Electronic Music Production & Sound Design

Digital Handbook
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Getting Savvy with Synthesizer Basics

By Loudon Stearns

From the Online Course
Composing and Producing Electronic Music 1
Change is the nature of electronic music—to keep pace, the composer must adapt and grow. If you’re already familiar with acoustic instruments, learning about electronic music and synthesis will require learning a lot of new skills, and a lot of new language. However, once you pick it up, it will change the way that you think about music. The following definitions will guide you through the basic language of sound and synthesis that we use throughout Composing and Producing Electronic Music 1, and help give you the tools you need to begin thinking about shaping new sounds.

**Amplitude and Frequency**

**Amplitude** is the most basic property of sound. There are a variety of meters we could use to analyze amplitude, but the most common is a level meter. You will see them all over your DAW. You probably have one on each track showing the level of the track output. When working in your DAW, keep an eye on those level meters. You will notice that the top of a level meter is labeled 0 decibels. **Decibels** (dB) are the standard measurement of level. Decibels are a relative measurement; a reference level must always be established. In a DAW, the absolute maximum amplitude is defined as **0 dBfs (full scale)** and negative numbers are used going down from there.
If your main output goes above 0 dB you will get ugly digital distortion in your final mix, which is to be avoided at all times. Individual tracks can exceed 0 dB, as long as you bring the level down later it shouldn’t cause a problem. But, it is generally advisable to keep all tracks from clipping (going above 0 dBfs—full scale, digital maximum). To remind you that you have exceeded this maximum level, there are often clipping indicators that stay red if the track went over max. Clicking on them will reset the indicator. While it may seem mundane, relative levels are the most important thing when mixing, so get to know your level meters!

All of synthesis is described as connecting small modules. While most synths use these same simple modules, how many they are and the allowed connections vary greatly. Our simple synth has two modules, an oscillator and an amplifier. The role of the oscillator is to create the sound, and the role of the amplifier is to control the level. The output of the oscillator goes to the input of the amplifier. The oscillator has a frequency parameter, and the amplifier has a level parameter. When the synth is turned on, the oscillator generates a signal, in this case a sine wave. That signal enters the amplifier, the sole purpose of which is to change the level of the signal. The sound then is sent to the computer output.
The frequency parameter changes how many sine waves happen per second. The more waves per second, the higher and more shrill the sound becomes. **Frequency** is measured in **hertz** (Hz); a waveform that completes one **cycle per second** is a 1 Hz signal. Notice that when changing the frequency there is no change in the level meter, frequency and amplitude are **independent** controls, they don’t impact each other. The level meter doesn’t tell us anything about frequency; for that we will need the next sound analyzer, an **oscilloscope**.

The audible range, for humans, is roughly 20 Hz up to 20,000 Hz, to display a waveform repeating that fast we must show a tiny amount of time. In a DAW, you would need to zoom way in to see the individual waveforms in a sound, just a few milliseconds must fill the entire screen. One millisecond is a thousandth of a second. This oscilloscope is configured to show four milliseconds on the Y axis. As frequency increases the shape squishes, there are more repetitions per second and we perceive a higher **pitch**. Notice that when amplitude is changed, the height of the waveform varies, but the number of cycles per second (frequency) remains the same. A waveform display in a DAW is a printed, static, version of the oscilloscope.
Notice what happens if the amplifier is set too high—the sine wave goes above the digital max, and clipping occurs. We see the clipping indicator on the level meter, and the sine wave takes on a different shape, the tops of the waveforms are “clipped” off. This is a very crude form of distortion that does not sound good. We see that the shape of the sine wave has changed, as did the sound, but the frequency did not change. The waveshape or timbre changed, though the frequency remained the same.

**Filter**

A sine wave is an artificial construction that includes energy at a single frequency. They are easy to create in a computer, but not really found outside of electronics. Sounds in nature are more complex; they have energy at many frequencies simultaneously. An oscilloscope can make a sung note go through a variety of vowel sounds. Like the earlier sine wave, it has a repeating cycle, and the number of cycles per second remains constant, but the tonal quality of the sound is varying. This change in waveshape is how we can distinguish different vowel sounds on the same note and different instruments playing the same note, the shapes of the waveforms are different.
Our simple synth is more complicated now. It has sample playback (of a single sung note), and the standard synth waveforms: **sine**, **saw**, **square**, and **triangle**. After switching between the waveforms, it becomes obvious how they got their names. Saw and square are very bright, buzzy sounds. They have a powerful high end, more powerful than any acoustic instrument. To tame that harshness, we have added another module to our synth, a **low-pass filter**. While there are many filter types, low pass (LP) is by far the most common and most useful, because it reduces the extreme high end of synthetic waveforms. A low-pass filter lets the lows pass through, but blocks the highs. The main parameter on a low-pass filter is the **cutoff frequency**. Above the cutoff frequency the sound is reduced. The further above the more reduction. Actually, that is a simplification. The cutoff frequency is the point at which the sound has already been reduced by 3 dB.

With a complex waveform like a sawtooth, you will hear a change in brightness when moving the cutoff frequency. The higher the cutoff frequency, the brighter the sound. The moving, “sweeping,” of a low-pass filter cutoff frequency is a very important sound in electronic music. Do not underestimate its importance. Changing the cutoff frequency of the filter has a dramatic impact on wave shape.
A low cutoff frequency makes the wave look and sound more like a sine wave, and a high cutoff frequency lets the brightness of the waveform through. Notice that the changing of cutoff frequency has had no impact on the frequency of the waveform, but it does change the level. As the filter cuts the high end of the waveform, it reduces the overall energy and in turn, the level meter goes down.

To get an even better picture of sound, we move to the **spectrum analyzer**. On the X axis of the spectrum analyzer is frequency, and on the Y axis is amplitude. Each of the sounds we have been using has a series of peaks. If it is square, saw, triangle, or the sung phrase, the peaks are spread out evenly on the spectrum analyzer. Though the relative levels of the peaks change from waveform to waveform, their locations do not. These peaks are known as **partials**, and since all the sounds we have been using are **harmonic**. The partials are organized in a **harmonic series**. The frequency of each partial is an exact multiple of the lowest (**fundamental**) frequency.

Starting with a saw waveform and the filter at a high cutoff frequency, we move the cutoff frequency down. The harshness of the sound diminishes. An oscilloscope shows the sharp corners of the waveform smooth over. A spectrum analyzer shows the upper
partials reduce, and the level meter shows the overall energy of the sound is going down. Now, playing the sung phrase, see that the peaks stay relatively still on the Y axis, but as the vowel changes the levels of the partials change. **Timbre** is the relative level of the partials of a sound, also known as the **spectrum** of the sound.

### Envelope

An acoustic, instrumental note has a shape, the shape you see in the waveforms of recorded instruments in your DAW. A snare starts loud and gets quieter over time. A trumpet note has an initial loud burst then settles into a quieter state until the player stops blowing, and the sound quickly returns to nothing.

A synthesizer includes an **amplitude envelope** to emulate those natural shapes. The amplitude envelope **modulates** the level parameter. The envelope creates a path for the level to travel every time a note is pressed. There are four stages to an envelope: **attack time**, **decay time**, **sustain level**, and **release time**. A note is pressed, and the envelope moves to full volume over the attack time. Then the envelope proceeds, over the decay time, to the sustain
level where it stays until the note is released. The envelope fades to zero over the release time.

### An Important Note about Modulation

The amplifier envelope is our first introduction to **modulation**. A very important concept, think of modulation as the time dimension of synthesis; it describes how synth parameters change over time. While working with electronic music there are many ways parameters will change over time, so here is how we will use the terminology throughout the course:

- **Modulation**: A synthesizer itself moving a parameter.
- **Automation**: A DAW moving a parameter.
- **Control**: A person moving a parameter directly.

All instrumental sounds can be placed in one of two categories, **sustaining**, or **non-sustaining**. If energy is being added to the instrument over the course of a note (blowing, bowing, mechanically vibrating) then it is a **sustaining instrument**. If the instrument
gets an initial burst of energy then is left to resonate and decay (striking or plucking) then it is a **non-sustaining instrument**.

To emulate **sustaining** instrumental sounds, the sustain portion of your amplitude envelope is non-zero. To emulate **non-sustaining** instruments, the sustain portion of the amplitude envelope is zero.

Now that we have a sense of what some of these approaches will sound like, let’s look at the wave shapes and the parameters, to get a visual. Here are some common settings for the amp envelope:

<table>
<thead>
<tr>
<th>Switch</th>
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<tbody>
<tr>
<td><img src="image" alt="Switch Diagram" /></td>
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<tr>
<td><strong>Attack 0, Decay N/A, Sustain 100%, Release 0</strong></td>
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</table>

Switches are on or off with nearly instant movement. So, it takes no time to go from zero to full volume. Attack is 0. Sustain is at 100 percent, so decay does nothing. There isn’t a different level to go
down to. On “Note off,” the sound should stop instantly, so Release is set to 0. Organs can be emulated with this envelope. Pro tip: To add a little bite to the beginning of the note reduce sustain to 80 percent and set decay very short. That is good for percussive organs.

### Blowing or Bowing

<table>
<thead>
<tr>
<th>Attack</th>
<th>Decay</th>
<th>Sustain</th>
<th>Release</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-10%</td>
<td>0-10%</td>
<td>50-90%</td>
<td>0-10%</td>
</tr>
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These percentages are rough guides and will vary from synth to synth. But when you start to blow or bow, there is an initial strong burst of energy, and then the note settles into a steady sustaining level. That initial energy causes the envelope to jump from 0 to full volume quickly (the low attack time setting) then quickly down to the sustain level (the low decay time setting). The note holds at the sustain level—any variations in level during the sustain are added with LFOs—until the note off, where the instrument vibrates for a moment, trailing off after you’ve stopped blowing or bowing.
Increasing attack time and decay time will soften the initial transient. Increasing sustain will bring the note to the forefront of your mix. Increasing release time sounds a bit like adding reverb and can help to smooth out the lines when moving from note to note.

This envelope is the standard sustaining envelope and is adjusted according to the actual instrument. For strings, the attack decay and release is longer, but varies with articulation. For horns, the sustain level is lower as the initial burst of air is quite strong, compared to the sustaining level. Again, this varies according to playing style.

<table>
<thead>
<tr>
<th>Pluck or Strike</th>
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<tr>
<td>Attack 0, Decay 10-80%, Sustain 0, Release same as decay</td>
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This is a non-sustaining envelope that plays out, regardless of how long you hit the note for. It’s perfect for emulating struck or plucked
instruments. When an instrument is struck or plucked it goes to full volume nearly instantly, then decays based on the decay time. Release is set similar to decay so that if the player releases the MIDI note the envelope will continue to play out naturally. The Decay (and release) parameters are adjusted based on the instrument. A gong would have a very long Decay, while a marimba note would be very short.

**Envelope Trigger Mode:** Some synthesizers give a variety of modes for envelope playback, one possible mode is Trigger or One-Shot. in this mode the envelope plays out completely, ignoring the note off, and is particularly useful for percussion sounds.

**Keytracking and Envelope Time:** Often higher notes decay faster than lower notes in real instruments. To make that happen on your synthesizer you would need to route keytracking to decay and release time (negatively, because high notes need to cause short values)—this is a common parameter on synthesizers. Some synthesizers have a general purpose time control for the envelope, routing keytracking to control this parameter has a similar result.
This is very similar to the pluck or strike, but because release time is zero when the envelope receives a note, off it goes to zero, stopping the sound. This is representative of a piano, when the key is pressed a felt hammer strikes a string, and when the key is released a damper raises up and stops the note. A similar envelope would be used to emulate electric guitar and bass.

But if you don’t have access to your synthesizer right now while you read this, the best way to hear a damped pluck or strike in your head is by thinking of an analog piano. Think about how the note simply stops sounding once you’ve taken your finger off of the key. There is no sustain because you’re no longer holding down the key.
This one emulates a reversed percussion sound. It’s great for energy-building and transitions, but no real instrument behaves this way.

This is a funny envelope—and not really that useful, if I’m being honest—but interesting to try. With these settings, if you hold a
note down for a long time, the envelope goes through its short decay phase and you end up with a short percussive note, like a pluck.

Once you have a basic understanding of these definitions, you will be able to move on to the low-frequency oscillator (LFO), inserts, sends, post-fader sends, pre-fader sends, and more. But what I recommend at all stages of your learning journey is experimentation. Experiment with what you’ve just learned, and then experiment with concepts that might be just out of your reach. That way, when it’s time to learn those concepts you’ll already have a framework.

**Loudon Stearns** is the author of the Berklee Online course from which this lesson comes. Read about his favorite piece of vintage tech gear on the next page, or learn more about the other lessons in this course by clicking the link below.
Loudon Stearns is the program director for Live Experience Design at Berklee NYC, a facility established in 2020 at the famed Power Station recording studio, where students learn skills in performance technologies, sound and lighting design, projection mapping, LED panel technology, stage design, computer-aided design, and more.

He has authored and co-authored many Berklee Online courses, including *Composing and Producing Electronic Music* 1 and 2 and four different Ableton Live courses.
How did you first become interested in electronic music?
After finishing at Berklee, I took a deep dive into exploring synthesizers, and in that exploration, I started to find that the masters of synths were also amazing musicians, making this kind of music I had never explored before. So my intro to electronic music was through the synthesizer!

What is the most memorable electronic music concert that you’ve been to?
I saw Amon Tobin in concert at the House of Blues with this insane projection mapping set. ... I have never been the same.

What’s your favorite vintage machine that you use?
I have an all tube Hewlett Packard sine wave generator. It was my father’s and it sits on my desk all the time. I love it so much!

What advice do you have for someone interested in studying electronic music production at Berklee Online?
Dive in! Make all the time. Don’t let “I don’t know how” stop you from making anything. The beauty of Berklee Online is it forces you to make constantly, and there is no better way to grow as an artist.
Preserving the Art & History of Sampling

By Ashley Pointer

**Chris Read** is an accomplished DJ and producer. He’s also the Head of Content at WhoSampled, where he produces much of the site’s written, video, and audio content. WhoSampled is the leading destination for sample-based music, covers, and remixes, housing
the world’s most comprehensive database of music with more than 730,000 samples spanning more than 1,000 years. The UK-based company founded in 2008 was the first to really map out music in a way that allows you to explore its DNA.

In this Q&A, which originally appeared in Berklee Online’s *Take Note* publication, he opens up about what drives this powerhouse of a music discovery service, and breaks down the deep history of sampling as well as the direction it’s pushing music in today.

**WhoSampled is definitely a gift for us music mavens.**

**Who is your target audience?**

People who get the most out of WhoSampled are probably die-hard music fans who would really want to dig deep into the history of a particular song, or do a deep dive on a catalog of a particular artist. It’s also just a lot of fun for more casual music fans. If someone hears something that sounds kind of familiar, but they’re not really sure why, we’ve got the answer to that question. Maybe they’ll discover something they didn’t know or rediscover something they’d forgotten about.
As a listener you don’t always know you’re listening to a sample. Like the beginning of “Ray of Light” by Madonna, or the guitar line from that Gotye record . . . what’s your favorite unexpected sample?

Well, I guess within hip-hop, the stuff that people really geek out on is stuff that was buried for years and years and then gets unearthed. So, there’s always a buzz when a sample in a popular hip-hop record, like a big ’90s classic that has been previously unknown for 25 years, suddenly comes up.

But I mean, the samples that I really like are ones where the use is very creative, but the original record is also a great record. I know it’s maybe an obvious choice and it’s an all-time classic, but Pete Rock and C. L. Smooth, “They Reminisce Over You.” I love the hip-hop record and I also love the Tom Scott original and I also love the way it’s been used. When you hear the horns, you know instantly where it’s from. When you go listen to the Pete Rock track, you hear the way he’s used loads of little parts of it and there’s filters of it in the main bit.
To the less informed, sampling can have a negative connotation, especially in regards to artistic merit. When do you think the general public started to accept it as a valid artistic expression?

It’s difficult to say, really, because I think there will always be people who don’t like the idea of it. There will always be people who will see the art in it. I also think it’s really difficult to generalize, because there’s such a broad spectrum of things, which can determine sampling. On the extremely creative end of it, you might find a person who only ever samples individual notes, or individual drum hits and pairs it with something that doesn’t sound like any of the source material, out of tons and tons of tiny fragments of other things. That is a very difficult thing to do. I would argue it’s just as difficult to do, as playing some of those instruments yourself. It’s no less creative, because they have used sample material.

In terms of where it sits in popular music: samples in most big records are cleared. I think people enjoy the nostalgia element of it, if they’re familiar with the original. And if they’re not familiar with the original, they might enjoy discovering that record for the first time. If you ask Timmy Thomas, whether he thinks being sampled by Drake on “Hotline Bling” was a good thing, I guarantee you he’s
going to say, yes. Because for one thing, he got paid really nicely for it and it gave his career a second burst. He’s in the later years of his musical career and suddenly a song that he made 40, 50 years ago, is kind of trending again off the back of a Drake song. He’s an absolute winner in that situation.

We hope what people enjoy from the site is finding a pathway into discovering new music, or new-old music, in some cases.

- Chris Read

With more recent songs that are charting and hitting the radios and more people using samples in their music, do you notice any trends with traffic on WhoSampled?

In terms of traffic, yeah, definitely. WhoSampled makes a big effort around New Music Friday, every week. We’re looking at new releases. We’re looking at the playlists and trying to make sure that
we’re as up to date and comprehensive as possible. We have a Hot Samples Chart on the front page, which essentially documents the most visited pages in the last 24 hours. So, that’s quite a current, accurate window into what the current popular trending and most searched for tracks are. So, what we usually see is if one of the real headline artists like a Kanye, or Drake, or someone, drops a new album on Friday, tracks from that album will be dominating the Hot Samples Chart by Saturday morning and will stay on that chart for several weeks. Then, there’s one-off hits. Occasionally, a viral song that’s got a sample in it will end up on the chart for weeks, if it’s big on TikTok, or something at the moment, which is the source behind so many big records at the moment. They blow up on TikTok.

**What inspired the conception of WhoSampled?**

Just to put it in context, I wasn’t around when WhoSampled first started. So, the site’s been around for about 13 years now and I joined somewhere around the four- or five-year mark. So, I wasn’t around for their sort of conception, as it were. The founder is Nadav Poraz, and he is still our CEO, so I work closely with him. He was just a fan of sample-based music and had done that same thing that so many of us do, which is to be into either hip-hop, or electronic, or dance music and make that journey of discovery. Discovering Isaac
Hayes, or James Brown, or Sly Stone through the contemporary music that was influenced by it, or sampled it.

So, he discovered loads of music that he already loves, through contemporary music. He thought it’d be great if there was a resource where you could discover those connections and actually hear the music as well. There were other sites talking about samples and some of them in the early days of the internet were a bit more like lists: People trying to join the dots between a couple of songs and posting it in lists.

So, it was really just by him and a friend as a fun project. They added the first handful of samples themselves that they knew from their own record collections and just started adding stuff as they discovered it. They quickly realized that this wasn’t something one person or two people could build on their own. So, they made it a crowdsourced thing where anyone can submit and quickly, it just started building. It just ran away.

What does that process of compiling the data look like?
So, anyone can sign up for a WhoSampled account and anyone could make a submission, but it’s not like Wikipedia where whatever you
submit gets published. When you make a submission, it goes into a queue where it waits to be moderated by either a member of staff or one of our moderators. They’re kind of like super users of the site: people who have been long-term users with a proven track record of accuracy will also have the right to moderate incoming content. So every item before it’s published is reviewed to check if both the connection between the two songs is accurate and also that all the data attached, like your release details for each track is correct, the release year and record label and all of that sort of stuff.

We use a variety of resources online to check the data sides of things. Most of the WhoSampled moderators are producers or beat makers themselves. They understand the process behind it and are able to make that call, as to whether something’s correct, or not. But generally speaking, we’re cautious on the other side of making sure everything is accurate. So, if something sounds like it might be correct, but we can’t say absolutely, then that won’t get published. Only if we can say with almost complete certainty, “This is how this was made.” Then, we publish. WhoSampled publishes about 1,500 new pages a week, at the moment.
1,500 a week, just new discoveries?
WhoSampled lists cover versions and remixes, as well. So, there’s an awful lot of content coming from those categories. But it’s largely samples and those numbers for cover versions and stuff are always stacking up, as well. But of one type, or another, new entries around 1,500 a week.

Another great thing about having a community-based thing, is that there’s people out there who are super passionate about all sorts of obscure corners of the musical spectrum. There’s someone out there who’s an expert on Polish jazz, or Turkish psych, or niche regional hip-hop subgenres, just filling all the gaps in that particular world that they’re passionate about. That’s what’s really cool about it.

What job do you hope WhoSampled will accomplish, for the artist and for the listener?
I mean, fundamentally WhoSampled is a music discovery service. So, that’s the principal thing we’re offering. We hope what people enjoy from the site is finding a pathway into discovering new music, or new-old music, in some cases.
Do you use samples in your music?
For the most part, yes. I sample and I guess my approach is to try and treat sampling like producing a band.

What do you look for when you use samples in your music?
Rather than look for something that’s a complete piece of music, I tend to look for isolated instruments in other records, which can be used almost like a sort of toolkit. So, I like ideally to take drums from one place and take my keys, or whatever else it is, from another place and horns from another place and try to construct something new out of multiple parts and layers. I like to do as much for the challenge and the creative processes, as anything else, to try and build things from the ground up.
‘Halloween’ Theme: So Many Uses for Synth it’s Scary

By Michele Darling

From the Online Course
Synthesis, Sampling, and Sound Design in Film
Scoring: Electronic and Textural Resources
The music from the 1978 film *Halloween* was revolutionary, not just because director John Carpenter also composed the score, but because of Carpenter’s adventurous use of early synth pads and stabs, which helped him create one of the most powerful and creepiest soundtracks of all time.

The late 1970s were a pivotal time for electronic music in the soundtrack format, and music like this was previously the domain of science fiction, but Carpenter discovered that the new electronic sounds lent themselves well to the horror genre.

*Halloween* was a low-budget film, which cost around $300,000. There weren’t enough funds to pay a film composer, let alone an orchestra. Carpenter had a bit of previous musical experience, so he booked a studio in LA and connected with Dan Wyman—and eventually engineer Alan Howarth—to help him realize the soundtrack with synthesizers. The challenge was that they had to record the music without synchronizing it to picture since the technology had not been invented yet. They played and recorded the music to a click and a stopwatch, then matched it up with the film later on the 35 mm mag stock at the film studio. It’s amazing, the score works so well and captures the frightening vibe perfectly.
On his website, Carpenter tells the story of composing for the film: “[The script for] Halloween was written in approximately 10 days by Debra Hill and myself. I screened the final cut minus sound effects and music, for a young executive from 20th Century Fox. She wasn’t scared at all. I then became determined to ‘save it with the music.’ I had composed and performed the musical scores for my first two features, Dark Star and Assault on Precinct 13, as well as many student films. I was the fastest and cheapest I could get.”

Carpenter has said that his biggest influences as a composer were Ennio Morricone and Bernard Herrmann, the latter of whom is best known for his score for Psycho, which is the film that inspired Halloween. He says the rhythm of Halloween’s main title theme was inspired by an exercise his father taught him on the bongos in 1961, the beating out of 5/4 time.

“There is a point in making a movie when you experience the final result,” he writes on his site. “For me, it’s always when I see an interlock screening of the picture with the music. All of a sudden a new voice is added to the raw, naked without-effects-or-music footage. The movie takes on its final style, and it is on this that the emotional total should be judged.”
Let’s take a look at the main *Halloween* theme:

![Musical notation image]

The main theme from the film is actually very simple yet incredibly memorable. This could be because of its haunting dissonance or its relentless drive. One of the techniques Carpenter uses to make us feel unsteady is the irregular time signature. As he mentioned, the piece is in 5/4: the syncopation is created with accents in groups of 3, 3, 2, and 2. The initial pace in the groups of three is set, but then is suddenly changed to groups of two, making it feel as if it’s pushing us forward and creating an unsteadiness.

Look up the opening credits of the movie. Note how the uneasiness of the music works with the zooming in of the jack-o-lantern. A piano plays the 10-note melody in eighth notes. The C# to F# (Tritone) repeats three times and then the C# raises a minor 2nd to D and returns to F# (creating a minor 6th). The entire melody descends one half step, C to F (TT), creating a feeling of falling
and leaving what was the original key. The chosen intervals of tritones and minor 6ths that then descend by a minor 2nd all create dissonance and tension just by the inherent nature of the intervals.

Whole notes (playing every 10 notes) in the low brass and layered electronic strings play the tonic to give us an impending doom and a slight feeling of grounding. Tucked underneath the melody is a steady pulsing electronic rhythmic percussive sound almost sounding like a foot keeping time played in unrelenting sixteenth notes. All of these parts together create a suspenseful and dissonant theme that is incredibly unsettling.

Let’s take another look at the main theme in a different context. Look up the “Speed Kills” scene online. (Warning, there are spoilers ahead, and some legitimately scary scenes.)

The theme occurs as a car drives by the girls. Jamie Lee Curtis’ character Laurie notices the car. Her friends think it’s a friend, but it’s really Michael Myers, the killer. As Laurie’s head turns and watches the car pass, the pulse of the music matches the speed of his driveby. As soon as he stops—once the girl yells at him—the music surges in volume. Then it slowly fades as his car finally passes.
The simplicity of this theme is highly effective with its steady pulse in 5/4 time and the recognizable melody. The tick-tock clock-like nature of the electronic percussive sound in relentless sixteenth notes suggests Michael’s unrelenting drive to kill. It truly is what makes this scene so frightening. There’s no gore here, but we know the threat is imminent, and the continuous, steady, and unresolving, music holds us in anticipation; we know this threat will continue.

Let’s take a look at another scene (this one is definitely gorier). Again, just do a quick search online. It’s called “The Chase.” The following music cue, “Michael Kills Judith,” occurs when Laurie sees her murdered friend on the bed in a position representing Jesus
dying on the cross. For context, Judith is Michael’s sister, who he killed at the beginning of the film. It is her gravestone that we see on top of the bed.

The mysterious three-note synth melody is immediately recognizable as the “Michael Kills Judith” cue, establishing the fact that Michael has already killed Laurie’s friend. The synth lead sound is made of a triangle wave with dissonant minor 2nd layers. It’s interesting to note that as the sound is held, you can hear a wavering or pulsing, similar to a vibrato. This steady pulse in the synth sound keeps time with Michael’s relentless mission, which has a terrifying effect on the audience.

Notice that just after the stinger, which is meant to surprise the viewer, a piano enters playing descending minor 2nds in steady eighth notes. The synth pad that accompanies the piano descends in scale with the piano, going deeper into the drama and the potential demise of our heroine.

This is the ultimate tension in the film! The music takes us through the terrifying ride of Michael hunting Laurie through the house until she is temporarily safe in the house across the street with the kids.
At about the 1:22 mark we are once again reminded of the three-note synth motif, which references Judith’s murder from earlier in the movie. Hearing the same musical motif makes us more fearful that Laurie will meet the same fate.

It’s interesting to note that, when Michael attempts to stab Laurie in this scene, the music dies out. The silence during the most intense part of the film leaves us unsettled, as if the rug has been pulled out from under us. We stand in silence with Laurie as we wonder if she’s going to be alright. The music begins again when we realize she is still alive and Michael continues to move towards her with a simple yet steady single-note piano rhythm.

It is this sort of technique, and the courage to keep the score simple that makes Carpenter such a master of horror music. Notice also that many of the score sounds in Halloween came from synthesizers but were emulating traditional instruments such as piano sounds, harpsichord sounds, strings, brass, and bass.

Carpenter says the scoring sessions took two weeks “because that’s all the budget would allow.”
He dubbed the music in late July and finally saw the picture with an audience in the fall.

“About six months later I ran into the same young executive who had been with 20th Century Fox,” he recalls. “Now she too loved the movie and all I had done was add music. But she really was quite justified in her initial reaction. ... My plan to ‘save it with the music’ seemed to work.”

**Michele Darling** is the author of the Berklee Online course from which this lesson comes. Discover which film score she is currently streaming on the following page, or learn more about other lessons in this course by clicking the link below.

**Want to explore this course even further?** Learn More
Michele Darling is the assistant chair of the Electronic Production and Design department at Berklee College of Music. An accomplished sound designer, composer, recording engineer, and educator, she worked as part of an Emmy-winning production team at Sesame Workshop, where she composed music, worked on sound design, and recorded voice work.

At Berklee Online, she authored the grad course *Synthesis, Sampling, and Sound Design in Film Scoring: Electronic and Textural Resources.*
What piece of media do you think is a prime example of music and visuals coming together to create a masterpiece?
Francis Ford and Carmine Coppola’s score for *Apocalypse Now* is one of my favorite classic examples.

What is your go-to soundtrack/score that you are currently streaming most?
I’m fascinated by Ludwig Göransson’s score for *Tenet*. I’m spending some time unravelling the storyline and enjoying the reverse sounds.

What do you wish you could have told yourself early on as a composer?
You are capable. Just get out of your own way. Stop trying to force it and let the music and visuals lead.

How do you get inspired and into the composing mindset?
I watch the visuals several times until I start to feel emotion. When I feel immersed in the emotion, I start to play on the keyboard and come up with musical elements and sounds that align with the emotion. Then I have a basis to work off of and I can build on it.
We’re in the midst of an incredible resurgence of modular, semi-modular, and desktop synths. To name but a few: The modular synth components by Noise Engineering and Erica Synths, the Roland Boutique synthesizers, Korg Volca devices, and the ever-expanding
line of Behringer models. There are also a slew of amazing vintage synths on the market today, for pennies on the dollar of their original price tag, that you can easily fold into your setup with an old school MIDI connection.

Incorporate a few of these units with your modern DAW, such as Ableton Live or Pro Tools, and you’ve got yourself an incredibly powerful music production and sound design toolbox. You can have the best of all worlds: analog sound at your fingertips and comprehensive recording and audio editing control in your DAW program.

So you’ve picked up a few of these amazing vintage and semi-modular synths, now the next obvious question is . . . how do you connect them all to your system? Or, more to the point, how can they become fully integrated into your music production workflow?

For example, if you’ve got two Behringer semi-modular devices, an analog drum machine, and a vintage synth module, how do you plug all of these into your two-input audio interface for complete audio and MIDI control? Let’s dive into this on the next few pages.
The Audio Interface and Sound Modules

Here are the devices you will need, as well as the modules I will be using as an example.

1. A Computer

Obviously we’re going to need a computer to run Ableton Live.

2. An Audio Interface—AudioBox USB

You should ideally have a couple of inputs with trims on them for the line inputs from our sound modules. It’s very important that we have MIDI inputs. Yes, I’m talking about traditional old-style MIDI inputs, with outputs on the back, specifically MIDI outputs to control our sound modules, our external sound modules, that are the vintage sound modules that don’t have the USB ports on them. The Behringer semi-modulars have the USB ports, but some of the old vintage units don’t, so we’ve got to have that MIDI to work with the really old gear.
3. A Drum Machine

Some old equipment that I’ve found success hooking up to new systems include a drum machine called the Cyclone TT-606, which is a nice little clone of the TR-606, the classic Roland analog drum machine. I like this one a lot and it actually only has MIDI on it.

4. Synths

- Behringer PRO-1 Analog Synthesizer
- Behringer Analog Synthesizer Model D
- An old Yamaha TX7 (basically a DX7-1 in a desktop unit [MIDI])

5. Keyboard

It’s nice to have a MIDI control keyboard to play your parts in.

For the drum machine, I’ve got audio outputs going to the audio interface, and I’ve got MIDI input going to the MIDI output on the AudioBox. I have an input for the Model D, and another cord will be the Model D’s audio output. As for the MIDI for the Model D, we’re using USB. Tip: check out my video, *Using Hardware Synths with Ableton Live*: https://berkonl.in/LinkingVintageGear
Confirming Devices and Preference Settings

The first thing you’ll want to do is make sure that the devices are recognized by the operating system, which are USB compliant. Open up the “Audio MIDI Setup,” and you should see the AudioBox USB, the MIDI I/O, and the Model D.

Now in Ableton Live, you’ll want to make sure that the devices are recognized in the preferences. In the command bar, click Live > Preferences. Then click on the Link MIDI tab and make sure that all of the devices are clicked “ON” under MIDI Ports and Tracks.

One other thing you’ll want to do while you’re in Preferences is make sure that the buffer size is set nice and low. Click the Audio tab and look under Latency. You can get away with 512 Samples, but really it’s external hardware devices that are generating the sound. So the MIDI is going out to the external hardware devices, the external hardware devices are generating the sound, and that’s coming back into your computer where you’re monitoring it. So you want to make sure that this is set as low as your computer can handle. I’ve found success using 64 Samples.
Why I’m Not Using the External Instrument Device

I could use the External Instrument device (Instruments > External Instrument) to control the external instruments, but I recommend using the individual MIDI and audio tracks. This makes it easier to record MIDI data on the MIDI track, and then record the audio on the audio track.

Setting up the Drum and Bass Tracks for MIDI Sequencing

Start by deleting the external instrument track and creating another MIDI track (right-click > Insert MIDI Track). You should have four columns. Name one track “drums” and another “model d” for your synth bass line.

Then let’s set up the output to the drum machine, so in the green “drums” column, under “MIDI To,” click the drop-down and select AudioBox. The input from the drum machine (dark yellow column) should have “input 1” selected under “Audio From” drop-down.
For the “model d” column (light yellow), the output (or “MIDI To”) will be going to the Model D. And the input for the Model D is already set under “Audio From” to 2. Again, for visuals of this, see my Using Hardware Synths with Ableton Live video on YouTube.

We’ll arm the “drums” track by clicking the small music note at the very bottom, which should light up red. You’ll see audio coming into channel 1, but you won’t hear it because we have to set the monitor input. In the “2 Audio” column, click In, so that it lights up blue.

At this point, you should hear the drum machine.

Next, let’s do the same thing for “model d.” Arm the track by clicking the small music note at the very bottom of the column, lighting it up red. In the “4 Audio” column, click In under “Monitor” so that it lights up blue.

Now that we know everything’s working, let’s label the two audio tracks. Label the “2 Audio” column “DRUMS” and “4 Audio” to “MODEL D.” Notice that I’m using all caps for the audio and lowercase for the MIDI. This helps you to recognize what the track is pretty quickly, whether it’s MIDI data or audio waveforms.
MIDI Sequencing the TT-606 Analog Drums

Now, let’s record some MIDI. First, play around a bit with the sounds available on the TT-606.

We could play several different drums together on the same track, but let’s start with a four-on-the-floor beat with the individual drum sounds. We’ll start with a nice dance beat at 128 BPM.

Let’s turn the click on and lay down a kick drum for a few bars. Then do the snare. You could even make a new track for the snare so you could have more control over the details. Here are some general examples of MIDI drum notes:

- Kick = C1
- Snare = D1
- Closed Hi-Hat = F♯1
- Open Hi-Hat = A♯1
Now let’s work on the hi-hats. Again, like we’ve been doing, create a new track, rename it “hats,” and set the output to the “AudioBox.” We have three MIDI notes to work with here: The closed hi-hat (F#1), pedal hi-hat (G#1), and the open hi-hat (A#1).

When you play all of the parts together, you’ll notice they create some nice variety. We need to record them as audio, but first, let’s put down some bass.

**MIDI Sequencing the Model D Bass Synth**

For the Model D, let’s add one of the MIDI effects. Go over to the far left “Collections” menu > click *MIDI Effects > Arpeggiator* > and select something simple like the Bach 16th notes.

Let’s take the “Bach 16th” and drag it on top of the “model d” MIDI track. Arm the track and see how that sounds. If you like it, develop a bass line to record. It’s always fun to create a bass line under these circumstances, because you never know when you’re going to chance upon something that you end up really liking.
Recording the TT-606 Analog Drum MIDI Sequences to Clips

Now it’s time to record these parts into audio, on clips, so that we can later slice and dice them.

We’ll start by record-arming the drums, so you’ll want to “uncheck” everything else, besides what you are recording—so first the “kick” into “DRUMS.” Repeat the same process for the snare.

One nice feature of the TT is that you can play around with the tone button to achieve your desired sound, so we can do some modulations for the snare. If you choose to do that, label them differently: “SNARE 1” and “SNARE 2.”

Now we’ll switch over to the various hi-hats, checking the appropriate inputs, and repeating the process until you have the parts and tuning you desire. Take your time, coming up with parts and tuning, and just explore the possibilities until you find something you like. That way, when you start to experiment, you’ll be more likely to enjoy the end result.
Recording the Model D Bass Synth to Clips

Now let’s record the Model D, so record-arm the “model D” track and make sure that you’ve checked your input levels. Go ahead and record “model d 1” and “model d 2” into “MODEL D.”

So for this next one, “model d 3,” let’s mess around with some filters, specifically the filter cutoff. So while you’re recording, go ahead and move the knob around.

Connecting the TX7 (DX7) and Pro-1

On the back of the TX7, connect the MIDI input to the AudioBox, and the audio output to the AudioBox. The orange cable you see is connecting the AudioBox to the Pro-1, which will be the lead synth. The MIDI will be connected to the Pro-1 by USB. Again, I encourage you to check out the video at https://berkonl.in/LinkingVintageGear. That way it will all make sense when you read about the “orange cable”!
Chords and Lead Synth Tracks for MIDI Sequencing

Start by setting up two MIDI tracks (right-click > Insert MIDI Track). One MIDI track will be the TX7, which will be for the chords. The other MIDI track will be the Pro-1 for the lead synth.

And we want to go MIDI to the AudioBox for the TX7 and MIDI to the Pro-1. Let’s set up a couple of audio tracks. One will be for the TX7 and the other will be for the Pro-1. Once we do that, let’s start off with some chords. We want to make sure that our monitor input is set, and we’ve record-armed the TX7. Again, to hear what it sounds like, (and to actually watch me as I do all of this) check out my video, entitled Using Hardware Synths with Ableton Live on YouTube.

Experiment with different octaves, and start recording. You’ll be able to slice and dice those chords up and make something you can work with. That’s the best part about experimenting and recording: you can lay something down, listen, and then go back and do it again, keeping only the parts you really liked.
Next, let’s try out the Pro-1 synthesizer, which would be the lead synth. I want to make sure that we’ve set this to “in” and we’ve armed the track. The input there needs to be set to 2.

Don’t forget to check that you’re in tune, because whenever you’re dealing with something that is analog, there’s a chance it could be slightly out. Luckily, Ableton Live has a tuner.

So now that we’ve got all of these parts done that we can work with, let’s record! With a lot of this analog equipment, there’s also no real-time controls, in terms of filters. It’s just a vintage digital synth!

So you’ll want to do a couple of takes, then grab the cutoff filter and play around with that to see if you can find any cool sounds there.

What I’ll do next is press save and then take these tracks and drag them over to my arrangement view, and then start editing all these little sections together to create my song structure. And pretty soon I will have brought a new song into the world that wouldn’t have existed had I not plugged my old vintage gear into my newer tech setup.
So that’s basically how you do it. To refresh—so you don’t have to flip back through all of the previous pages of this tutorial—here’s a bulleted list of what we’ve covered:

- Make all the connections
- Sequence your MIDI clips
- Make edits to your quantization
- Record those clips
- Drag them into the arrangement view to arrange your song
- Mix and master to taste

And although this is my method, it’s just one way to do it. The most important thing is to experiment and have fun. And the more you do of that, the chances increase that you’ll find a new song that nobody’s heard before. And that’s why it’s called synthesis!
Erik “Hawk” Hawkins is an EDM artist, producer, composer, remixer, label owner, and author. His music has been used by networks and film studios, including ABC, CBS, MTV, Nickelodeon, and New Line Cinema. He also manages his own music production channel on YouTube, with nearly 5,000 subscribers.

At Berklee Online, he is the author and instructor of the award-winning course Programming and Producing Drum Beats, as well as Remixing and Producing Music with Reason.
How did you first become interested in electronic music?
I was 15 and tired of trying to wrangle band members for practice, so I figured it’d be easier if I just played everything myself. I found two Radio Shack cassette decks and started recording and bouncing takes back and forth between cassette tapes.

Who are your most influential electronic music artists?

What’s your favorite vintage machine that you use?
The Korg DDD-1 drum machine from 1986.

How important is it to you to stay up-to-date with the most current software and equipment?
Pretty important, since it’s my job! But staying up to date with the gear should never replace practicing your instrument, because the gear isn’t going to write the music. That’s your job.

How do you stay current with software and equipment?
Mostly YouTube and my amazing Berklee Online students, who are always cutting edge.
Improvising in Ableton Live

By Erin Barra

From the Online Course
*Ableton Live Techniques: Non-Linear Creative Strategies and Composition*
The idea of improvisation is something that a lot of laptop musicians cringe at the thought of. For some of us, the whole idea of being completely in control is what draws us to a Digital Audio Workstation (DAW) in the first place. But in many respects, even when it’s just us and we’ve got a distinct plan in place, much of what we do is largely improvisational. Whether it’s the point at which we’re picking out a melody, playing around with drum patterns, or twisting knobs until we find just the right setting, we are in fact improvising in those moments. Composition is improvisation, just at a different pace and through a different lens.

Improvising is a state of mind; there are no hard and fast rules and there’s no specific way to do it. The only thing that you must do in order to have a successful improvisational session—either with yourself or with another musician—is listen. You have to really use your ears, take in what it is you’re hearing in the moment, and act accordingly. That may seem simple enough, but you’d be surprised at how difficult some people find it to be.

On the following pages you’ll find some helpful tips about what you need in order to improvise in Ableton Live. But keep in mind that the main thing you need is a sense of openness to new experiences.
Prepared Improvisation

Even though the idea of improvisation is anchored by things happening in real time, prepping the environment you’ll be improvising in is pivotal. The last thing you want to be doing is auditioning drum sounds or adding new tracks on the fly, so the first step is to prepare your live set. Here are a few things to consider:

1. **What are you good at?**
   Each of us has a different skill set. Some of us might be strong instrumentalists, others might be more accustomed to clicking MIDI events into sequences and coming up with very precise melodies. Whatever it is that you’re good at, incorporating that into the improvisational environment you’ll be building will help you to put your best foot forward.

2. **What role will Ableton Live play?**
   Improvising with Ableton Live in the mix isn’t necessarily the same as improvising with other traditional instrumentalists. Ableton Live can do so many things for you, so deciding what role the software will play in this is an important step. You could set up the generative functionalities so it’s improvising right along with you, or you might
want to use it only as a place to capture what it is that you’re doing. You are only limited by your own imagination and understanding of the software, so consider what role Ableton Live will play in this experience.

3. What do you need to prep in your set?
Depending on what you decide you’ll be doing in real time, you might have a lot to do before you actually get to the improvisational part. Things like adding tracks, choosing and loading the right instruments, routing things properly, MIDI mapping, changing your default settings and preferences, pulling in audio or sequencing MIDI, or creating empty MIDI clips with follow actions. Whatever it is that you need, you need to take care of all of this before you start. Just as if you were a guitarist, you’d need to set up your amp, plug in, tune up, dial in the tone, get your volume just right, and make sure all of the settings on your effects pedals were set just right.

Using Link to Prepare for a Multi-Person Improvisation

Okay, now that you’re ready to improvise, let’s figure out who’s involved. If you do want to bring another person into the mix and
they are also using Ableton Live or an iOS app to make music, you might want to consider using Link. Link is technology that will sync devices together over a local wireless network, keeping them in time with each other. This works from one Ableton Live session to another, as well as between a number of other apps, both desktop and mobile, and even pieces of external hardware, such as an MPC. Or if you’re improvising with somebody who is playing a more traditional instrument, you’ll want to be even more careful that you’re actively listening and engaging with the sounds they’re creating, rather than trying to show off all of the bells and whistles you’ve prepared. Improvising is like a conversation: you talk and listen.

Improvising Alone

Being the only person around when you’re improvising is a lot of responsibility because you’re the only one making any sound, but for some of us it can be easier to let go and feel free when it’s just us. If you decide to go it alone, remember to be yourself and be in the moment, and then to let yourself go and get into the music. Because if you’re not into it, you can’t expect anybody else to be.
What’s Next?

Just keep going and exploring where your ears guide you or your hands fall. The goal is to get into a flow state. Many perceive music technology as rigid and highly structured, but hopefully you’ll prove the exact opposite to be true with your music. Whether you’re improvising alone or with other musicians, just show up and let the timeline keep running.

Erin Barra is the author of this course, along with Loudon Stearns. Learn how she got started in music production on the following pages, or learn more about the other lessons in this course by clicking the link below.
Erin Barra is a songwriter, educator, producer, multi-instrumentalist, and music technology consultant. She is a leading product specialist for Ableton and works with artists and bands to integrate digital technologies into their writing, production, and stage setups. Erin has worked with Grammy winners like John Oates, George Massenburg, Kathy Mattea, and Elliot Scheiner.

She has also authored and co-authored many Berklee Online courses, including four Ableton Live courses.
How did you first become interested in electronic music?
I’ve always been a fan but I got interested in making it around 2012 when I started experimenting with electronics in my live stage show.

Who are your most influential electronic music artists?

Which electronic music subgenres are you drawn to?
I’m into all types of house: deep house, global house, ’90s house, Italo disco, and so on.

What is the most memorable electronic music concert that you’ve been to, and why?
I saw Disclosure at Boston Calling maybe five years ago, and I’ve never heard music that was so loud and yet so clear in the low-end. It was the best-sounding concert I’ve ever been to.

What advice do you have for someone interested in studying electronic music production at Berklee Online?
Don’t get overwhelmed by everything there is to know and instead get excited by the fact that you’ve got a lifetime of learning ahead of you and endless discoveries pending.
Establishing a new habit can be difficult, but having some accountability can make the process easier, especially when you’ve committed to it publicly on social media. Berklee NYC program director and Berklee Online course author Loudon Stearns wanted...
to help his students stick to the habit of songwriting, so he started the #hundredtrackhive experiment to inspire musicians who are struggling to create. He got his Electronic Writing and Production students to compose a track every day—yes, every single day—and they shared their work with each other on Instagram under #hundredtrackhive.

“I’ve been really inspired by a lot of research into creativity that states that quantity is more important than quality,” says Loudon, who now heads up BerkleeNYC’s Live Experience Design program. His findings from the #hundredtrackhive project have significantly informed his approach with his graduate students.

“I can’t imagine any artist that hasn’t made a ton of garbage before they made their masterpiece” he says. “Everything I know about creativity is that the only sure thing is simply that you’ve got to make, and when you make, you get better and that’s the whole creative process.”

Loudon says that he was also inspired by an artist named Mike Winkelmann, who is known professionally as BEEPLE.
“He’s one of the richest artists on the planet now through an NFT sale of his works,” says Loudon. “He had a job he didn’t like, and he just wanted to be a graphic artist, so he said to himself, ‘I’m going to make a piece of art a day and I’m going to post it online for the rest of my life.’ It’s a matter of making every day, putting it out there, allowing yourself to just create and publish constantly: It reduces the need to be amazing or precious.”

The idea for #hundredtrackhive first came about as a response to the pandemic. What was a class that only met once a week to learn Electronic Production & Design (EPD) techniques became an online community that shared and supported each other’s works. Using Splice’s sample downloads and synthesizer presets helped keep the inspiration flowing for those 100 days, and the company was kind enough to provide Loudon’s class with a free three-month subscription.

“I figured, ‘Okay, let’s just create a class structure where the whole class is communicating with each other every day, giving each other comments and good vibes through the media we’re already using,’” says Loudon.
Instagram ended up being a great medium for the project, due its fast-paced nature. The fact that Loudon and his students were sharing snippets and ideas instead of full projects made the app seem like the right place for the experiment. Loudon also saw other advantages to it:

“We have a natural tendency as artists to make long things, so I love Instagram for many reasons,” he says. “One, the audio isn’t the best quality. So it avoids getting too precious with the mix, because it’s going to sound like shit anyway. And two, you have this one-minute limit, which means that everything should take under a minute to work there. And you have to be visual.”

The only sure thing is simply that you’ve got to make, and when you make, you get better and that’s the whole creative process.

- Loudon Stearns
Even before the #hundredtrackhive project, Loudon required his students to submit a visual with their projects, which lent itself well to Instagram and added more layers to the students’ musical submissions. Some held a low-fi aesthetic, others strived for glitch-art. Some posted pictures of their friends or places with funny captions. Above all, it provided their music with a visual identity.

“Some of the students really developed a vibe of their own,” says Loudon, noting that one student always used a white border around everything, “and that was really striking visually.” Another student also used white borders, but with a predilection for including visuals of digital synth interfaces.

Aside from the music and eclectic artwork, what is also remarkable is all the heartfelt comments his students made on the posts. There is an apparent honesty in the comments that translates a strong sense of community between the students. Loudon says there’s also another major plus of doing a little bit of work a lot.

“One big benefit of making one track a day is that I’ve saved it all,” he says. “I have a folder of all this stuff and every one of those is a starting point now, a template. It becomes a kind of portfolio.”
Loudon explains that if a student collaborates with an artist or director, they can tell them to look through their examples on Instagram for inspiration for what they are looking for. Not only that, the student can then pull up the Ableton session and build the project around a preexisting foundation, saving time. Plus they can say they completed these pieces in an hour, which is pretty special.

But regardless of how fun and whimsical this sounds, these students are creative people, and generating so many creative ideas for one course must be pretty draining, right?

“Yeah, they do get drained, and there’s a couple of ways I dealt with that,” says Loudon. “I made sure that the first thing we posted, we did during the class and only took an hour on it. I’ve done this a number of times with different classes and different groups of people, and if anyone out there is trying to start this idea for their own, the trick is to set a low bar with your first post.”

Loudon says that when he first introduced #hundredtrackhive to students, he had them jump right in, to take away any anxiety of preparation and expectation. He also made sure to keep it light, so students would go easy on themselves.
“We did it in class, so you only have an hour, which means you make it, you post it. That sets a standard of a low bar,” he says. “Then the other thing I did is that I made games of it every week. There’s a tendency to sit at a blank sheet of paper and be lost in a blank sheet. So as the professor, I would set up games like: ‘Okay, this week, it’s all about modular synthesis, so you just make a modular synth patch every day of this week.’ So that sets up a game to play. Or ‘This week you have to remix someone else’s project,’ or ‘This week every piece has to be part of a continuing story.’”

Loudon says he noticed a natural kind of arc: most of the students are really good up until their 20th post and the quality drops off a little, with the lowest points happening between the 40s and 60s, but after that there was an exciting uptick.

“To me it’s like, ‘I’m almost there!’ and it’s a marathon,” says Loudon. “And then we all did the last one in class and we all made our 100th post together, which was super fun.”
David Doms is an associate professor in the Electronic Production and Design department at Berklee College of Music. He has a long history of teaching MIDI and music synthesis, and has composed and produced TV and radio commercials for regional and national broadcast, corporate video, and film. He is a published songwriter with Warner Chappell Music and DSM.

At Berklee Online, David authored and instructs the courses *Sampling and Audio Production* and *Producing Music with Logic.*
Who are your most influential electronic music artists?

What is the most memorable electronic music concert that you’ve been to, and why?
Suzanne Ciani at the Berklee Performance Center in 2017. She created a masterful and inspiring extended improvisation using her Buchla synths in quadraphonic sound.

Which emerging electronic artists should we look out for?
Floating Points, Oneohtrix Point Never, FKA twigs, FKJ, and Flume.

What’s your favorite vintage machine that you use?
Access Virus T1: This is a great hardware synth from the mid-2000s.

How do you stay current with software and equipment?
The time spent updating has to be balanced with the goal of spending the majority of your time mastering the tools that you already have and developing your own music. It’s good to research the updates you are making before implementing them to see how this will affect the rest of your rig.
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Shaping the Sounds of Your Mix with EQ

By Jeff Baust

From the Online Course
Mixing and Mastering for the Electronic Musician
**EQ is a tool that does a lot** in shaping the sounds in your mix, and using it effectively is a key part of mixing music.

EQ is especially important to mixing, and we use it in many ways. We can use EQ to gently shape the sounds so that they fit better into the mix. We can also use EQ sounds more aggressively to completely change a sound in the mix, recasting it as something different.

When it comes to mixing music, there’s really no set rule as to where we start. Some people might start with dynamic processing, some by adding mix automation, others might start by first adding some reverb, and so forth. But we’re going to start with what many people would consider a fairly common first step in mixing: working with EQ.

The idea here is that with EQ—and also dynamics processing, which we get into later in this course—our first step is to just shape the sounds so that they are a little more polished and refined, and a little more workable. It’s a good first step in mixing, because once your sounds are in better shape, you can take your mix forward with more involved signal processing, and add some spatial effects, work with automation, and so forth.
Why Use EQ?

First, let’s consider why we use EQ in mixing music. EQ, as you probably know, is short for equalization. EQ is used to change the frequency balance of a sound in your mix. It can reduce the low frequencies in a sound, boost some midrange frequencies, notch out a problematic resonance, or add some top end “air” to a sound. There are many ways we use EQ in mixing. Consider the following:

To Get Tracks to Blend Together

We use EQ to help tracks blend together in a mix. A very common example would be regarding the relationship between a kick drum and bass track. Since both the kick and bass track could have a lot of low-frequency energy to them, you can use EQ on each of them to help shape them differently so that they complement each other more. Similarly, you can have a great sounding vocal and a great sounding synth track playing chords. But in the context of the mix, the synth track has too much presence where the vocal intelligibility lies (typically 1-4 kHz), so they can tend to fight with one another. By adding a little EQ to reduce some of that energy in the synth track, you can get these two parts to sit together better in the mix.
For Balance

One of the most common uses for EQ is to help improve the overall frequency balance of a sound you are using in a mix. You might, for example, have a kick drum sound that is too boomy because it has too much low end to it. Or you might have a vocal that seems too muffled in the upper midrange. Or perhaps a synth track that’s just too bright and buzzy in the top end, and it eats up too much frequency space in the mix. These are all situations where EQ could come in handy.

To Creatively Change and Manipulate Sounds

Those first two examples were about using EQ in a way that tries to improve the original sounds in your production. However, we sometimes use EQ to take things further, and completely reshape a sound. You might, for example, have a big bright synth track that eats up a lot of frequency space, yet it’s really just playing an inner line, something that adds a little rhythmic and harmonic texture to your production. Instead of trying to gently tweak it within EQ, you might try more aggressively recasting it by shaving off all of its low end and top end, and rebalancing its midrange so that it sounds like
a completely different element. Especially in electronic music, with so many synthesized and processed sounds, it’s very common to use EQ in this manner.

**Types of EQ**

Let’s begin with a short review of the different types of EQ bands, and how we work with them in mixing.

**Parametric**

In a parametric EQ band, which is also known as a bell curve, you typically find three basic parameters. They are the center frequency, the bandwidth, and the gain (the boost or cut).

In a parametric EQ band, the center frequency and the gain parameters are pretty straightforward. The center frequency is the frequency you choose to boost your cut, and gain is the amount you want to boost or cut at that frequency. Bandwidth refers to the area around the center frequency that will also get affected by the boost or cut. If you have a wide bandwidth, you affect a lot of frequencies around the center frequency, or with a narrow bandwidth you can...
boost or cut more specifically just around your center frequency. Notice that we express the bandwidth using the letter \( Q \). This is so that you can express the bandwidth of a parametric band as a proportion between the bandwidth setting and the center frequency itself. The number is actually calculated mathematically, dividing the center frequency by the bandwidth expressed in hertz. For example, if you have a center frequency of 1 kHz, and the bandwidth is 500 Hz wide, then you could express the bandwidth as \( 1,000 \text{ Hz} / 500 \text{ Hz} \), or \( Q = 2 \). Note that if you then changed the center frequency to 2 kHz, and wanted the same bandwidth, it would actually be 1,000 Hz wide, as \( 2,000 \text{ Hz} / 1,000 \text{ Hz} = 2 \).

A better way to think about the \( Q \) number is to think of it in musical terms. Think of the \( Q \) number as the inversion of the bandwidth of the EQ expressed in octaves. In other words, if you have an EQ band with a \( Q = 2 \), you could think of that as being \( 1/2 \) octaves wide. An EQ band with \( Q = 4 \) could be considered as being “roughly” \( 1/4 \) octaves wide (a minor 3rd interval). If you set your EQ band to \( Q = 6 \), that’s about a whole step wide, or \( 1/6 \) of an octave. Thinking this way will help you conceptualize what it means, for example, to have an EQ band set to \( Q = 0.5 \). This would be \( 1/0.5 \) of an octave, or in other words two octaves wide. That’s a pretty wide EQ band!
Parametric EQs are the most flexible types of EQ, since you have so much control over the parameters. It’s the only EQ type that lets you focus in on a narrow range of frequencies. For example, you can hone in on a particular “ringing” in a snare drum, and reduce it with a parametric band set to a narrow bandwidth, cutting at that particular frequency. Conversely, you can find the exact fundamental pitch of a kick drum or tom tom, and boost or cut it, depending on what you want for your mix.

With wider bandwidths, you can lift up a section of midrange frequencies, say 2 to 4 kHz, on a vocal track for better intelligibility, or gently reduce the midrange “honk” in a synthesizer track with a moderately wide dip around 1 kHz, and so forth.

**Shelving EQ**

A high or low shelving EQ is useful for boosting or cutting all of the frequencies above or below a certain set frequency. Typical parameters would include the shelving frequency itself, and the amount of boost or cut above (for a high shelf) or below (for a low shelf).
Some shelving EQs also include a third parameter, often indicated with a Q, that changes the shape of the transition from unity gain to whatever the gain change is for that shelf. You can use lower numbers for a smooth transition, or higher numbers to shape that transition area more dramatically. With this control, you can even create a combination of boosts and cuts around the shelving frequency.

**Filters**

These filters do exactly what their name implies: they pass just high frequencies or just low frequencies, filtering out the rest of the frequencies.

Whether a high-pass or low-pass filter, you can typically expect to find two parameters: the cutoff frequency, and the slope.

The crossover frequency is pretty straightforward. It’s the frequency above or below which the signal is filtered. In the case of a high-pass filter, for example, if the crossover is set to 200 Hz, the filter reduces the amplitude of everything below 200 Hz. If it’s a low-pass filter with a crossover at 5 kHz, the filter reduces the amplitude of everything above 5 kHz, and so forth.
The slope of the filter refers to the shape of the attenuation applied to the filter frequencies. We typically express the slope in “orders,” which are units of 6 dB per octave. That is, a first-order filter has a slope of 6 dB per octave, where a fourth-order filter would have a slope of 24 dB per octave (4 X 6 dB per octave). We would say that the first-order filter has a very gentle slope, while the fourth-order filter has a very steep slope.

In the Logic Pro X filters, the third parameter field, similar to the shelving EQs, changes the shape of the filter and adds some inverse resonance to the filter response. This can be useful for, say, adding a highs filter to a synth bass that cuts away the very low end of the signal, but also boosts a little of the low-end frequencies just above the filter cutoff.

Having said that, EQ is often a good starting point for mixing a project, because it helps get your sounds to work together better. That’s what we’re going to do here, and we’ll go to the tracks thinking about the kinds of things we can do with a little EQ. There are many different ways to approach using an EQ in mixing. While there are no hard and fast “rules,” one good approach is to start by thinking about what you can cut to get the sound you are
looking for. After you’ve done some cutting, if it still isn’t what you want, then you would start to think about boosting. In other words, you could look at it in terms of the rule of thumb “cut first, boost second.”

The hard part, of course, is figuring out what it is you want to boost and cut, and where you even start with EQ. The possibilities seem endless, of course. One very common approach is to start by creating a narrow EQ boost, and sweeping through some frequencies as you listen to your signal. This way, different things will jump out at you, and might help you hear what you want to boost or cut.

There are methods and experiments you’ll want to try for EQing individual tracks, and you’ll have a different approach for each instrument, whether it’s bass, vocals, synth, kick drum, bass drum, or other drum sounds. We discuss this all in depth in the actual Berklee Online course.

As with any aspect of mixing, it’s important to remember that when you are working with EQ, it’s very rare that you will set up an EQ for a track and never touch it again. Typically, as we are mixing, we are
constantly returning to EQs and other plug-ins we’ve already set, tweaking them over and over again as the mix takes shape.

For this reason, it’s a good idea to get used to the notion that when you are working with an EQ, you don’t want to spend too much time working with a single track. Since it’s very likely that you’ll be returning to that track over and over again, it’s usually best to work quickly, letting your first instincts guide you, and being okay with the idea that for the moment the track isn’t perfect. That’s exactly what the EQ is for!

**Jeff Baust** is the author of the Berklee Online course from which this lesson comes. Read about his electronic music influences on the next page, or learn more about the other lessons in this course by clicking the link below.
Jeff Baust is an associate professor in the Electronic Music and Design program at Berklee College of Music. A composer, audio engineer, and multi-instrumentalist, he has created scores for ESPN, the Bruins, the Red Sox, and others. As an audio engineer, Jeff has worked on projects for the Boston Symphony Orchestra, NBC-TV, Itzhak Perlman, Jessye Norman, and more.

At Berklee Online, he has authored several courses, including *Mixing and Mastering with Pro Tools* and *Producing Music with Logic*. 
**How did you first become interested in electronic music?**
In college I really became immersed in electronic music, taking classes, working in the electronic music studio, and really diving into the artists and the technologies.

**Who are your most influential electronic music artists?**
The shortlist would certainly include Jean-Claude Risset, Squarepusher, Aphex Twin, the Crystal Method, Richard Devine, Amon Tobin, and more.

**How important is it to you to stay current with software and equipment?**
It’s really important to me, for my teaching as well as for my music. I do a lot of research, keeping up on new software, new gear, new technologies and how artists are using it all.

**What are some entry-level jobs that someone should consider if they want to pursue electronic music?**
Our graduates go onto careers in a lot of different aspects of the industry, some of them into game sound design, film sound design, electronic music composition, working for technology companies, and more.
When Josh Sebek arrived at the Berklee campus in Boston to start his freshman year, he was already quite familiar with what taking classes through Berklee was all about. Right out of high school, Josh completed his Advanced Certificate in Music Production using
Pro Tools, a stepping stone that led him to attend Berklee’s Boston campus and eventually become a Music Production and Engineering (MP&E) student.

“Coming out of high school I was like, ‘Okay, well, I’m not super ready to go [to Boston] and make that kind of a move, so I’m going to do some online classes,’” says Josh. “I found the certificate online, and I ended up taking it and falling in love with it.”

He’d also fallen in love with the Boston campus when he first toured Berklee on a field trip with his high school jazz band, but he had to consider a few more things than the average college freshman: he has a visual impairment called incomplete achromatopsia.

“It’s a bit of a rare one, but it’s basically a slew of things,” he says. “I’m colorblind, I’m very nearsighted, I’m very sensitive to light ... The cones in my eyes don’t work. They don’t receive anything, so I’m stuck with everything very bright. It’s like an oversaturated camera all the time, so I wear tinted glasses to combat that as well as the nearsightedness. My eyes are always shaking, so reading sheet music has always been a problem. It kind of sucks, but it makes me who I am and I wouldn’t trade it in if I had the chance to.”
Josh grew up in a small town in Ontario, Canada and found ways to pursue the arts, though they were not always easy to find in his sports-dominated high school. He played the drums, breakdanced, and discovered his passion for producing electronic music.

“I really loved the whole music software side of things and being able to create my own stuff,” says Josh. “So, I started doing that for a while and trying to find my voice. Funny enough, it went from producing dubstep to downtempo chillout stuff. It’s not even remotely close to the genre that I started with. After that, I just went, ‘Oh, I want to look into more of this production stuff.’”

Josh was able to further his education in music production from home through Berklee Online while teaching breakdancing to

As a breakdancing teacher, I was able to become more confident [and] say ‘yes, I can do this. I can go to school. I can make this move.’

- Josh Sebek
elementary school kids for two years. The combination of learning and teaching music and dance gave him the boost of confidence he needed.

“As a breakdancing teacher, I was able to become more confident and come out of my own shell,” says Josh. “That was the thing that made a difference for me. It made me say ‘yes, I can do this. I can go to school. I can make this move. I can be successful here.’ That was the big push for me.”

During his time as an online student, Josh explored the Berklee campus in Boston several times, twice through Berklee Onsite. During this annual gathering, Berklee Online students have the opportunity to meet their professors, classmates, and attend in-person sessions.

“I knew I wanted to go to campus,” says Josh. “You get the connections prior and then you go down for Onsite. The biggest thing for me was being able to take a workshop with the professor that I had been studying with online for so long and seeing through video chat every week.”
When Josh arrived in Boston for his first semester in fall 2018, he was already orientated with the campus and had a network of friends and instructors from his online classes.

“Everyone around us in the whole Berklee circle is there to help each other,” says Josh. “It’s not a competitive environment. It’s a very collaborative, very welcoming community. Most people I run into don’t even really realize or even care that I’m visually impaired.”
Your Career Path

Ever wonder what kinds of careers exist in electronic music production and sound design? There’s much more to it than just making beats. The opportunities are even broader:

- Mixing Engineer
- Mastering Engineer
- Synth Programmer
- Music Editor
- Sound Designer for Games and Tech
- Technology Trainer/Specialist
- and more!

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Michael Bierylo is an electronic musician, guitarist, composer, and sound designer. He has been a faculty member at Berklee College of Music since 1995 and is currently the chair of the Electronic Production and Design Department.

He authored the *Electronic Music Production and Sound Design Capstone* course for Berklee Online and co-authored *Music Production 101* and *Sound Design for the Electronic Musician*. 
When did you realize production was your calling?
I always knew that I would be involved with music and technology in some way, but there was never an “a-ha moment.” It was always there, the question was how I would get paid . . .

When did you figure out the answer to that?
What was your first production job?
A bandmate of mine had a friend who owned a video post production company. At the time, they were mainly using library music, and I proposed that I could produce custom music for about the same cost. From there, I launched a freelance career producing commercial music.

What is the project that you worked on that you find yourself listening to the most?
I generally don’t listen to music I’ve worked on once it’s finished, but I still enjoy the albums I did with Birdsongs of the Mesozoic.

What’s one piece of advice that you’ve kept with you throughout your career?
If something takes forever to mix, there’s probably something wrong with the music. Fix that, and the mix should be easy.
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