***The following appeared in edited form in Muzik ETC in Graham Collins' Synthesizer Basics column.***


The last time around, I discussed the very basics about a typical synthesizer's architecture. Just to recap, the 3 fundamental types of components in a typical synthesizer are *oscillators, filters*, and *amplifiers*. In short, an oscillator creates the raw sound that we will start synthesizing with, while a filter then removes or modifies certain tonal characteristics of the oscillator, then an amplifier controls the overall volume of the sound for us to hear. Today I'm going to take a little closer look at oscillators and what they really do. First however, we do need to take an initial plunge into the nature of sound itself.

Sound is the perceptual result of our eardrums vibrating sympathetically with some other thing in the external world via the magical medium of air pressure. When a baby cries, it's vocal chords move in a particular manner that causes the surrounding air to vibrate, which travels to our ears and in turn causes our eardrums to vibrate accordingly. When a vibration is constant in speed it is said to have a particular *pitch* or *frequency.* Thus, when a guitar string is plucked and vibrates back and forth at a rate of exactly 440 cycles per second, or 440 Hertz (Hz) we perceive it to be playing the note 'A' in tune. Not all things in the natural world however vibrate in the same manner. Due to a variety of factors like material construction, shape, density etc, different objects have different vibratory characteristics. This is why a coated drumhead sounds different from a clear one, and nylon guitar strings sound utterly different than bronze ones. The result of these different characteristics is that different things sound ...well, different. Some are bright, some are tinny, some are complex and evolve over time, while some are simple. We as people perceive these things as the natural sound characteristics of whatever happens to be creating the sound, and we associate the sound itself *with* that object. This is particularly handy for us when we don't confuse a meowing kitty with a growling lion. *Pitch* and *tone* it would seem, have more than a passing correlation to object size.

Any vibration that we can hear (and many that we cannot!) can be shown as a visual representation on an oscilloscope -- a device that gives you an on-screen 'picture' of the air vibration of any particular sound. This visual representation is commonly referred to as a waveform. Oscilloscopes don't get much press these days in the world of synthesizers unless you often wield a soldering iron, but there *was* a time when it was considered 'hip' and very useful to have one to look at the waveforms you were creati... Ok ok it was never 'hip'. My name is Graham and I am a synth-nerd. The real point here, is that we can and do associate the shape of a waveform with it's resulting sound.

Oscillators in synthesizers come in a variety of different flavours, and you're bound to hear the terms 'analog' and 'digital' thrown about like kitchenware at a dysfunctional family reunion. These terms also refer to synthesizer filters, and I *will* be splitting hairs over the differences and *supposed* differences between 'digital' and 'analog' in another article. For right now though, all you really need to know is that *all* oscillators can create different types of waveforms. The more waveforms an oscillator can generate, the more useful and versatile it is generally considered to be. Early synthesizers used discrete electronic circuits to generate voltage waveforms that were generally very simple and 'electronic' sounding. With names like 'sawtooth wave', 'pulse wave', and 'triangle wave' you knew you weren't going to be synthesizing the London Philharmonic any time soon. These waveforms are named after their oscilloscopic images, and are mostly static in that they don't evolve over time the way sounds in the real world typically do. They are a little bit dull sounding just on their own, and this usually means that other parameters of the synthesizer are required to make the sound a bit more interesting or animated.

Modern synthesizers generally speaking use a series of pre-recorded digital samples as their oscillators. They are far more intricate than their earlier waveform counterparts and many would appear quite erratic and overly-complex on an oscilloscope screen. As a result, they are generally not named for their 'shape'. Not surprisingly, this also usually results in much more 'realistic' sounds than from those created by a synthesizer that uses the older-fashioned style of simple geometric waveforms. It goes without saying that it is much easier to synthesize a piano when a synth's oscillator is a recording of one. This raises several points. Since modern oscillators are really nothing more than glorified computers, *like* computers, generally speaking more is better. When a synthesizer boasts of '32Mb of ROM samples onboard'  it is referring to the amount of computer memory the oscillators have access to.  If it has 32 Mb of memory compared to say 8 Mb, then it likely has digital samples which are either longer in length and hence more detailed in the way the sound evolves over time (higher quality), or it simply has more waveforms available to use (higher quantity).   Another interesting point to note is that you will still see the terms 'sawtooth' (or 'saw'), 'pulse', 'square', and 'triangle' available as oscillator waveform options on modern-day synths.  The simple reason is that golden-oldie synths are red-hot in the popularity department and as a result, *emulating* that sound on newer synths is also a popular thing to do.

Voila!  There you have the oscillator.  Love 'em or hate 'em, these are the oscillators in your neighbourhood.  Next time, we'll be undertaking an investigation of everyone's *favourite* synth component--the filter!

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