF instruments, with the balance tipped in a brighter, happier direction than some of the darker, colder synths to be reviewed downstream. As with all HGF synths reviewed so far, there are some gems amongst these presets. One other fun feature is the back panel skin itself has ten presets. The default silver can be changed to a smoky gray, blue, deep red (which does not look very good behind the lighter blue buttons), sky (my favorite after the default) and some grainy galaxy and nebula images that don't work very well. Otherwise, the GUI is a plain panel of knobs with labels. This would be a good one to call up for inspiration, but probably not needed at my fingertips.

Arracis Gold

One of the first HGF synths I checked out, I had to give it a quick re-trial. Presets are almost exclusively one of two things' pads or sequences, the latter consisting mainly of pulsing sounds rather than a handful of looping notes. This may appear limited, but this is one of the HGF instruments where "what it does" matches the evocative name. Lots of shimmering sounds, many featuring two-note harmonies, bring to mind a mythical version of ancient Egypt (a quick search shows only a possible Dune reference, with a spelling difference). The distinctive gold interface helps set Arracis apart. For me, this one's still a keeper.

Alien Space Weaver (ASW)

Okay, I'll just quote the introduction to the manual and move on: Alien Space Weaver is a very exceptional synth as it is especially made for spacey or dark athmospheric backgrounds and FX sounds. One oscillator contains 75 very special samples i.e. fairly long ones being created from various images providing very spacey sounds from the start already. Thus play it slowly and let the sounds evolve. It's also been called the Eeriator...

We're in very familiar territory here. This really is a great atmospheric synth, and one of the larger downloads (probably owing to those fancy waveforms).

Atonoise

This one did not load for some reason. From the manual:

> Atonoise 2 is a widely enhanced version of prior Atonoise and is basically built around the modified Mystify processors of the Avatar ST VSTi Synth. Thus it can mangle up sounds to a great extend beyond recognition. It can be used on virtually any kind of sounds like vocals, drumloops, tracks and is even suited for deep sample processing if very few til no modulation is involved. For a more easy access and to give you some ideas of the capabilities a small set of internal samples (including vocals, drumloops & track excerpts) is used for the internal preset bank.

Avatar

More lush, cinematic atmospheres that "play themselves". Another interface with tons of knobs ' four oscillaors. I should say a word about the patch names ' they are wonderfully inventive in all HGF VST instruments, sometimes coined words. Lots of "space" this and "galaxy" that, in keeping with the sounds. Panning and delay are a big part of these soundscapes. One Avatar patch is called "Good For Intros" - that says it all. Some of these presets are like little movies unto themselves, one was called something like "Scene Three For Alien Movie". Herein lies a small problem ' the names can almost dictate how the sounds might be used, just as the sounds themselves are so complex, often with pitch shifting, that they are not what we normally think of as "musical". This VST comes with a handy virtual keyboard, a feature that seems to have been added on to several HGF pro offerings at some point.

Laserblade

Where several of the above synths are weak on "musicality", Laserblade has sounds labeled as bass, synth, lead, and pad ' while ranging in quality from interesting to cheesy, they certainly could be used to play a melody, bass line, or hold down chords. One feature that stands out is a "metalize" section. I'm not sure what this does, but some of the presets have a metallic timbre, and the GUI itself appears to be made of polished meta. As I mentioned, it's easy to find demo tracks of this synthesizer and many of the other HGF instruments. Lot of sci fi film references in patch names, although sounds do not necessarily correspond.

(Z) Percumat

From the manual:

> "This is a versatile Rhythm machine for backing drums percussion so definitively not an 808 or 909 type thingie. It features 6 instrument parts / slots to choose from 512 inbuilt drum & percussions sounds. There are two step sequencers one for setting up the beat steps in groups of 4 x 8 steps (or 4 x half a bar) labeled A1, A2, B1 & B2, while the 2nd sequencers on the left allows you to control a sequence of the 8 step beat groups in 16 steps. Thus it is easy to get variations without having to program complete 16 step bars. In addition to that there is an Auto Track Mute feature for tracks 4, 5 and 6 to have one or two tracks muted for a certain range." Plenty of nice presets to get you going fast, includes world beat, a few alternate time sigs, etc.

Protoplasm

Gray GUI with art deco lettering. Three oscillators, High- and Low-pass filters, three LFO, sample and hold, delay, VCA mix section. Familiar ability to layer two soundfonts at once. Lot of patches named after

planets. This may have been "proto"type for some of the space ambient synths to come later.

Shuniji

Maybe I am missing something with Shuniji pro, but it seems like more of the same. A few sounds are vaguely eastern-sounding, and this comes with a bar-graph supposedly for editing waveforms. Sounds tend to be muted. Another blue and gray GUI. I give it a "meh" and will not keep it installed.

Silver Orbit

Pretty typical HGF, another gray panel, this time with a ball interface in the Gui that can be animated. Primarily what I would call "goofy" sounds, unlike the darker long delay sound of similar synths. I don't dislike any of these synths, but this is one of my least favorite thus far. If someone had only this VST, they would probably get frustrated soon.

STS-26 Protoplasm

This was one of the first HGF VSTs I tried out, and was curious to see if it held up as "best of breed" for space ambients. From the picture of the galaxy on the "dashboard" to the four waveforms, this really is the luxury model. There are some credible lead sounds, but again pads and backgrounds are the strength of this synth. The STS strings patch rivals any synth string patch on any keyboard I can think of and is worth keeping this VST in itself. Many of the presets actually play little melodic motifs, again encouraging a different approach to composing, one of collaborating with the patch designer, effectively. And why not? If you don't like the chosen notes, it should be simple to mute that oscillator. If there was only one ambient HGF synth, I think I would still chose STS-26.

Swamp

Two versions of Swamp are great examples of idosyncratic VSTs ' ambient, but darker and "swampier" than the other offerings. Electronic frogs and cricket sounds inhabit this voyage into a creepy otherworld. Like nothing else out there. It's great!

XWOF-4

Just when it appeared Mr. Fortune had nothing else up his sleeve, along comes this amazing electronica looper. If, like me, you are not very good at concocting beats, and at least occasionally like the idea of "press play and off to the races", this is for you. In fact, the synth has "play" activated as soon as you plug it into your rack. These segments are often longer than the memory limited two measures of old school drum machine "rhythm patterns" and the sounds go way beyond kick, snare, tinny hi hat, and toms. In fact, so much is going on, that these might sound like completed songs in themselves on first hearing. I did not read the manual, and the front panel does not have anything that looks like a step sequencer, so it's not clear if this is more than a loop library. Either way, this synth is, to my mind, distinct from the others in that it is more firmly in a subgenre (electronica/dance) and addresses the rhythm rather than pad backgrounds. Great to have in the arsenal, even if you're not a DJ.

(Z) Plutonia

Leads, leads, leads. This instrument has a smaller front panel and fills the void of lead patches from the HGF fleet of plugins, while still offering some breathtaking pads and wiggy special effect sounds. But let's be honest about highly complex sounds that have to be "held out" to even hear everything they do. The more bizarre they are, the more rare the situation where anyone will ever call them up. If you are writing a tuneful piece of music, atmospheric pads alone just won't cut it. The lead sounds here are on par with U-He's free offerings such as Zebralette, and things

like warped, delay-rich bells are also quite similar in quality and approach. Many HGF bass sounds strike me as too busy or fuzzy to be functional, but some of the bass sounds on Plutonia are more punchy. Plutonia is not only a welcome addition to round out the HGF collection ' it's lead presets have enough of their own character to compliment others in your library. Another keeper.

Conclusion

Which ones should you install? That depends what you want to do. These are all good, but I find some more inspiring than others. Why not play around with, say, Altair, even if you ultimately uninstall it? I hope this was a helpful overview of the synths the late Gunther Fortune most generously made freely available as his legacy to musicians everywhere. To audition them, you can find patch demos on YouTube and whole recordings at the Archive link for these instruments.