PSYN-tology

"A tutorial for the PSYN synthesizer of Cakewalk Project5"

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PSYN-tology 1 [Echoes]

OK, as promised, this is the first installment in a series of PSYN mini-tutorials which will try to demonstrate various programming techniques by deconstructing PSYN patches. I'll keep the subject line in the form of PSYN-tology [*tutorial number*][*patch*] to ease searching later, as I hope this will become a long-running series. Enough BS; let's dig in. Fire up P5 and load the Echoes patch from the downloadable 128 presets package available from Cakewalk.

At first glance, it's a fairly simple patch: two oscillators, two filters in series, and an amplitude envelope. The key to this one is the mode button between the oscillators. Notice it's set to Sync. This means that Osc 2 (or 4) is slaved to Osc 1 (or 3). This usually results in a 'thicker' sounding, harmonically rich patch if the core pitches of the oscillators are the same or close in pitch. But here you'll notice that the slave osc is set to +3 octaves while the master is at -5 octaves.

So what does that mean? For a technical discussion, go here. But the net effect is that as this low frequency waveform crosses zero (repeats it's waveform), it restarts Osc 2, resulting in a choppy, echo-like sound.

First, click off Osc 1. Now you hear the main oscillator sound provided by Osc 2 (as run through the filters and the EG. More on this later ...). Now enable Osc 1 again and increment the octave switch. The 'echoes' increase their 'delay speed' until you eventualy reach +3 octaves: a classic hard sync sound. Perhaps it would be a good idea to disable Unison (3 oscillators per note) and double-click Detune to hear this better, as the two blur the concept a bit. Also, changing the actual notes played changes the relationship here, increasing speed with pitch. You can't play too low with this patch due to the filter setup. (More later ...). One final experiment: disable the Keys switch for Osc 1. With the master now disengaged from your KB (and outputting a static pitch), the 'delay time' become static, too.

The filters are setup up in a serial fashion. Think of filters as a flood gate. With the Cutoff Frequency completely clockwise, the gates are wide open. You're hearing all the harmonics output by you choice of waveform; in this case, not many with a Sine wave. As you back off the CF a bit, you're actually hearing less of the waveform. This is the heart of subtractive synthesis. Now here you have two floodgates in a row: the first is a Highpass filter set to 4186.8 Hz. It opens top to bottom: high frequencies pass, lower ones are choked. The sound meets the second gate: a lowpass filter with the CF set to 4522.5 Hz, which is slightly higher than the first. This allows sound to pass from bottom to top, and serves here to shave off some high aliasing-type clicky sound and almost create a narrow Bandpass area for frequencies to peek through the two gates. This results in the 'ethereal' sound demonstrated here. Try disabling one or the other to hear the differences.

The only EG used hear affect the amplitude (volume envelope). The Delay, Sustain, and Slope are effectively out of the mix in this one. The Attack is slowed to provide a gradual fade-in. The Decay and long release time work with the slow release shape to reinforce the echo simulation. The Amount is set for the maximum effect on your waveform.

You can skip all this and make similar sounds by using an LFO or a repeating envelope shape. For the first, disable Osc 1 and enable LFO 2 (bonus question: find out why I chose LFO 2 rather than LFO 1 to detail settings). Bring the Depth to 100% and the Speed to .7 Hz. (Bonus question #2: Is this setting also technically correct?). Set the Modulation Dest1 to Lev-All or Level-02 and bring up the Depth control there. Almost the same sound, but subtly different.

Now disable LFO2 and go to the Amplitude Envelope [EG A]. Keep the Amount at 100% and drop the rest of the sliders. Change the Set from Normal to Repeat [Norm to Rep]. Now play a note and gradually increase the Decay slider to about 252.6 ms. Again, quite like the sync setup.

So why go through all the trouble with Sync? For one, in the LFO and EG examples, the 'delay time' is static, but the main reason is to add yet another color to your sonic palette. This patch (or tutorial) really doesn't scratch the surface of the variety of tone colors you can achieve with oscillator sync, but hopefully this little discussion gets you curious about the possibilities.

Notes:

Unison adds two additional internal oscillators (for a total of three) for each MIDI note played, up to the limit of polyphony. I assume that means the polyphony limit that you set yourself in PSYN (up to 64 notes), but audibly it seems like that setting isn't the whole story. You can set polyphony to 2 notes, yet have a fuller sound with Unison on and a three note chord. Sometimes I don't hear the 'voice-stealing' taking place.

Detune spreads the pitches of those internal oscillators by some unknown amount and algorithm; my guess is at least 50 to 100 cents up & down (half to one full semitone). It only seems to affect the sound with Unison enabled. I could've sworn it was independent, but there may have been 'beating' induced elsewhere in the patches in question. [Slight difference in Fine Osc control, filter settings were sweeping, etc.] Think Superwave.

LFO 1 displays different Speed settings in the Tooltips than either LFO 2 or 3. The kicker is that none of the three indicate correct settings. They all function exactly the same, with identical controls, but the difficulty lies in trying to *describe* what your settings should be. They all display different numbers in Hertz for identical setups, and my ears tell me that those numbers aren't what's really happening there.

Don't be confused into thinking that Osc 1 and LFO 1 are linked in some way. Any oscillator can be controlled by any LFO, or EG, for that matter. The door to any oscillator opens with it's own Mod Sens LFO knob, and that door lets in all the LFOs. The LFO Modulation Depth is the door that lets out the LFO control signal to the destination displayed *directly above it*, and *only* that destination.

Where this gets even more confusing is in the Destination choices. Pitch is sent to any oscillator with it's door open. Level-All is sent to all the oscillators and controls the amplitude (loudness over time); it doesn't need a door. Level-01 through Level-04 are sent to a specific oscillator corresponding to it's number. It crawls through an open window in only one oscillator; no door needed. There's a similar setup for the PWM Destinations.

PSYN-tology 2 [...–.—..-]

Can't resist. Here's another patch that reinforces some of the concepts introduced in PSYN-tology 1 [Echoes]. Load up the 'Morse Code' patch [...--.---...] from the downloadable patches.

Here we have a fixed pitch courtesy of the Osc 1 settings of +2 octaves and -4 semitones in concert with the Keys disabled. Notice that the LFO Mod Sens is at 100%, allowing the LFOs to have the maximum (pitch) effect on this oscillator (but ...why?)

Move on to the filter section. This time the filters are configured in parallel, allowing two separate streams side by side to pass your signal. Cutoff Frequency on the Highpass section is set to maximum, allowing only very high frequencies through. The second Lowpass filter is set moderately high, but, as we'll see, this is really the center frequency that will be knocked around by an LFO. The settings are such that a change to a Serial mode will obliterate any sound passing through (the first 'floodgate' door has obscured the second 'floodgate' door; nothing escapes).

The key to this one is LFO 3. It's set to affect the CF of the second filter in a random fashion at a maximum Depth, both in the LFO section and the Modulation 'matrix'. The latter routes the control (not audio) signal from the LFO to a particular destination (the 'controlee'). It has an identical counterpart in the Envelope Generator section. If you set the Destinations to Pitch, the levels of interaction are regulated by the EG and LFO controls in the Oscillator sections. For some reason, the Sync box in LFO 3 is set to 1/8 note, just in case you find it musically useful to send an S.O.S. locked to the tempo at your next gig.

The end result of this is that the LFO allows some static notes to jump out randomly, simulating a telegraph sound.

PSYN-tology 3 [Reso Sweep]

This is the kind of sound got me into synths in the first place. The Reso Sweep patch reminds me of my Poly-800 (still with me, unfortunately all but retired). Let's look under the hood ...

Have you noticed how many patches only utilize one oscillator? Having four, it seems that someone could come up with some great patches (a la Crystal) with four simultaneous but unique sub-patches controlled by the four EGs (through the fifth EG A). Unfortunately only one (really two) filter section. But I digress. This fat sound starts with a sawtooth wave and is generated in part by the Unison section and a healthy (38%) Detune amount. If I understand the architecture correctly, Unison uses three oscillators per played note up tp the polyphony limit. In that case, I'd consider the choice of 8 note polyphony to be an odd one. [2 and 2/3 note chords?] Might want to increase polyphony here to avoid voice-stealing. It also appears that the patch author flirted with adding Portamento to this patch, but enabling it with the default Time gets lost in the slow envelope attack.

The filter choice is a 12dB slope Lowpass filter with a moderate amount of Resonance added. This increases the level of the frequencies at or around that set by the Cutoff Frequency. You can increase this close to self-oscillation. That's not a bad thing; you can hover near some squeaky sounds that'll pop with the right velocity touch. Notice that the settings for the second 24dB per octave filter appear to have been tweaked, but abandoned as perhaps unnecessary. Try enabling it and alternating between filters 1 & 2 enabled.

Examine the two EGs that are active. The setups are almost identical, with some subtle differences. The Amplitude envelope jacks the Sustain up but backs off on the Release time a bit with a slow Release Shape, when compared to EG 1. Both Attacks are slow, but the EG A comes in near 700ms, and EG that controls the filter is double that time. The Velocity knob here is the key; by setting it to 100%, you have the ability to 'play' the filter with your keyboard technique. [You do have a velocity-sensitive KB controller ... you don't? ... go back to PSYN-tology 0 [Disabled]].

EG 1 routes it's envelope to the Cutoff Frequency of the first filter section at 100% Depth in the Modulation 'matrix'. This makes for a very expressive patch with a minimal amount of effort. Try it with some automated 'stab' delays for a killer 'endless-ending' while your drummer shows that his extensive training in high-school marching bands have finally paid off.

OK, perfect patch, so now let's fug it up. The easiest mod is to go for a fast attack, while retaining much of the original character. Decrease the Attack time of both EG a & EG 1 to somewhere around 5 ms. While anything faster may or may not mess with the filter attack, there is an audible psycho-acoustic 'thump' that will occur with your amplitude envelope set to <5 ms. Use that as a rule of thumb. Now you've got a sound capable of a more rhythmic feel, but a bit too much release time for many circumstances. This time

back the Release Time of just the EG 1 down to about 40ms. and listen to the note 'ring through'. Nice resonance, and it has the timing of my bass player when he takes his medication. Now drop the EG A Release down to zero, and comp it up like a spaced-out clavinent. Now this sounds good with some judicious tempo delays.

Reload the original patch by using Replace Synth and PSYN in Project5 and choose the Reso Sweep patch again. This time just cycle through the first filter options and audibly note the differences: Lowpass 12, Highpass 12, Bandpass 12 and Band Reject 12. Spend some time with this last one: drop the Resonance to zero and manually sweep the Cutoff Frequency with your mouse while playing a note. Hear how that chopping a section of the frequency spectrum out can actually give you a phasing/flanging type of sound? Add a dash of automation and you'll agree that it's a great time to be alive.

One last thing: After the last experiment above, load the patch above Reso Sweep in the new [F] patch bank [Sweet Sweep] to see how a Band Reject filter, some heavy Resonance, a second filter and a little variation introduced by altering the Amplitude Envelope and using EG 1 to modulate two filter parameters can completely change the sound of what is essentially the same patch.

Notes:

This is the least flexible area of an otherwise versatile synth. The main audio routing appears to be that the final individual outputs of all oscillators go to the filter inputs, and there you have only the choice between a series or parallel setup. The output of the last filter (in series), or the sum of the two filters (in parallel) are then sent to the EG A(mplitude) to a single stereo output.

All the other EGs, LFOs and performance controls can be 'inserted' along the way, but that's the basic signal folw, to the best of my knowledge. The routings that you suggest were certainly add to the configurability. Routing specific groups of Osc would be great; routing individually would be even better. And I like the idea of a 'balance' control, splitting the filter one's output, and routing some signal out and the rest in series with filter 2. You should be a synth designer!

Actually, PSYN does follow one style of classic analog design. I've compared it to the Korg Poly-800 before. People used to complain about the one-filter 'funnel' in that, but there's no denying that contributed to it's unique sound. So, the bottom line is you can switch one filter or both on or off, and configure them in series or parallel. You get a choice of lowpass, highpass, bandpass, and band reject (notch) filters in filter 1; all at a less steep 12 dB per octave slope.

And, yes, filter 2 is a 24dB per octave lowpass-only filter, as was the Minimoog filter design. Sometimes with the Help file in P5, you have to know *exactly* what you're looking for before you can find it, which doesn't help. Persistence pays, though; there are some hidden gems in there.

Addendum:

This seemed like the best location to drop this quick tip, although some similar techniques were also presented in [PSYN-tology 7 [Radical LFO Pitchbends]](). We'll use an LFO in conjuction with KB control to impart an intermittent rhythmic shuffle to this patch. Follow the original tutorial down to the third-to-last paragraph, to the line "the Release Time of just the EG 1 down to about 40ms." Enable LFO 1, Set SMONO,Tempo Sync to 1/8, 1/4 or 1/2, a Saw Down waveshape, and LEV-01 as a Destination in Modulation at 100% destination Depth. Choose a WAB knob and crank it full-on in the Control section. Which you select depends on what's available for transmission from your controller, and personal style. Most anyone can utilize the Mod Wheel, but using Aftertouch, if possible, frees "half" of your left hand for later on.

Play some chops, and slowly increase pressure (for Aftertouch) or wheel position on only a few selected notes. The LFO slices up your progression at a speed set up in the Tempo Sync window. It's a nice addition to your toolset to jam with, but there's more.

Set one of the Assignable Controllers in Syn:Ops to LFO1 Sync, and assin it to another MIDI message that your controller can send. I'd suggest a slider, or a programmable knob (as opposed to a rotary encoder); something that'll hold a position, and therefore, a discrete MIDI value. A button that can be set to toggle, or increment in steps will do, or even the PB wheel in a pinch, if you can live without it for the project.

Bind the LFO1 Sync to your selected secondary control with right-click/MIDI Remote Control manually, or Learn it in. A slide/knob with high & low value limits is ideal here, as you can pare down the range of the Tempo Sync variation, even to only two values (for example: 1/4 & 1/4t). This'll prevent your second control from adjusting to faster or slower than you want your Tempo Sync to wander. It also can limit the control from taking the Tempo Sync to Off, but you may want to keep that setting active. You can use this value to bring in a "preset" with a unique & not necessarily synchronized tempo that's set with the Speed knob in LFO1.

Now you know what I meant by 'frees "half" of your left hand for later on'. Using Aftertouch, or the Mod wheel, to introduce the amount of LFO1's influence over the oscillator volume, the second slider/knob changes the rate of the 'attacks' either radically, or in a subtle fashion. You can even 'play' this control for accelerando/decelerando effects, and certainly to vary the rhythm of the LFO in a continuous fashion. Sometimes it'll sound like you're messing with the filter, but you're not. You still hear the downward sweep, independent of the note chopping. Have fun with this.

PSYN-tology 4 [Welcome to PSYN]

I'm beginning to think that I should've started this series with this patch. After all, it's the first taste of PSYN language that most people get, and is one of the more complex patches in terms of oscillator usage and the number of envelopes used. I guess it's meant as a showcase patch of sorts, but with all apologies to Cakewalk, they could've done a little better. As you can tell, I've never liked this patch, so let's see what we can do to spice it up. Just load PSYN; this is the first patch in the A Bank by default.

Welcome to PSYN uses all four oscillators, so let's break those down first. You may want to disable all of them, then 'solo' each one to hear it's contribution to the overall patch.

Osc 1 is a Sine/Sawtooth combination tuned down a half semitone [Fine] with the addition of the Sub Oscillator, a wave one octave lower split off from your main notes that provides octave doubling without using any polyphony. Remember that whatever waveforms that you have selected in your oscillator are duplicated down an octave with the sub; in this case, a Sine/Saw combination. Dial in just the right amount with a dedicated Level control.

Osc 2's sole purpose in life is to duplicate Osc 1's Sawtooth wave tuned up a quarter semitone, to create additional 'beating'. Personally, I think this is overkill, considering the hefty Detune amount (85%) and Unison enabled settings. I might've chosen one or the other in this patch, but it's a musical decision, and there's no denying that it's omission changes the overall texture.

Osc 3 is slowly developing part of this patch, due to the EG 2 settings: a 5 second Delay added to an already slow Attack and relatively long Decay Time. Of special note here is that Osc 3 is the only one with it's Modulation Sensitivity cranked. This allows for a completely different Envelope from the main EG A envelope by virtue of the Lev-03 in the EG 2 Modulation section. Further, the Pitch envelope set up in EG 3 is drifting over time and modulates only the pitch in Osc 3. Now add LFO 1 into play. As a square wave with a bit of a fade-in delay, the diving & swooping pitch of Osc 3 is trilled by LFO 1's square wave, making this quite a complex interaction. Note the octave and a minor third pitch difference in the oscillator settings make this leap above the other 3 oscillators.

Osc 4 further thickens the sound established in Osc 1 & 2 by dropping an octave and adding another sub oscillator to the mix; this time as a Sine wave. This is a favorite trick of many genres: adding a low frequency sine wave to bass, synths or even kicks to get those subwoofers, chicks, and town drunks up & dancing.

Hmm, what'd I miss? Oh, the filters! Double Lowpass filters in series with differing amount of Resonance and slopes (remember the second filter is always a sharper 24dB per octave Lowpass filter) set up some nice variations as the envelope (in this case, EG 1) progresses. The Cutoff Frequency of the first filter is at minimum (16 hz.), allowing next to nothing through at first glance, while the second filter is adjusted more

reasonably, around 2600 hz. But EG 1 raises the CF of both filters slowly, taking a bass-heavy sound gradually into mid-range. It could be argued that this is the true main Amplitude Envelope of this patch, just from the way the clamped-down sound opens up. The actual EG A is a rather non-descript fast Attack/Decay envelope that's there to provide some Release Time.

Perhaps this belongs in the Osc 3 discussion, but we've neglected EG 4. This one does double-duty: it adds additional modulation to an already wacky pitch envelope affecting the third oscillator, while it simultaneously creams the cutoff of the second filter. You'll only notice it's presence if you really hold some notes, as it doesn't come to life until almost a nine-second Delay and a half-second slow Attack. Utilizing Slope here adds a second Decay phase to an already busy combination. Notice that this EG really affects the Pitch of Oscillator 3, but only moderately affects Cutoff 2. This demonstrates the flexibilty of having seperate Depth controls for each Destination.

OK, OK, I'm starting to like this patch a little better after analysis, but we can do better. I think the oscillator complement is squandered with all that doubling, but, to each his own. Time to fug this one up.

We'll disable the Unison and Detune controls for now and leave Osc 1 alone as to not completely eradicate the patch. Osc 2 gets switched to an inverted Sawtooth wave, boosted an octave, a suboscillator added, and lets dial in a lot of EG Mod Sens. Drop the Attack slider near 0 on EG 1. At this point, we have a snappy thick patch. Play a chord and hold it. The power chord mutates to a 'pitch bend' which disintegrates in tremolo and finally into landing a spacecraft in the mud. Go to EG 3 and drop the Amount slider to -100%. This effectively reverses the envelope and results in a sound repeated nightly by my rhythm guitarist trying to catch up.

Return the Amount to 100%, but select PWM-All (instead of Pitch) in the Modulation section of EG 3. The quirky sound of pulse width modulation deserves a tutorial all it's own. Go to Osc 4 and boost it +4 octaves. Now we have quite a full sound that'll create a nightmare for EQing all your other instruments in the mix, but it sounds fairly full. This without using Unison and Detuning. My point here is that there's certainly a place for these functions, but they don't have to be in on every patch.

Well, my goal was to create a patch to properly showcase PSYN, but I fell miserably short. I imagined a weaving, undulating use of the envelopes and oscillators like a good Crystal patch. Guess I can't program a good patch and compose a tutorial at the same time. Some kind of right-left brain conflict. I'll work on that definitive patch, and I hope this discussion served to provide some insight into the patch. Welcome to PSYN(-tology)!

PSYN-tology 5 [Portamento Pad]

Time to take a good patch and really transform it's character with a minimum amount of moves. Prepare the Portamento Pad patch from the PSYN presets provided by the P5 programmers (then say that three times very quickly).

The Portamento Pad uses only one Sawtooth wave to generate it's sounds. It's single Lowpass filter is once again the defacto amplitude envelope, and the real EG A has a guitar-like fast Attack, moderate Decay, and long Release, though not as long or natural of a release phase. EG 1, controlling the CF of the filter, builds tension with similar settings, replacing the EG A Attack with 5 sec. slow one. Be aware that the Decay/Slope shape has also changed to Fast here.

Of course, the namesake sound comes from the Portamento section. Around a five second Port Time and a style choice of FFIX comprise the variables. So what's FFIX? Fingered, Fixed Time. Hitting F1 while PSYN is active in P5 explains these options very well, but what's important here is that you can control it's effect with your playing style. Legato playing switches on the portamento effect, while staccato notes pass uneffected. A little later, we'll butcher this patch to illustrate this more clearly, and completely alter the feel in the process. In the meantime ...

Hold a single note and follow it shortly with another held note. The first remains at pitch, and the second bends down (or up) until resolving at it's center; all while the filter delivers a frequency-dependent 'cresendo'. Fingering chords with this patch instead has a cool and somewhat unpredictable flavor to it. Although I'm not quite sure, I believe that by sensing slightly different timings per finger (due to human frailty), the portamento direction changes with each chord, even repeated ones. This is somewhat unsettling at first, until you realize this is a goldmine of 'happy accidents'. By alternating your playing techniques, and even by unintentional 'attack' differences, you can open up a world of possibilities, like finding some notes ascending and other decending in pitch at the same time.

OK, it's time to beat this patch up. The first move will be to drop that Port Time down to 200 ms. Set the EG 1 (the one controlling the filter) Attack portion to a fast (around 10ms.) setting. We're now at a modern synth piano-with-sustain-pedal type of sound. We'll tighten this up now. Drop the Detune to a reasonable 20%, and we'll keep the Unison on.

Add the second filter to the mix and Link the two together, so that altering a control in one filter causes a corresponding change in the other. Bump the Resonance in both to past halfway, between, say, 18 and 28 dB, the Cutoffs to about halfway, reset the Keys knobs, and drop the Velocity controls there to about -30%. Play a mix of staccato and legato notes and chords, like an old Elton John riff or similar. Only when you hold two notes simultaneously do you get a pitch bend type of glide. And it's controllable. Now to prove that Polyphony can also be a performance effect, drop the Polyphony count to three. See how the voice-stealing actually cleans up the long Release Times of the filter and EG A?

Let's get crazy and add a second oscillator, Osc 2. Reset the Fine control, leave the Saw wave, but raise the octave to +3. Subtlety be damned; we'll max ot the EG and LFO knobs under Mod Sens and the Oscillator Level knob.

Now go to the EG section and enable EG 2. Set the Delay, Attack and Decay to about 3000 ms. and the Sustain to 60%; these 4 sliders should all be a bit past half of the way up. Max out the Slope Release and Amount controls. Set the destination in the Modulation section to Lev-02 and the Depth to 100%. If you sustain a note, you'll hear a feed-back sound fade in 3 octaves up. Nice, and triggerable.

For the icing on the cake(walk), enable LFO 1 and set the Delay to half a second, the Depth to a few percent (certainly way less than 10%), and the speed to around 700 hz. [In LFO 1 only! Attention: Cakewalk. *Fix this bug, please.* I'm trying to **work** here, and I'm giving out misleading information.) Set the Modulation destination to Pitch, and the Depth to 100%. Now we have a little 'whammy bar wiggle' on our feedback. Those of you with Aftertouch: don't hesitate to substitute some of that for modulation control. With a little practice, it can be both expressive and controlled.

This time around I didn't delve too much into the 'whys' of how things knit together. I thought this time we'd just bang one out. If I've left any questions unanswered, please let me know.

Now take a break now and play with the 'new' patch. Use a combination of legato, stabs, and some held notes to create a variety of performance sounds. And don't take my settings as gospel; some small tweaks can greatly customize this patch to your own liking. OK, I can't resist one last tweak: Try dropping all the Release Times on the three active EGs (1,2, & A) to zero. Knock the Polyphony down to Mono. Now the same playing techniques yield a radically different sound: more slurred and not unlike an analog monosynth (appropriately!). Add some Pitch Bend over an octave in random spots and really get freaky!

Enjoy the newly mutated "Portable Port Popper" patch.

PSYN-tology 6 [LFO Explained]

I'm going to deviate from the formula that I've been following in the earlier installments. In this one we'll stick to exploring the functions available in the Low-Frequency Oscillator [LFO] section. This'll be good grounding for some of the later tutorials, and I hope that it'll open up some fascinating possibilities. So let's start with a scratch patch (say, Bank H; Patch 000, if you haven't filled it already), and peel back the layers in the LFO.

So what's the difference between a regular oscillator and a low-frequency one? Usually nothing but the frequency range available, although some synths limit the waveforms, as well. Many ancient modular synths simply used one oscillator patch-corded into another oscillator, using the first as a control source. Modern synths may limit LFOs to less than 20 Hz.; barely into the range of audible frequencies. Above this, you get into what's commonly called Frequency Modulation (FM), but it's all the same thing with different results.

Which brings up my pet PSYN peeve: LFO 1 offer a range of 0 Hz. to 1000 Hz., as indicated by the Tooltips. LFO 2 & 3 show a range of 0 to 1.0 Hz. in decimal increments. Neither is correct, to my ears. Not only that, the descending reading (especially in LFO 1) differs from the Tooltip indication when raising the slider. Even though the Help file indicated 0 to 20 Hz., I'd guess (without comparative testing against a function generator) that both offer a range less than that, and I've learned to mentally divide by 50 or multiply by 20 to compensate. Makes it difficult to write a tutorial ...

Enough BS; you've got your scratch patch in, with Osc 1 sending a Sine wave. We'll leave this alone, except to crank the LFO knob in the Mod Sens section to full. Go to the LFO section and enable LFO 1, and raise the Destination Depth to 100%, so that we can hear what's going on. The first thing you see is the Set choices. The thing to remember here is that the **F** choices are free running; that is, the LFO will run constantly whether you're playing a note or not. The **S** selections are key-synced; they restart their phase ['cycle-shape'] with each MIDI note that you send it. The MONO selections have one modulation for all the notes; for example, all have the same vibrato. The POLY ones maintain a seperate waveform for each note; potentially a very full & complex sound. Leave it on FMONO for demonstration purposes, but don't neglect this setting in the future!

You're already familiar with the wave shapes, as they're the same as the oscillators, only much lower in frequency. When using L-FM and E-FM in the Oscillator Mode, you're actually doing the same thing as we're doing here, only in the audio range. Leave the Sine wave clicked, raise the Depth to a few percent, and the Speed to (grrr!) 700 Hz. Set Destination 1 to Pitch. There's the classic vibrato sound. Raise the Delay slider to about 500 ms., and you'll get a nice fade-in for your vibrato. Reset the Delay to zero.

Set the waveform to Square and gradually raise the Depth to from about 10% to 100%. The sound ranges from a classic trill to alternating note a couple of octaves apart. Slow

the Speed control down to (grrr!) 500 Hz. and switch between the two Sawtooth waves. The standard Saw produces an '80's Synth drum beat, and the Inverted Saw puts you in a mad scientist's laboratory. [You'll get similar results with the Sine and Triangle waves at this Speed.] Before we leave this area, click the Random waveform and experience my favorite mass confusion sound: the classic Sample & Hold sound. [It sounds great with the same wave controlling Cutoff Frequency and Resonance in a filter. Try it for 'extra credit'.]

Phase and Polar are a little difficult to explain without getting technical, so we'll slow down the Speed parameter to about (grrr!) 250 Hz. and set the wave back to Sawtooth. These two settings only work with the SMONO or SPOLY modes, so choose one and hit some notes, holding for a second or two. As you vary the Phase control, you'll hear the 'pitch sweep' start at a different point. Note that the Phase at 180 degrees with the Polar switch off seems to me to be the same as the Phase at 0 degrees with the Polar(ity) switch on. That would make sense.

In a similar vein is the Offset control and it's neighbor, the Keys knob. Let's get back to where we were before: FMONO, Sine, LFO Depth < 10%, Speed (grrr!) 700 Hz., Pitch as Dest1 and Modulation Depth to 100%. Offset adds a 'DC' voltage to the control signal. In effect, instead of your LFO (in this case, vibrato), being centered on the note you're playing, the Offset raises or lowers this center of variation for the LFO. This interacts with the Speed and Depth controls, so you can get quite a variation. Try some points between -100% and 100% to see what I mean. The Keys knob introduces a connection between your keyboard and the Speed control: key tracking. It's very similar to the keytracking available in the filters and the Keys switch in the oscillators. With a positive setting, the speed of the LFO increase as you ascend the keyboard. With a negative setting, the speed decreases as you play higher notes, and vice-versa. Neat performance tool; it was originally implemented in synths to emulate some orchestral instruments, but you need not be limited to that.

I sure you already have figured out the (Tempo) Sync options, but for the sake of completeness, here goes: Any setting other than Off disables the Speed control, allowing you to synchronize your LFO waves to PSYN's host tempo at short note increments up to several measures. This is an essential feature is almost any synth/effect these days, but don't overlook the possiblities of un-sync'ed LFOs. Sometimes there's a human quality imparted by varying from 'lock-step' perfection. Click it back to Off for now.

The Control section at the bottom offers you some expressive options. The Wheel, Aftertouch, and Breath knobs work in conjunction with the three Destination Depths to allow you almost any combination of static and variable LFO control. Say you want a little vibrato on all your played notes, but want to blast only *some* notes out with some very deep modulation. Back off the Destination Depth a little, and adjust your main settings to taste. Now dial in the Wheel knob, and use your KB Mod Wheel to have continuous control over those note that 'jump out". Aftertouch is great for those of us who are fortunate enough to have it, but it will choke a MIDI stream, and takes quite a bit of practice to master. It would be nice to be able to draw an automation envelope for

an added level of control in Project5, but you can always reassign under MIDI Remote Control to bind to another MIDI message. How many of you have a wind controller or an old DX-7 breath control rig lying around? You can assign one of your controller knobs to CC #2 to control the Breath knob in a parallel fashion; it's just a different road to the same arrival point.

OK, we're down to the Modulation 'matrix'; possibly the most powerful area of PYSN, although it could be more flexible. [3 LFOs with 3 separate slots each for 15 destinations and 5 envelopes with 2 slots each for 15 destinations, and I'm bitchin' about it! Some people are never satisfied!] I think were still at our vibrato settings, so increase the LFO Depth to 100% and switch the wave to Square. Change the Dest1 to Lev-All or Lev-01 any play a few classic tremolo sounds. This in conjunction with your Sync options can give the illusion of a pounding bassline while you add a drone, a pad & some lead lines over the top with the remaining oscillators. [Coming soon to a forum near you: Another tutorial ...] Change the waveform to the Inverted Saw to give a little 'decay' to the line or to Random to imitate my drummer on a good night. Switch the destination to PWM-01 with the Random wave enabled. Go back to Osc 1 any select the Square wave. Play a note while varying the Width control with your mouse to get a taste of what Pulse Width Modulation is all about. Of course, continue to experiment with the Destinations. Cutoff1 and Reso1 are active in this patch, and will yield some cool results that should be the jumping-off point for a ton of new presets.

Whew! Now multiply what we've just gone over by 2 more LFOs with three destination slots each, and the possibilities start to really open up. Each LFO can control 3 things, or can modulate the same destination in three different ways. See the **Pitchin' LFOs** patch for a sample of what you can do with pitch variations from 3 low-frequency oscillators. And we haven't considered the EGs yet. But that's for another day ...

PSYN-tology 7 [Radical LFO Pitchbends]

OK, OK, so it's been a while since the last installment. I've got a litany of excuses (including "The dog ate my tutorial."), but rather than going into that, let's just say that I've been busy (and easily sidetracked) with my explorations of PSYN. While I touched on many aspects of the LFO in PSYN-tology 6, many deeper aspects are ripe for exploration. We'll visit some of these here, and hope that it opens the door for your own performance enhancements.

Let's load up the Ring Mod Clavinet patch (5th patch in the new PSYN bank) for this exercise, but, for most of this, the patch could be just about any one. It's a cool sound by itself, but we'll add to the performance capabilities with a few simple steps. First, enable LFO 1. Next, it's decision time, depending on your preference and your particular keyboard controller. In the Control section, you have three knobs: (Modulation) Wheel (CC#1), Aftertouch (non-CC MIDI message), and Breath Control (CC#2). These controls are 'hard-wired' to their respective MIDI messages in PSYN.

I encourage those with Aftertouch to turn that knob to full-on for this tutorial, but those without it aren't left out. The Wheel is one of the most commonly implemented devices in MIDI KB controllers, and quite appropriate for controlling the LFOs in PSYN. You may instead want to assign another knob, slider, or X-Y controller in your KB to CC#2 and use the Breath Controller knob. You could even assign a two-state or momentary switch (like a Sustain switch- reassigned from CC#64) to CC#2, and use that to pop in your LFO.

Whatever method you choose, turn the appropriate knob up each time we enable another LFO, and turn the Depth control just above the Control section for each Modulation destination that we use. The two knobs (Destination Depth and either the Wheel, After, or Breath) work in conjunction with each other here, like trim knobs and fader sliders would. You can 'turn down' the effect that your controller has on PSYN with either one, but you may prefer to have your Control knob full-on, and adjust the amount of effect with the Depth Control. This will many times give you the widest range of control from your KB.

Don't confuse the Destination Depth in the Modulation section with the Depth control in the LFO. For the following exercises, we'll leave the LFO Depth at 0.0% at all times. That way, the LFO will not affect anything in PSYN until we command it to with our performance techniques. We've already covered basic vibrato and tremolo situations, so, if you need to, go back to the other tutorials for review.

Let's get down to business. Change the Set mode to SMONO. Let's take advantage of the fact that, in this mode, the LFO resets with each Note On (as it does with the SPOLY mode). Speed goes to around 300 Hz. (grrr!), Dest1 set to Pitch, Depth of Dest1 to full, and Control knob to full. Click the Saw Down waveform. Now turn up the LFO knob in Osc 1 and fade in your Control (WAB - from here on out, I'll call it that for Wheel-Aftertouch-Breath). You get a 'shortwave radio' glide because your now modulating the modulator oscillator in the Osc 1/Osc 2 pair. Turn down the LFO knob in

Osc 1, and up in Osc 2. You'll now get a steep pitchbend effect because we're modulating the carrier in this pair. Turn the LFO knob in Osc 1 back up; this'll mellow the pitchbend a bit, as we're sweeping both oscillators by the same amount. Let's leave them both there for the rest of the tutorial.

Notice that this pitch jumps quickly well above your base pitch, then glides downward. Adjust the Sync Offset knob to -100%. This gives a more predictable 'whammy down' sound. Now turn the Sync Offset up to +100%. If you hold a note, you'll see a delay introduced before the downward pitchbend. The opposite settings will hold true with a Saw Up waveform, along with an upward PB. Let's try that now: Saw Up and Sync Offset = +100%.

Let's take a breather here, and clear up any potential confusion. My descriptions are based on a fully deployed 'WAB' setting in conjunction with your KB control fully up, in the case of MOD Wheel or an assigned knob, or maximum pressure with Aftertouch or Breath Control. A huge variety of nuances can be achieved by a subtle shift of settings or any of the 'in-between' 'levels'. Just wanted everyone to be straight on this, in case the description here doesn't quite match what you're hearing.

OK, where were we? LFO 1 = Set=SMONO Sync Offset=+100% Waveform=Saw Up Speed= ~300 Hz.(grrr!) Dest1=Pitch Depth of Dest1=100% Control(WAB) knob=100%. Go ahead and enable LFO 2 with the following settings: SMONO Saw Down Sync Offset= (minus) -100% Speed=.3Hz. (grrr!) Pitch Depth of Dest1=100% and the WAB to full on. Adjust your keyboard's WAB control. What happened to the pitchbend? It's now almost perfectly offset by the opposing directions of the Saw waves, and the opposing Sync Offset as well. Moving either Sync Offset at this point gives you a wild array of pitch bend effects, from next-to-nothing; past combination up & down sweeps, to the pseudo-random result of the two waveforms fighting for dominance. Likewise, a difference in Speeds between the two LFOs will give you a crazy set of options for some pitch modulation, and the best part is that the amount and timing of the effects can be controlled from your keyboard and/or playing technique.

Now leave all the LFO 2 settings the same, except increase the Speed to .7 Hz. (grrr!) and the waveform to Square. The result is not unlike a stylized 'bell tree' effect, with the trilled notes of LFO 2 being swept upward in pitch by the Saw Up wave in LFO 1. Here the Depth of Dest1 has a huge effect: By backing off the 100% setting, you can change the distance between the two trilled notes produced from octave(s) apart to narrower musical intervals to vibrato-like tones at small percentages.

And while the Depth of Dest1 is set to a few percent, click the Random waveform. A few percentage points difference in the Depth now can simulate analog oscillator drift, a spastic pitch bend wheel, or a classic Sample & Hold effect. The Sync Offsets and Speed settings in both LFOs come into play here, as well, adding to an already large variety of pitch sweeps. If you increase the (Random wave) Speed from .7 HZ.(grrr!) to full up, the tones can imply a jazzy atonal riff to 'stutter/glitch' effects, without all the precise editing usually associated with a true glitch, especially if you add a Cutoff1/Reso1 destination at full Depth to another Dest(x) in the same LFO. A switch to

Sine or Triangle wave at these speeds and low Depth can give you sounds that you haven't heard since you watched the Cartoon Network. Keep the settings of LFO2 to Sine/Triangle at a low Dest1 Depth.

Go back to LFO 1, and add Cutoff1 to Dest2 and Reso1 to Dest3, at full Depth. We're screwing around with resonances, so keep your monitor/headphones level low. Go to LFO 3 and set it as follows: SMONO Sync Offset=-100% Saw Down Speed=.3 Hz.(grrr!) Dest1=Lev-All Depth of Dest1 and WAB=full on. Now your crazy vibrato fades out, with the level decreasing in LFO 3 and the Cutoff and Resonance increasing in LFO 1, along with the Pitch. Now increase the Sync Offset in LFO 3 (reduce your volume!) and watch those vibrato notes jump out.

For a variation, let's increase the LFO 2 Keys knob to +100% and listen to how the vibrato speed changes according to where on your keyboard that you play. Remember that this Keytracking feature can be applied to any of these Modulation Destinations that we've explored here, and it's also available in a positive and negative direction, both here and in the Filter(s), and as a more limited 'switch' in the oscillators [disconnects your KB Note Ons from the internal oscillator(s)].

We haven't even touched upon PWM, or adding some Delay to one of these radical pitchbends, or how Phase and Polar affects all this; I'll leave that for your 'homework assignment".

Once again, I hope that I've gotten you curious on alternate ways to produce some pitch bends. We're almost using the LFO's as envelopes here, but many of these effects can be produced with even more control in the EG section. And many LFO-type patterns can be produced in the EGs (Set:Repeat) with more precise control over shape. Hmmm ... have I missed anything? I'm sure that I have, but it'll have to wait for the last of the LFO Trilogy to come out. <g>

Edit: Well, I forgot to add this to the discussion: The methods above also leave your actual Pitch Bend wheel available to augment or modify the other settings controlled by your 'WAB' knobs in both PSYN and on your KB. PB can be adjusted to some extreme parameters, like +/- 4 octaves, and the WAB can be more subtle. Or reverse that scenario. Depending on the Bend Mode choice, you can have the PB wheel bend all, only the high note (or low note), or held notes, and with independent upward & downward parameters. Combine this with PB rising from key pressure, or position on the keyboard scale, or timed delay, and you'll never run out of performance techniques. Those of you with a combination Pitch/Mod joystick or a programmable X/Y controller have it all at your fingertip(s) and those with aftertouch have bonus techniques available to your *other* fingertip(s).

I also didn't touch upon the Tempo Sync options. Obviously, synchronizing each LFO not only to project tempo, but to each other (either exactly, or in multiples/divisions of the tempo), is a great source of wild effects. Think of a ramp wave distorting pitch sync'ed at 1/2 note, 1/4 note, and an eighth note. All are competing for the attention of the base pitch simultaneously, but in a musical & rhythmic fashion. This stuff just

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boggles the mind with the possibilities ...

Late-breaking News: A lot of these techniques revolve around using the Saw Up & Down waveforms triggered with a Note On (SMONO or SPOLY) as a type of envelope. I've discovered that at slow speed settings [say, 200 Hz. (grrr!)], no matter what the Set Mode., the Sync Offset has an unexpected (to me, anyway) side effect. At any setting other than 0.0% (default-centered), the waveform 'flattens out" at the beginning or the end of a wave cycle.

That is, depending on the Saw Up or Down selection, and whether the Sync Offset knob is set towards -100% or +100%, the expected gradual rise and sharp fall (or gradual fall and sharp rise-Saw Down) characteristic of a sawtooth wave is clipped or held level for a period of time, before the sloping begins. I mention this both to prevent any confusion during experimentation and to explore the avenues opened up by this news.

I'm sure this peculiarity (?) is present at all speeds, but just more noticible at slow speeds. Now I'll have to explore whether the same effect happens with the other wave shapes with the Sync Offset. I suspect there's always going to be more to discover with this synth ...

Well, **another edit**, and after a quick review of the other wave shapes, here's what I found: Perhaps it shouldn't have surprised me. The Sine and Triangle waveforms exhibit the same 'flattening' as the Saw waveshapes, while the adjusting the Sync Offset with the Square has the aforementioned effect of determining the interval space between two trilled notes (with a Pitch Destination).

To me adjusting the the Sync Offset is akin to adding a DC component to an AC voltage (as the knob's name implies ...doh!). This can be heard clearly by adjustment in the Random wave shape. Any setting but 0.0% skews the formerly random pitch towards more & more occurences of a specific note. It's an octave lower than fingered with the SO=-100%, and an octave higher than fingered with SO=+100%. These settings make the Random wave shape ...well, not so random. I hope someone finds these discoveries useful. *I* do, but then again, I'm not that normal ...<g>

PSYN-tology 8 [Squeezy Lead]

Here's a simple patch made to sound complex by the addition of a few tweaks, and the introduction of Pulse Width Modulation. This installment of PSYN-tology also marks the return of the reverse-engineering tactics that started the series. [For those of you still waiting for my Oscillator tutorial, I'll tide you over with this great link and the specific synth link at the bottom of the page; it's a companion reference on one page that covers a lot of what we've been discussing.] I realize that things got a little heavy with the last two LFO tutorials, so let's back it off a bit. You'll find the Squeezy Lead patch in the original A [Bank Change number 0] bank of PYSN; Patch Change number 66.

The oscillator section seems non-descript: Osc 1 is set to a Square wave. No octave or transposition changes; no sub-oscillator or Mod Sensitivity. The latter indicates that any modulation that we hear will be outside the normal paths taken by the EGs and the LFOs. The Level is cranked up; the Mode is Normal. The only distinguishing settings here are the Phase (63.0 degrees) and Width (59%) control settings. Read this quick excerpt from the Help file:

> ### quote:
>
> All waveforms width is controlled by using the WIDTH control, in a continuous way. When the waveform WIDTH is selected as modulation destination in any of the EGs or LFOs, the WIDTH control regulates the modulation offset of the oscillator.

> ### quote:
>
> The initial phase of the waveform when a MIDI Note On event arrives is set with the PHASE knob, from 0 to 360 degrees. It is possible to create complex sound textures by combining waveforms in two oscillators with different starting phases.

Ok, so what's that mean? First, let's discount the Phase setting, as it needs two oscillators to highlight a difference in the starting point of a waveform, or phase, measured in degrees. No other oscillators are used in this patch, so we can disregard this setting. You can verify this by adjusting the control while playing some notes. There's no apparent difference in sound across it's range, but return it to 63.0 degrees for now. The Width control, however, is another story. Adjusting this while playing has a marked effect on the resulting sound. as you approach 0%, you can hear the effect the the modulation offset ('Width') has on the sound produced. At 0%, the result in reminiscent of a sync'ed-type of sound, although not quite there in a subtle way.

The Unison On and Detune set to 41% play a large role in the full sounding, beating nature of this patch, but not entirely. Verify this by shutting off the Unison [bringing the Detune to 0% in not necessary, in this case], temporarily. The 'beating' is coming from somewhere else, but before we track that down, let's rip into the rest of the patch.

The other performance parameters are set up for a lead patch. The Polyphony is set to Mono: one voice is active, and playing any new Note Ons with your keyboard while another Note On is held will not re-trigger the Envelope Generators or the LFOs. A 'legato' setting like this goes well with the Portamento controls, as set. The NVAR mode means Normal-Variable Time. The confusing part of this is that this mode, while always

active (Normal), always takes the specified amount of time (in this case, 200 ms.) to make the leap from note to note, whether that jump is a semitone apart or eight octaves. The glide takes a proportional amount of time in the Fixed modes (NFIX & FFIX): that is, a several octave leap will take longer to resolve to the target pitch than a semitone jump will. Note that the programmer here expects you to pitchbend this patch: the Normal Bend mode has a range of +/- one octave.

We've seen this style of Serial filter setup before. Filter One is a High-Pass with it's Cutoff set to 26.2 Hz. It passes about all of the Square wave, but adds 12.04 dB of Resonance around it's CF, producing a low-frequency peak. Notice that the Keytracking there is at 82%: the Cutoff Frequency will climb, the higher you play on your KB. This signal gets funneled straight into Filter Two. It's Cutoff is a high-midrangy 5545.1 Hz., with a strong Resonance peak of almost 30 dB. Once again, I'd recommend toggling each filter on & off to see what's each one contributes to the overall sound, and how one interacts with the next.

The key to this patch is in LFO 1: Destination 1 is PWM-ALL; an acronym for Pulse Width Modulation for all the oscillators. Since there's only one active oscillator, a setting of PWM-01 would result in an identical sound. So what's PWM? Here's a couple of links to get you started: this one & a semi-technical one; it's useful here for the illustrations. But the short story is that a Square wave, for example, has a duty cycle of 50%: that is, it spends half it's time in a positive mode and half in a negative mode. Look at the little Square wave icon in the Oscillator or LFO section to illustrate that. If you modulate the amount of time that a Square wave spends in the positive realm (with a proportional increase/decrease of time in the negative), a whole palette of harmonic variations opens up. This is cool enough in a static sense (like the Width control), but when adjusted dynamically, you'e actually sweeping through all those harmonic variations defined by the shape and under the control of an EG, LFO, or many of each, or both. I'll also add that PWM is available to all the oscillator wave shapes in PSYN, with varying results. This is an unusual configuration for any synth; use that fact to your advantage in your own programming efforts.

The LFO 1 setup here is pretty straightforward: a free-running LFO with a single trigger [FMONO], a Sine wave shape, an LFO Depth of 80%, and a Speed setting of 760 Hz. (grrr!). The Modulation section features the PWM-ALL in Dest1, as mentioned, with a slightly reduced Depth of Destination of 76%. All other settings (and LFOs) are default or not involved. So what does this PWM sound like? For now, disable the Unison button again, as to not distract from the core PWM sound. I also reduced the Portamento Time to around 20 ms., for the same reason.

Here's the main source of the rapid 'oscillator-beating' simulation. Switch the LFO wave shape to Random to hear the variations even more clearly. Now slow down the LFO Speed to around 500 Hz. (grrr!) while increasing both the LFO Depth and the Dest1 Deth to 100%, and the modulation is highlighted even more so. If you switch to Triangle wave shape at this point [slow the Speed down to 250 Hz. (grrr!)], you'll hear what resembles a 'zero-crossing' flanger, albeit with double peaks. Reducing the LFO Depth to around 90% changes the sound to include a single peak. Changing to a Sine wave

and adjusting the Sync Offset result in a similar, phasing-type effect with the Sync Offset changing the range of the sweeping sound. Reducing the Speed further still to around 125 Hz. (grrr!) and changing to one of the Saw wave shapes makes the sweep barely noticible until the wave peak is reached. This provides a gradual timbre change that you might find useful. For further experimentation, enable a second oscillator with identical settings, but vary only the Phase knob to see what this brings to the table.

I never feel like I've covered the possibilities of a particular PSYN feature in depth enough with these tutorials, so, as always, please feel free to post any questions or corrections that you might have. This is only a starting point to trigger your own explorations into the deep world of PSYN-tology. Now go modulate some pulses!

PSYN-tology 9 [Envelope Arpeggios]

Have you ever wished for an argeggiator function in PSYN, like the one in Synth1 or perhaps a fuller-featured one? Well, this tutorial will show you how to simulate an arpeggiator, and the sky's the limit as far as functionality goes. The resulting features will be proportional to how much elbow grease & creativity that you want to put into this (within your system limits). Once you get by some initial setup and repetitive input, you'll have a tweakable patch as a starting point for deeper explorations.

Let's start with a blank template patch (for example, Bank H Patch 000, if you haven't overwritten it) and a project tempo of 100 BPM. Enable all four oscillators, with a Sine, Triangle, Square, and Sawtooth Up waveform in Osc 1-4, respectively. Adjust only the octaves in each Tune section (I used +2, +1, +2, +3); we'll stay away from Transposing for now, to keep the patch usable across key scales. Enable the Suboscillator in each, and crank up the level there, along with the main oscillator level and EG knob in the Mod Sens.

The filter will be kept simple: LP12, Cutoff around 1000 Hz.,Resonance at 11 dB, Velocity there about 50%. Make sure you increase the Polyphony to something reasonable, like 08. We won't be using any LFOs. Now comes the tedious part:

All five envelopes will be used in this patch, although in a sense we're overriding the 'hardwired' nature of the EG A to amplitude with the other 4 EGs. Each one will be Set Normal & have a 0 ms. Attack, 200 ms. Decay, 20% Sustain, 32 ms. Release and +100% amount. The differences are as follows: Set Envelope 1-4 with Lev-01 to Level-04 in Dest1 with a Destination Depth of 100%, respectively. That is, EG1 controls Lev-01 (Osc 1 level), EG2 -> Lev-02, and so on. Another exception is that EG 1 has a Delay parameter of 0 ms., EG 2 = 150 ms., EG 3= 300 ms. and EG 4= 450 ms. Set these as closely as you can and forget any exact numbers.

Although we're trying to separate these notes into discrete quarter notes at the current tempo of 100 BPM, it's next to impossible to get absolutely correct settings, even with the 'fine increment' hot-keys within PSYN. The click/middle mouse wheel method jumps in large 'random' increments, as does the click/arrow key method. It makes me wonder why a Sync to Tempo setting isn't available to the EGs, like their neighbors, the LFOs. That makes it difficult to get a repeatable configuration.

The EG A has the general settings listed above, with a couple of exceptions: The Delay setting remains at 0 ms. and the Attack, Decay/Slope and Release Shapes (looks like eyebrows) are all arched upward. [The proper terms are Fast, Slow and Normal shapes, but to me, there's easily potential for confusion between a Fast setting for Attack, and a Fast one for Decay.] If you're feeling adventurous, set the EG A Dest1 & Dest2 to Cutoff 1 & Reso 1 at full Depth. OK, play a few notes. Staccato jabs only reveal one or two notes; held notes sound four 16th notes in succession.

The waveform spread gives the arp pattern a little variety. We could've used any combination of notes in the oscillators, and any delay times in the EGs. What's

important is the musical intent with the notes. The exciting thing is that you can 'arpeggiate' any pattern of up/down, pseudo-random, scalic, detuned; you name it. And with different waveforms: try that with your garden-variety arp!

The other thing is maintain a proportional relationship between the Delay times of the EGs. Because of the lack of EG Sync options, you'll often need to calculate milliseconds from beats per minute. I won't scare anyone off with the (simple) math. Instead I'll refer you to this neat link, the main tool page of that link, or suggest that you download a BPM calculator for your taskbar. Just figure out what you need in a musical sense, and calculate the millisecond interval that you need between notes, plugging those values in the various envelope delays.

We still have a quite a basic 'arpeggio': four sixteenth notes. It'll get dressed up shortly, but first, let's try a little experiment: In EG A, up the Decay to around 2000 ms., and in EG 1-4, change the Set from Norm to Rep. This repeats the Attack/Decay/Sustain portion of the envelopes, and adds some complexity to the note rhythm. Not very musical as is, but slight adjustments in the ADS sections of any of the EGs changes the relationships between the notes. You can find some useful poly-rhythms here by enabling Rep(eat) in one or two of the EGS controlling an oscillator, and tweaking the ADS sections. Now set all back to Norm(al), and the EG A Decay back to around 200 ms.

Another component in the Arp simulation is the P5 Tempo Delay. Since we have no way of looping the four notes within PSYN, we'll have to resort to external means. You can use patterns at this point, and have greater control over the progressions. I'm presenting a more automatic solution, replete with what I like to call 'happy accidents'. This solution introduces a more human element; a performance aspect to the problem. Load the P5 Tempo Delay in the track's Audio FX bin, and call up the Slapback 1 Measure preset. Set the Tempo Sync to 1 and increase the Feedback to around 30. It's a bit more like an arpeggio now, albeit with a fadeout on the note patterns that we can use to keep the arrangement uncluttered.

So how do we get more than a four note arpeggio? **Clone synth**. At this point, we have two instances of PSYN playing the arpeggio in parallel. One way to liven things up is to change the octave Tune in the 2nd instance. [I used +4, +3, +2, +1 in Osc 1-4.] Sort of a 'harmonized' version, but the timing is identical. One way to extend the arpeggio pattern's length is to increment the EG Delay settings in the 2nd instance to 600 ms., 750 ms., 900 ms., and 1050 ms. in EG 1-4 there. Workable, but there's another kind of solution..

An easier alternative is to load another instance of the Tempo Delay in the second track. Call up the same preset, but this time set the Tempo Sync to 2, the Mix to 100% (wet) and the feedback to 0. Now the arpeggio is as before, but on the third beat of a measure, another higher riff enters only once. Of course, altering the Tempo Sync relationships and the Feedback and Mix settings will yield about any combination you can think of.

I need to add that you can shave off some CPU cycles by using a single Tempo Delay in an Aux, and pointing both PSYN instances to it. You will, however, lose the versatility that two per-track Tempo Delays will afford you.

You can keep on cloning synth instances as your system headroom allows. Just do the math, add delays to delays, and tweak to perfection. The setup above occasionally peaked to 15%, up from 4-5% average, on a tweaked 2800+ w/ 1GB. YMMV.

Go wild here! Try triplets against duplets, use the Osc Levels to fade the arp pattern in/out, vary the Osc Tune numbers, including Transposition, load a completely different patch in another instance, add pitch bend to one or the other synth, change the Delay times, Osc settings, or anything else with MIDI Remote Control; run with the possibilities. And to think, not one LFO was harmed in the making of this tutorial ...<g> But if we added the square wave trills provided by an LFO (as detailed in earlier installments) to the arpeggios ...

I hope this one got you thinking outside the [PSYN] box.

Notes:

> *quote:*
>
> change the Set from Norm to Rep. This repeats the Attack/Decay/Sustain portion of the envelopes

I (and the Project5 Help file) was in error here. I should've tested the options more thoroughly.

My gut feeling proved correct in that anything between MIDI Note On (finger presses key) to Note Off (finger releases key) is included in the Repeat 'loop' when it's switched from an envelope's Norm Set mode. The Delay, Attack, Decay, Sustain level, and Slope (second decay) settings all contribute not only to the envelope shape but also affect the overall length of the repetition.

To try a quick experiment that will clearly show the true parameter interaction, open a 'blank' PSYN patch, turn up the EG knob in the (solo) Osc 1, and, in EG A, set both Modulation Destination slots to Pitch at full Depth. Set the Mode from Norm to Rep, and lower the Slope from 10,000 ms. to at least half of that. Now play with the Delay, Attack, Decay Sustain and Slope for quite the variety of repeating pitch sweeps of different lengths.

The Release stage setting will only affect your envelope after Note Off, but nonetheless plays a role in 'closing out' the repeating envelope shape. And speaking of Shapes, these settings are also within the confines of the Rep 'loop'. The experiment above gives excellent audible feedback indicating clearly which 'eyebrow' Shapes correspond to Fast & Slow Shapes, along with the obvious Normal Shape. I hope this helped clarify some of the envelope settings (and the Help file).

Edit: Of course, in keeping with my motto: "Excess through moderation." (or is that

vice-versa?), I've just added a couple more envelopes to the mix in the experiment detailed above. Set them all to Pitch at full Depth and Rep mode. Now change the settings on all three (or more) envelopes to be as different as possible from the other envelope settings. Great for percolating, pseudo-random freaky stuff, and that's just controlling Pitch. Lots of possiblities come to mind for filter, pulse-width and oscillator level applications. Remember that adding Pitch (or many other destinations) in both Destination slots in each envelope greatly increases the range available to the pitch modulation. The same goes for doubling/tripling Destinations in the LFOs.

PSYN-tology 10 [LFO Arpeggios]

It seems there's more than one way to skin an arpeggio in PSYN; not bad for a feature that doesn't exist! This version is quite easily implemented, and also very versatile, but the tradeoff lies with exact note selection. Curious yet? Let's dig in.

Once again, start with a 'blank' patch (any one of the F, G, or H Banks, or half of the B, C, D, or E Banks, if you haven't filled the slots). It doesn't really matter what the Osc 1 settings are, but you do need to maximize the LFO Sensitivity knob there. I happened to select both the Square and Saw Up waveforms instead of the Sine, and bumped the Width to 70%. The Filter 1 settings are rather blase; feel free to change this stuff later. I'm just trying to keep the distractions to a minimum until the basic concepts are presented. LP12, Cutoff mid-way, Velocity 50% for a little variation, Reso to taste, if you like.

The only envelope that we'll be using here is the amplitude envelope: EG A. The settings here affect how long you're arpeggio will 'sustain' or 'echo', before fading out. You can adjust these to taste and tempo, but the following seemed fine for 90-130 BPM; my project tempo was set @ 100 BPM for programming. Delay=0.0 ms. Attack just over 5 ms. Decay at 1600 ms. Sustain Level around 50% Slope=1400 ms. Release at 4400 ms. Amount +100%. Feel free to adjust the Shapes above this: a Fast Attack works nicely here, while the 5 ms. slider setting avoids the psychoacoustic 'pop' phenomenon. Oh, and bump the Polyphony up to around 8.

The heart of this patch is the LFO section. Enable LFO 1 and set it to SMONO, 1/2 Tempo Sync, full LFO Depth, Lev-01 as a Dest1, and full Depth there, too. Now start punching LFO waveforms, and play some staccato notes. Sine & Triangle both have a nice 'volume pedal' fade in/out. A Square wave has more of a beat to it; it makes you want to enable the Osc 1 Suboscillator for an easy *ostinato* bassline. The Saw Down is similar, with a perceived sharper attack. The Saw Up is more of a fade in. We'll settle on the Random waveshape. It has more of a variable rhythmic quality to it, which we can adjust with the Sync Offset. At it's default setting, it's solid, but a bit blurred in 'notes' attack. +100% Sync Offset slurs the distinction even further, but -100% gives a wider range between 'off' & 'on'.

I hope that you've noticed how the notes have faded away over time, but always in the order played. That is, last note played fades last. We'll use this to our advantage later. Remember that this is determined by the EG A settings.

LFO 2 is set up similarly, but with a few surprises. Enabled, SMONO, Square waveshape, Sync Tempo=1, LFO Depth at maximum, and Dest1 is set to Pitch at 100% Depth. Now the notes we've been listening to have been split, and alternate between one octave below, and one octave above, the original pitch. You can have some fun with the Sync Offset here, too. -100% yields the original note & an octave below; +100% gives the original and an octave above. Now try some intermediate settings: it is possible to set an interval between. Try +/- 40% and see what you think. You may need to bump up the Osc 1 Octave to +1 or +2 to hear this clearly and/or keep it out of the

mud. Now try increasing the Delay time in LFO 2 to around 1000 ms. Now you'll hear the original note 'strum', followed later by the octave switching. Return the Delay and Sync Offset to zero.

LFO 3 is setup exactly the same as LFO 2 (where's the copy/paste function here for programming?) with the exception of a Sync to Tempo setting of 2, and a Sync Offset of +100%. his combination changes every other repetition of LFO 2's alternating notes and alternates *them* at the original octave(s) and an octave(s) above that.

Everything is getting a bit thick here, so let's try using the Polyphony setting once again as a performance device and thinning filter. Set it to 4, 3, 2, and Mono voices in turn, but try to play larger chords than there are available notes in each case. Let the voice-stealing make some choices for you, and rob your voices to make room for your next phrase. When you get to 2 voices or Mono, go crazy with your octave switches on your KB controller. You'll hear overlapping phrases fading as the next phrase comes to life. [Warning: Sometimes the Mono setting will not retrigger, leaving you in stunned silence. Bump the Polyphony to recover quickly.]

You can now use this as a basis for a whole variety of simulated arpeggiator sounds. Try substituting a Saw Up in LFO 3 for a weird glide, or drop the LFO Depth there to a few percent and use the Random waveshape. Old-school analog oscillator drift comes to mind, and a few percent more yields some semitone trills around your note center. Oh, and don't forget to try selecting Pitch in all three Destination slots; all at full Depth. Your note range will shoot through the roof!

So there you have another way to fake an arpeggiator function in PSYN, and one that involves no math, BPM conversions, and less work. This is thanks to the Sync to Tempo settings in the LFOs; it's a feature that's sorely missed in the EG sections. And while we're at it, if there were a choice of Destinations with Pitch, similar to the Level designations, we'd have yet another Arp tutorial. With Pitch-All, -1, -2, -3, -4, we could send to specific oscillators, each set to a different Octave/Transpose note. That would expand on the techniques thus far and allow for sequential & repetitive mini-phrases. Oh, well, that's for another thread (and version number). Enjoy!

Addendum:
Had I re-discovered the "DLA delight !" patch (#87 in the Cakewalk downloadable patch set) before I wrote this tutorial, I might've used this as the basis for this installment. To mark the unofficial return of the PSYN-tology series, I'm going to start by closing out some unfinished business.

Load the patch above, and notice that it's a simple one-oscillator creation that uses all three LFOs to modulate the pitch of Osc 1 to simulate a tempo-sync'ed arpeggio. A mellow (harmonically subdued) Triangle waveform was chosen, and boosted a couple of octaves to shift the average range of 'playability' toward the high end of the spectrum. The LFO Mod Sens knob at 100% allows the LFOs to exert maximum influence over Osc 1's pitch.

Next we'll examine the filter action in this patch. In parallel, both filters are heard in their respective paths without influence from it's companion filter. The LP24 Filter 2 delivers the main body of the sound, with a fixed Cutoff of 267.9 Hz. being bumped upwards by the velocity of your playing. Disabling both filters is a similar sound to having only Filter 2 Enabled, but the second filter gives a noticeable boost to the low end without using Resonance.

The HP12 Filter 1 imparts a 'sheen' over the patch, which, when auditioned alone, doesn't have much influence below middle C without an assist from the LFOs or EGs. The Cutoff is based around an mid-to-upper midrange 3161.3 Hz. Your velocity messages from your KB controller only influence this half as much as the Filter 1 Cutoff. Without the LFOs, this is a fairly muted ethereal patch.

Before we leave the filters, note that the programmer setup all three LFOs with a Destination(2) of Cutoff1, but with the Depth of those destinations at 0%. As it stands, the LFOs have nothing to do with Filter 1's Cutoff Frequency, but you can easily add some snap to the 'arpeggio' by raising each of these knobs to 100%. This guy (the programmer) *wants* you to experiment.

OK, the keys to this sound lie within the LFOs. All three have a a 100% Depth over the Pitch destination (Osc 1), along with the 'inactive' Cutoff1 assignment detailed above. All three also use a Square waveform to alternate between two discrete levels (in this case, producing scalar note events) at a rate that's sync'ed to tempo. Remember that a setting in the Sync box disables the Speed control. The Polar, Phase, Delay, Speed, Sync Offset, Keys, and the second & third destinations are all effectively out of the patch.

It's the interaction among all three LFOs that produce the final 'notes' here, and the differences found there produce the variation. Disable LFO 2 & 3, and listen to the slow 2 beat sync alternation between a tritone above and below your fingered note. This is by virtue of the LFO Depth being set to 50%. Your sending half of the amount of possible LFO control through the destination, and the result is a half-octave above and below. Try shifting just the Depth slider for many odd intervals, up to +/- octave at 100%. With enough patience, you can get close to musically useful ratios with intermediate settings, but, be forewarned: "It ain't easy". Return it to 50%. LFO 1 also uses a free running setting [FPOLY] that isn't re-triggered by your MIDI Note Ons, but each note retains it's own LFO phase.

Disable LFO 1 (& 3), and Enable only LFO 2 to hear a slower still 4 beat sync which alternates octaves above & below your core fingered note. Notice that it is also free-running, but maintains a single Square wave phase to it's waveshape throughout [FMONO]. If you Enable LFO 1 at this point, you'll hear a descending four-note progression which is the result of the combined influence.

If you now audition LFO 3 alone, disabling the other two LFOs, you'll hear that familiar tritone riff, but this time it's sped up with the 1/2 beat Sync. It also adheres to the FMONO characteristics, as does LFO 2. When you combine all three as programmed

originally, you'll enjoy that three octave downward drift with that quirky 'hesitation' in the pattern.

I'll interject here with a note pointing out that Unison is enabled at just under 50% to thicken the final sound, and Polyphony is limited to 4 voices to keep down any overlap from excessive decaying notes. I doubt that it was set this way to keep down the CPU usage; this patch is very easy on resources.

I didn't mention the EGs, as there's nothing there with an unusual control over the patch. The overall contour of your notes begins with about 1/10 of a second Attack, minimal initial Decay, a nominal 70% Sustain level, and a maximum (10 second) Slope (second decay) from that sustain level to your Note Off. From there, you can hear a nice two second fadeout of the 'arpeggio' courtesy of the Release Time.

Another EG curiousity is the disabled EG1. It's obviously been tampered with, and set to a cyclical (Rep) envelope that's out to get Cutoff1 for a subtle sweep of the highpass filter. It's got an Attack and Decay each set around two seconds, which combine for around a 4 second 'loop' of the settings. As I said above, this guy *wants* you to experiment here. Try Enabling EG1, but switch Dest1 to Cutoff2 and bring up Dest2 to Reso2 at 100%. Go the Filter2 and raise Reso to about 30 dB, and you'll clearly hear the filter sweep undulate. It's almost like another LFO, only better, with the added benefit of shaping the 'waveform' with the envelope controls. Now if only you could sync an EG to tempo ... Notice that both the Attack and Dcy/Slp waveform shapes have been altered for a unique cycle.

As the patch stands, you can easily add Lev-01 (or Lev-All) as a third destination in each LFO, and get interesting variations on which notes are heard with varying combinations of destination Depths. As detailed above, try differing amounts of LFO Depth in each for some atonal combinations that border on a 'random' sound. Nice trill sounds result from low LFO Depths. You can get a little crazier by bringing in a Pitch Destination in the Modulation section of EG1, and increasing it's influence with the EG knob in the Mod Sens section of our lone oscillator, Osc 1.

This addendum is a bit of a return to the roots in the PSYN-tology series. We started out analyzing patches that everyone had (presumably) in their setup already. I've drifted from that format somewhat, and hopefully expanded on the tutorials' usefulness in the process, but it won't hurt to revisit the process that began the series. Now before I'm off to other unfinished business, I'm almost afraid to ask for an explanation of what "DLA delight !" is, but if I don't, I'll feel like I'm missing out on something, and that'll keep me up nights.

PSYN-tology 11 [Random Detuning]

Here's quick & easy one. Start with a scratch patch and enable Osc 1 & 2. Deselect the Sine waveshape and select Saw up and Octave +1 in Osc 1 and Saw Down and Octave +1 in Osc 2, and turn up the Mod Sens LFO knob only in Osc 2. Play some notes; no sound, eh? The two opposite waveforms cancel each other out exactly. If you change the Level, Width, Phase, Octave, Transpose, Fine (anything that changes the waveshape in either Osc), the oscillator sound starts to come through.

Set the Polyphony to 8, and in Filter 1, bump up the Velocity to 40% for a little variation. You should change the EG A settings to the following: Delay 0 ms. Attack 0 ms. Decay 1000 ms. Sustain 60% Slope 1000 ms. Release 1000 ms. Amount +100%. These settings are rough guides, and some slight changes here later provide a great deal of variation to the sound that we're after.

Now here's the key: we're going to introduce a very slight Pitch change to Osc 2 through the Mod Sens LFO knob that we cranked earlier. Enable LFO 1 and set the Dest1 to Pitch, but only open the Destination Depth there by 2.0% or thereabouts. Set the waveshape to Random, and experiment with the Set later; for now, leave it at FMONO. The Speed of the LFO goes to 500 ms., and the LFO Depth is also set to 2.0%.

At this point, you should here a very random 'amplitude envelope' created by the Random pitch reinforcing and cancelling the Saw Down of Osc 2 with the Saw Up in Osc 1. Playing a series of notes creates an overlapping ambient atmosphere of tones helped by the long Release times of the EG A. Notice that though we have a very fast Attack set there, the resulting sound belies that fact.

Increasing the LFO Depth to around 10% for a slight chorusing and gradually to 50% produces a variety of subtle effects, approaching a randomly non-periodic 'zero-through' flanger sound. The Pitch change that's introduced is just deep enough for these effects. Up to 100% LFO Depth really gets into deep detuning effects, but in a more natural random fashion than repeating waveforms will give you.

One last thing to try before I let you go on to your own experimentation. Change the waveshape in LFO 1 to Sine, or Square, or Triangle, etc. It doesn't really matter which, because now you're going to enable LFO 2 with the *exact same settings* that you have in LFO 1. Now that everything's the same in both, hit the Polar button in one of the LFOs (or change the Phase slider to 180 degrees in one of them; it's the same thing). Theoretically the two LFOs should cancel each other out, as the oscillators did with the Saw Up/Down waveforms.

But it's almost impossible to get identical, repeatable settings in PSYN, especially across two LFOs, so we're treated with very slight variations that will take this detuning scheme to new heights. Play around with trying to adjust the settings the same, and listen to the strange beating effects that result.

[Believe it on not, I set out to write a Plucked String simulation tutorial. Somehow that transformed into a wild pitch-mangling patch that emulated the sounds that I hear outside the shutters (Hurricane Frances' outer bands knocking at my door). In the process I discovered this simple, yet effective combination: random and/or periodic detuning without the Unison/Detune or Fine controls. Go figure.]

Notes:

This seems like an appropriate addendum to this tutorial. I got to thinking that I'm always stressing 'extreme' effects in the series, hoping to show how wild a sound you can create. I then assume that everyone would absorb the technique and tone it down for their own musically useful purposes. Perhaps a better route would be to demonstrate some subtle techniques that are more useful upfront, and let the X-Fivers push the envelope, if they choose. To that end, I'll add some subtle variation to the detuning theme here.

In just about any patch, enable two or three LFOs and point the Modulation Dest1 to Pitch. This time we'll leave the Destination Depth on each at 25%, and go to your favorite WAB control (Wheel-Aftertouch-Breath) and turn it up to a very small amount, no more than 2% for now. This is where you want to accomplish your fine-tuning, as these controls display a much finer incremental progression than most any other control in PSYN. Remember, do this in all three. And don't worry about exact settings in any of this; it's the inconsistencies that make this sound.

Choose a Sine wave in each LFO, and a Speed at or around .4 Hz. [listed as 400 Hz. in LFO 1 only]. With Speed you definitely want to check that's there some variation in the Speeds of the 3 LFO's. Vary them 25 to 100 Hz. [Again, this is only in LFO 1].

Now play a few chords, and activate your WAB through it's full travel. You now have light flanging/chorusing/detuning, depending on your choice of settings. Notice that although you're cranking your WAB control, upstream you have for all intents put a brick-wall limiter on the effect that your MIDI messages will have on the depth of the time-based FX.

The best part is about all of this is that it's performance-controlled. You can add detuning effects on only some notes/passages, at adjustable levels. You need to keep all of these variations at your fingertips, even if you only use them twice in a song; in my opinion, that is the secret to constructing a good patch.

Don't limit yoursef to the Sine waveform. Even better sounds can be evoked from mixing a Triangle wave with a Sine. You can get a nice "Strawberry Fields" sound with a light dab of the Random waveform. Remember that the 2 or 3 LFOs are cumulative, so balance the destination Depths and WAB controls of all LFOs as if they comprised a 3-part LFO.

OK, OK, that's a one-time shot at subtlety! It's not my nature; I want **extreme**. Crank all three LFO's destination Depth controls to max, for a total of nine. Dest1, 2, & 3 of all

three LFO's goes to Pitch, with a different waveform and Speed in each one. Try a Saw Down in one, and a Saw Up in the other; throw in a Random in the third. *Now* use your WAB control. Now *that's* an effect!

PSYN-tology 12 [Phasor Lead]

Back again with a new patch deconstruction. This time let's analyze the Phasor Lead that's found in the new patches: Bank F - Patch #36 (on controllers with a 0-127 patch change implementation). This is a great sounding patch that's deceptively simple, and it illustrates one of the ways to fatten some oscillators. We'll also explore some others methods.

The programmer may have intentionally left Osc 1 inactive to encourage your experimentation with it. Osc 2 becomes the 'main' oscillator, with it's notable settings being a slightly lower than normal volume (mixed into the background a tad) and it's Saw Down waveform. Osc 3 & 4 come in at nominal level (70%) with the exact same Octave and Waveform, but with a twist. Osc 3 is detuned -40 cents, while Osc 4 tunes up 42 cents; a total spread of nearly a semitone around the base pitch set in Osc 2. Hear the difference this makes by first disabling LFO 2 for clarity, and playing a sustained note. Now disable one or two oscillators in turn and realize that this is what puts the "Phasor" in this patch.

This is an object lesson for what happens behind the scenes with the Unison and Detune section at the bottom of PSYN. Two additional copies of the original note are added by pressing Unison, and the Detune knob spreads those additional notes above and below the original pitch. I can't produce an exact ratio between a Fine setting in the Oscs and a Detune percentage, so there seems to be a different algorithm involved here. The Mono setting in Polyphony tells me that all oscillators are engaged with the Unison button in this patch, so that may contribute to the following scenario.

Disable Osc 3 & 4, leaving Osc 2 to fend for itself. Nice, but kind of thin, don't you think? Engage the Unison button while sustaining a note. There's evidence now of cancellations and reinforcements to the original wave, reminiscient of pulse width modulation (PWM), and this is with the Detune knob at 0%. Gradually increase the knob slowly while you're playing. Quickly the sound deepens it's phasing/flanging effect until an out-of-tune character overtakes the sound at around 40%. Continuing the increase takes you past 'oscillator beating' to a frequency modulation (FM)-type of sound, appearing to be +/- a semitone each way at fully clock-wise. The resulting sound isn't as subtle as the original patch, but it's worth exploring many ways to thickening your patch. Other ways that are equally viable are sweeping the PWM (quite a different process), sweeping the Pitch very slightly with an LFO or EG, varying the Width or Phase knobs between oscillators, adding a few milliseconds delay with an effect unit, etc.

It's worth noting that the Portamento control is on, with NVAR determining that the glide will always be there, whether you play legato or staccato. It also means that (counter-intuitively) the glides will all be 64.8 ms.long, if you jump up three octaves or two semitones. The "VAR" part appears to mean variable distances between notes, rather than a variable portamento time. Fixed Portamento attaches a specific time to each note on your keyboard; the results being that multi-note interval jumps take longer to resolve to the base pitch than smaller ones. Also remember that the "N" part means

Normal, and the Fingered pair of settings (FFIX; FVAR) are triggered by your performance (legato playing).

Return the patch to it's original state [Osc 2, 3, & 4 enabled; Unison/Detune off; LFO 2 enabled]. Let's concentrate on LFO 2. This adds another layer of sweeping by a slowly undulating filter modulation courtesy of a Sine waveshape, a Depth around halfway, and the Speed determined (and overridden) by a tempo Sync setting of 16 (dotted) beats. I should also mention that this is all made possible by the Cutoff1 in the Modulation Dest1, and the destination Depth of 100%. It's long enough (the sweep cycle) to be subtle, yet slightly longer than four measures at 4/4 to prevent a mechanical-sounding strict lock to tempo. Try switching the LFO off & on again to listen to it's effect on the patch.

Now let's glance on the Filter (1) setttings. These are pretty much the default; nothing unusual except the switch to a band-reject filter (BR12). You're now looking at yet another way to create a thicker patch by simulating "phasing". By sweeping the Cutoff Frequency of a band-reject filter, you're moving a relatively narrow area of the frequency spectrum where no frequencies are allowed to pass. This is (audibly) quite similar to the comb filter cancellations that are the heart of any phase shifter (effect). Try switching the waveshape of LFO 2 to one of the ramp waves or Random and/or increasing the Depth to maximum, to see just how long it takes to cycle through. For now, we'll leave the LFO 2 off for some more experimentation.

The only active envelope generator is EG A. I'm about to demonstrate how you can use EG A to not only determine the contour of your note's amplitude 'life-cycle', but also sync up some other modules in PSYN to follow the exact same envelope. EG A is set about as straight-ahead as it gets: Slight Attack (5.1 ms.; see the notes about this in the other PSYN-tology lessons); Decay, Release & +Amount at maximum; Sustain level at 70%. You have an almost instantaneous Attack, and the level holds until right when you release the key (Note Off), and not a millisecond longer. [Ok, maybe a few ms.; we'll leave MIDI stream timing/audio latency for another day.]

We're going to mess with this a bit: increase the Release in EG A to around 1000-2000 ms. and select Cutoff1 and Reso1 as Destinations there, both at a destination Depth of 100%. Go to Filter 1 and maximize the Resonance there. You won't hear much difference with the BR12, but click the Set section once to bring up the LP12 filter. Still sounds the same with legato playing, but you're treated to a nice "reso-release' downward filter whenever you lift your fingers from the KB. Now gradually reduce the Amount slider toward 0% and/or increase the Velocity knob to "play" the filter. There's some interesting sounds to be had between 0% and 30%, but don't neglect the negative Amount settings, either. Around -30% Amount, you get a nice bass pluck with an upward Reso sweep. Using a negative Amount of EG in effect "flips" the EG controls; what was upward is now downward, and slow becomes fast, in a manner of speaking.

You can also "play" the filter by reducing the destination Depth of Cutoff1 in the Modulation section. Changing Reso1 to another Cutoff1 Destination will do strange

things to the filter, as well, opening up a competition between the 2 destination knobs for the affections of the Cutoff Frequency. All of these methods send control signals to the same Cutoff Frequency, but we're altering the range available to it, or the amount of variation that's allowed to pass throught to the filter.

I'm getting behind on these tutorials. I've got many half-finished, and I'm working on a "Quick Tips" for programming in P5 that everyone will be welcome to add to. I've also got some promises to fulfill on some tutorial subject matter: straight-up and paired oscillators; branch out to other P5 synths; incorporating FX with PSYN; and ... now where did I put that Plucked String tutorial?

PSYN-tology 13 [Baba O' B Rock]

The thirteenth installment in this series is appropriately clouded in mystery! Start from a scratch patch to avoid any possibility of 'contamination' from hidden settings in any unused section. Plug in the numbers, and you'll be rewarded with an unusual implementation of PSYN's filters that 'push the envelope' in more ways than one. Depending on your age/musical background, you can glean a hint from the subject line. Happy programming!

[**Oscillator Section**]

Osc 1: Enabled

Wave:: Saw Up
Width: 0%
Phase: 0%

Tune:
Oct: 0
Trans: 0
Keys: On
Fine: 0%

SubOsc: Off
Level: 0%

Mod Sens:
EG: 0%
LFO: 0%
Level: 70%

Osc 2: Enabled

Wave: Saw Down
Width: 0%
Phase: 0%

Tune:
Oct: 0
Trans: 0
Keys: On
Fine: 34%

SubOsc: Off
Level: 0%

Mod Sens:
EG: 0%
LFO: 0%
Level: 70%

Mode (for Osc 1 & 2): E-FM

Osc 3: Enabled

Wave: Square
Width: 20.3%
Phase: 0%

Tune:
Oct: 0
Trans: 0
Keys: On
Fine: 22 cents

SubOsc: On
Level: 100%

Mod Sens:
EG: 0%
LFO: 0%
Level: 70%

Osc 4: Enabled

Wave: Square
Width: 79.5%
Phase: 0%

Tune:
Oct: 0
Trans: 0
Keys: On
Fine: -32 cents

SubOsc: Off
Level: 0%

Mod Sens:
EG: 0%
LFO: 0%
Level: 70%

Mode (for Osc 3 & 4): Sync

[**Filter Section**]

FLT 1: Enabled

Set: LP12
Cutoff: 80.8 Hz.
Reso: 18.52 dB
Keys: 0%
Vel: 34%

Config: Ser
Link: On
Feedb: 0%

FLT 2: Enabled

[**Set**]: [**LP24**]
Cutoff: 80.8 Hz.
Reso: 18.52 dB
Keys: 0%
Vel: 34%

[**Envelope Section**]

EG A: Enabled

Set:Norm
St Lev:0%

[**Shapes**]:
Attack: Linear
Dcy/Slp: Linear
Rel: Linear
Vel: 50.4%

[**Envelope Sliders**]

Delay: 0%
Atk: 5.1 ms.
Decay: 1409.7 ms.
Sus: 45.4%
Slope: 138.8 ms.
Rel: 2583.1 ms.
Amt: +100%

Modulation:
Dest1: Off
Depth [1]: 0%
Dest2: Off
Depth [2]: 0%

EG 1: Disabled

EG 2: Disabled

EG 3: Disabled

EG 4: Disabled

[**Low Frequency Oscillator Section**]

LFO1: Enabled

Set: SPOLY
Tempo Sync: 8
[Wave Shape]: Saw Up
Sync Offset: 100%

Keys: 0%
Polar: Off
[**LFO Sliders**]:
Phase: 0%
Delay: 0%
Depth: 100%
Speed: N/A

Modulation:
Dest1: Cutoff1
Depth[1]: 100%
Dest2: Off
Depth[2]: 0%
Dest3: Off
Depth3: 0%

Control:
Wheel: 0%
After: 0%
Breath: 0%

LFO2: Enabled

Set: SPOLY
Tempo Sync: 1/4 t
[Wave Shape]: Random
Sync Offset: 0%
Keys: 0%
Polar: Off
[**LFO Sliders**]:
Phase: 0%
Delay: 0%
Depth: 100%
Speed: N/A

Modulation:
Dest1: Cutoff2
Depth[1]: 100%
Dest2: Off
Depth[2]: 0%
Dest3: Off
Depth3: 0%

Control:
Wheel: 0%
After: 0%
Breath: 0%

LFO3: Disabled

[**Performance Control Section**]

Bank: N/A
Program: N/A

Polyphony: 06

Tune: 0 cents

Unison: Off
Detune: 0%

Portamento [Type]: Off
Time: 0%

Bend:
Mode: High
Up: 12
Down: 2

Output:
Pan: 0 %
Volume: -6.2 dB

Let me know what you think of this departure from the format that I've been using up to this point. Depending on the response, I'll use this method occasionally or abandon it altogether. An explanation of the programming techniques will follow ...

Explanation

OK, here's the reverse-engineering on this patch, as promised. The heart of the patch is in the LFOs/filters interaction, but we'll begin by disabling both LFO 1 & 2 to see how we got there. You also need to temporarily change the filter Config setting to PAR, as the absence of the LFO control signal leaves the Cutoff Frequencies too low. What you end up with is playable velocity-aware & filter-bumping patch following a piano/electric guitar-like envelope with a long Release tail. Perhaps a bit too much Res in the linked filters; watch those levels!

Oscs 1 & 2 are paired in the E-FM (exponential frequency modulation) mode. Osc 3 modulates Osc 4 as the carrier, and it is Osc 4 that you actually hear. Test this lowering first Osc 1's Level, then Osc 2's Level knob. Adjusting Osc 1's Level will cause timbre changes, but lowering Osc 4's Level to 0% results in no sound. The E-FM Mode is somewhat more dissonant, and skewed towards higher frequencies than the linear (L-FM) mode, which is perfect for this patch.

The whole idea was to present a complex signal to the filters to work with. You can just as easily get away with only one oscillator in this patch; I chose to make it a 'big' sound. There's a Saw Up in the first oscillator, with a Saw Down in the next, in hopes of some interesting cancellations between the opposing waveforms. I raised the Fine controls in Osc 2 a third of a semitone to introduce some oscillator 'beating'. You can raise the Octaves in both oscillators to +2 for more of a 'pluck' sound, but to do it properly, you should control both oscillators with an envelope cycle (EG 1,2,3, or 4) which totals no more than 30-50ms., to simulate the transient nature of the harmonically complex 'pick attack'.

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Oscs 3 & 4 are set to a relatively subtle use of the Sync mode. As you know from the other tutorials, Sync Mode has Osc 4 slaving to Osc 3's Master. The Fine control 'detuning' leaves it's mark, but that lovey Leslie-type of sweeping is the results of shifting the Width in both of these two oscillators. I had the Suboscillator up in Osc 3, for some reason; can't recall why; must've heard something that I liked. But click on the Subosc in Osc 4 for some odd tremelo effects, and use it's Level control for the depth of the tremelo. Notice that these two oscillators are mixed further to the front, compared to Osc 1 & 2 70% Level. These two provide the low to mid frequency foundation, and the first two Osc fill in the mid-to-high layer, with some overlap. Once again, you can switch to a NORM mode and bump one of the oscillators here to an octave, or octave & a fifth, higher as to simulate a strong harmonic when mixed in the background. You can use the same envelope trick listed with OSC 1 & 2, but with a bit longer (100ms; vary to taste) of a complete EG cycle.

The EG-A settings were already mentioned, but they combine to form that fading decay sound, with an 2500 ms. Release Time as the focus here. As you recall, the original patch at times sounds like a multi-tap delay. The shorter 'echoes' are determined by the LFO SPOLY Set. The longer ones are an illusion: By the time that the long cycle of LFO 2 sweeps to it's second cycle, the envelope above is in it's final decay. The two combine to sound like a second delay with a filter sweep. As you've seen, this patch uses no more envelopes.

The Performance Control settings are a personal choice. Because of the high Resonance potential, I dropped the master Output Volume -6dB. The Polyphony was kept low to keep the results uncluttered. Feel free to bump it up.

OK, the Filters don't look like anything exotic is going on. Identical Linked settings (except for the number of filter poles) show low Cutoff, quite high Resonance, and enough Velocity to keep you interested. Go ahead and switch the Config back to Ser mode. Almost all harmonics are stripped away by these settings, and this plays an important role later, as well as giving near-maximum range for performing the LFOs magic.

Enable LFO 1, and you'll hear a faint upward sweep, courtesy of the Saw Up waveshape selection; nothing very spectacular here, either. The Tempo Sync setting at eight beats is slow enough to build tension, but short enough to cycle through twice before the note's Release Time in EG A get's a chance to decay completely. I maxed out the Sync Offset to +100 based on personal taste. Other settings seemed to introduce an annoying filter 'pop' when it bottoms out, or be less reliable for synchonizing to Note On start times

The SPOLY setting really makes this patch. Both here, and in LFO 2, this key-synced mode starts it's sweep cycle (phase) with each Note On, and each fingered note keeps it's own LFO cycle. I used this so that when notes are played as a keyboard arpeggio ("strummed"), the results are cascades of 'delays', each following the pitch and LFO 'pattern' offset in time from each other. If you want repeatable effects triggered from

notes, use SMONO or SPOLY. The free-running settings certainly have their uses, simply because they *don't* sync to your playing style, but here, we're looking for things to line up. It's worth noting that the Modulation control (Cutoff1) at full Depth is sent drectly to the filter; no Mod Sens control knobs like the oscillators have.

Enable LFO 2, and it all comes together. The Random waveshape pumps the steeper Filter2 at a Tempo Sync rate of 1/4t, giving up a jumble of 'notes'. The LFO jumps the Cutoff Frequency of Filter 2 all over the place, including times where the random control level is so low as to produce very low or no sound, and other times where the filter leaps to include mid-to- high frequencies. This is the de facto 'envelope' in this patch, and gives it the distinctive sound.

The Ser mode sends Filter 1 and it's long sweep through Filter 2 with it's spastic rhythms, and as a result the sweep of LFO 1 becomes enhanced. Now if you haven't before, here's where you should try the Tempo Sync changes suggested in the post above. The sounds include tempo-synced tremolo, poly-rhythmic adventures, stutter/glitch, odd reverse tape effects, strange fade-in and staccato note mixtures, and "much, much more!". If you want to harden the rhythm, switch LFO 2 to Square. Try a Saw Down also at a Tempo Sync of 8 in LFO 2 to take advantage of the opposite waveform directions. The cancellations produce an unpredictably clicky *pizzicato* with some surprise medium-length filter buildups & sustained notes.

There you have it; I don't believe that I've missed anything. I was looking for a novel way to explore the filters, and this was the final product. Don't forget that there are **two** filters in PSYN, and get stuck in that single filter mode, as I did. Although there is limited routing concerning the filters, take advantage of what is there. Until next time ...

PSYN-tology 14 [Crystalline Layers]

I've always been a fan of long, slowly developing patches; the kind that seem to combine several different patches into one, depending on your keyboard technique. The free synth Crystal excels in it's ability to create these patches, in part due to complex envelope control and an extensive modulation matrix with a large selection of destination choices. If you haven't picked this synth up yet, get it here. It has one of the deepest programming interfaces out there; makes it's free synth status even more amazing. Don't be put off by its complexity. If you've been following the PSYN-tology series, you already have a good grounding to take Crystal on. There are also online tutorials and plenty of free patch banks on the 'net. Don't forget to check out Tim Conrady's excellent offerings.

So what does this have to do with PSYN? I thought that I'd attempt the same type of evolving patch here. Were this not a tutorial, I would clone several instances of PSYN and delay some of them (see PSYN-tology 9 [Envelope Arpeggios]) to approach that complexity. Unfortunately, I found nothing in the included patches (I may have missed some) that I could use as a basis for this tutorial, so I created my own. That means that you'll have to plug in the numbers found at the end of this post, but I think that it'll be worth it to take the time to do so.

I used just about every module in PSYN for this, but, as you'll see, that was needed to provide independent control over parameters & a variety of layer blending. Osc 1 uses a pulse width modulated (from LFO 2) Square wave with a percussive envelope to start out the sound. Osc 2 fades in (fairly quickly) an octave higher, and gains a slight vibrato over time courtesy of LFO 1. Osc 3 & 4 fade in even more slowly, at 2 octaves higher and one octave lower, than Osc 1, respectively. All but Osc 2 add an identical waveform one octave lower than their base pitch via it's own SubOsc. The Square waveform in Osc 3 adds a little 'bite' for a feedback or high string section flavor. The Triangle in Osc 2 simulates some harmonics and the Triangle/Sine combination in Osc 4 adds some bottom without overpowering the sound while playing chords.

The filter section has a highpass filter in FLT 1 with a touch of Resonance, and just enough inverse Velocity to bring the Cutoff Frequency downward on occasion. It is connected in series to FLT 2, with a Cutoff set high enough to give a bandpass-type of result when combined with FLT 1. The Velocity setting in this filter bumps upward with playing style.

OK, the EGs make this patch. Take a look at EG A: everything is set long enough as to be longer than any other active EG. Think of it this way: if EG A is set to a short complete envelope cycle, the other EGs will not have enough time to develop their (longer) envelope cycles. EG A is hard-wired to the amplitude in PSYN, but it can be overridden somewhat by using the Lev-All, 01-04 destinations in the EGs and LFOs. To put it another way, the master "volume control" of EG A can be trimmed with the "input faders" of EG 1-4 and LFO 1-3 by using the Lev-(x) destinations. Makes you wonder why there's an Enable switch on EG A; turn it off and there's no sound. Someone please correct me if you've found a use for disabling EG A.

EG 1 has the unique duty of controlling both that percussive envelope synth sound that you hear first, and the Cutoff Frequency in Filter 2. Note that there's only minimal influence over Cutoff2 with an 18% destination Depth. Just enough filter 'spice' is added to keep the attack phase interesting, and the filter somewhat open after that for the remaining notes to push through. I've lengthened the Dcy/Slp and Rel slider settings by using Slow curves. EG 2 fades Osc 2 in by virtue of its longer (1 second) Attack time and a Lev-02 Dest1. Osc 3 fades in more slowly by combining a long Delay with the slow Attack time. EG 4 changes only minimally from the settings in EG 3. I could've just chosen Lev-03 and Lev-04 as Destinations in EG 3, and saved an envelope section. However, I felt that it was more important to retain independent control over the final high-pitched (Osc 3) and bassy (Osc 4) sounds, as well as to give some variation. The Velocity controls of both EG 1 & 2 are set up at halfway to introduce playing variations in only the first two oscillators.

LFO 1 provides the straight delayed vibrato control. SMONO triggers a single-speed Sine wave from your Note Ons at a very light Depth (5.8%) with only a quarter of that control 'voltage' going to the Pitch destination. The Speed hovers around a standard vibrato rate (5-7 Hz., in real life), and it's more natural in this case to not have it sync'ed to tempo. The Delay slider allows the notes to develop before modulation ensues. LFO 2 controls the pulse width modulation on both the original percussive sound (Osc 1) and the final bass sound (Osc4). It's set at a slow, pulsating rate to disguise the sweep, and it too shouldn't be sync'ed to tempo. It adds a nice phasing/flanging-type of timbral modulation.

I threw in LFO 3 for an odd effect. It's tempo sync'ed at a half beat to the volume of Osc 1, working in conjunction with (adding to) the envelope in EG 1. But you don't hear it until a second or so has passed of the 'piano/synth' sound, and since that sound is fading, the LFO causes several staccato 'notes' to pop out, thanks to to Saw Down waveshape. Change the Delay time in the LFO and the Tempo Sync to greatly alter the character.

The Performance controls of note include a drop of -6.2 dB in the Master Volume (to reduce the potential for digital distortion from those envelopes with sharply increasing volume) and also a FVAR Portamento of only 5.0 ms. This is so slight that it's hardly heard as a pitch sweep. Legato notes will produce a small glide (always 5 ms.) that barely registers, unless you're looking for it. I also set the Polyphony to 16 to insure against those long envelopes causing sustained notes to drop out from 'voice-stealing'.

So what do we have? Tapping out some staccato notes yields a pleasant, velocity-sensitive sound that smacks of electric guitar, piano-synth, or bell-like tones, depending on the keyboard octave used. Holding notes a bit longer introduces the upper octaves. Hold long enough to hear the LFO 3 'staccato" notes, and longer still unveils a high/low sound split as the other 'modules' have faded away. Releasing the keys at different points in the cycle reveals unique-sounding note releases. A combination of held sustained notes and staccato chordal arpeggios has all the individual sections displayed at once for a most interesting effect.

Perhaps the Crystalline Layers patch not as spectacular as most Crystal offerings, but it is demonstrative of many techniques that you can incorporate into layering with own patches. Since the patch is broken into independent modules, you can easily disable an Osc or two to break it down to it's component parts. Don't like the 'staccato notes'? Just disable LFO 3. Want only one envelope for control? Turn down the EG knob in any Osc to revert back to using the EG A. Change the Tune/Octave & Transpose controls in any Osc to rearrange the order of entrance and static harmony over time of the oscillators.

Beyond that, it's a fairly versatile sound in it's own right. Try using it with a variety of playing techniques and see if this doesn't take you on an unexpected compositional path. Of course, feel free to add some WAB [Wheel-Aftertouch-Breath] control to stretch the variations even further. And, most importantly, have fun with it!

Crystalline Layers Patch

[Oscillator Section]

Osc 1: Enabled
Wave:: Square
Width: 26.8%
Phase: 0%
Tune:
Oct: +2
Trans: 0
Keys: On
Fine: 0%
SubOsc: On
Level: 100%
Mod Sens:
EG: 70%
LFO: 0%
Level: 70%
Osc 2: Enabled
Wave: Triangle
Width: 0%
Phase: 0%
Tune:
Oct: +3
Trans: 0
Keys: On
Fine: 0%
SubOsc: On
Level: 100%
Mod Sens:
EG: 100%
LFO: 100%
Level: 70%
Mode (for Osc 1 & 2): NormOsc 3: Enabled
Wave: Square
Width: 72%
Phase:
Tune: 0%
Oct: +4
Trans: 0

Keys: On
Fine: 0%
SubOsc: On
Level: 100%
Mod Sens:
EG: 100%
LFO: 100%
Level: 100%
Osc 4: Enabled
Wave: Sine & Triangle
Width: 14%
Phase:
Tune: 0%
Oct: +1
Trans: 0
Keys: On
Fine: 0%
SubOsc: On
Level: 100%
Mod Sens:
EG: 100%
LFO: 100%
Level: 100%
Mode (for Osc 3 & 4): Norm
[Filter Section]

FLT 1: On
Set: HP12
Cutoff: 360.7 Hz.
Reso: 2.04 dB
Keys: 0%
Vel: -20%
Config: Ser
Link: Off
Feedb: 0%

FLT 2: On

[Set]: [LP24]
Cutoff: 964.4 Hz.

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Reso: 0%
Keys: 0%
Vel: +30%

[Envelope Section]

EG A: Enabled

Set: Norm
St Lev: 0%

[Shapes]:
Attack: Linear
Dcy/Slp: Linear
Rel: Linear
Vel: 0%

[Envelope Sliders]

Delay: 0 ms.
Atk: 0 ms.
Decay: 10000 ms.
Sus: 100%
Slope: 10000 ms.
Rel: 1075.6 ms.
Amt: +100%

Modulation:
Dest1: Off
Depth [1]: 0%
Dest2: Off
Depth [2]: 0%

EG 1: Enabled

Set: Norm
St Lev: 0%

[Shapes]:
Attack: Linear
Dcy/Slp: Slow
Rel: Slow
Vel: 47.8%

[Envelope Sliders]
Delay: 0 ms.
Atk: 5.1 ms.
Decay: 13.1 ms.
Sus: 94.2%
Slope: 2891.3 ms.
Rel: 1075.6 ms.
Amt: +100%

Modulation:

Dest1: Lev-01
Depth [1]: 100%
Dest2: Cutoff2
Depth [2]: 18%

EG 2: Enabled

Set: Norm
St Lev: 0%

[Shapes]:
Attack: Linear
Dcy/Slp: Linear
Rel: Linear
Vel: 49.8%

[Envelope Sliders]
Delay: 0 ms.
Atk: 1069.3 ms.
Decay: 6463.7 ms.
Sus: 60%
Slope: 698.1 ms.
Rel: 360.5 ms.
Amt: +100%

Modulation:
Dest1: Lev-02
Depth [1]: 100%
Dest2: Off
Depth [2]: 0%

EG 3: Enabled

Set: Norm
St Lev: 0%

[Shapes]:
Attack: Linear
Dcy/Slp: Linear
Rel: Linear
Vel: 0%

[Envelope Sliders]
Delay: 1226..6 ms.
Atk: 2297.3 ms.
Decay: 4404.0 ms.
Sus: 55.2%
Slope: 237.9 ms.
Rel: 1232.8 ms.
Amt: +100%

Modulation:
Dest1: Lev-03

Depth [1]: 100%
Dest2: Off
Depth [2]: 0%

EG 4: Enabled

Set: Norm
St Lev: 0%

[Shapes]:
Attack: Linear
Dcy/Slp: Linear
Rel: Linear
Vel: 0%

[Envelope Sliders]
Delay: 1226.6 ms.
Atk: 2884.2 ms.
Decay: 4404.0 ms.
Sus: 71.2%
Slope: 431.6 ms.
Rel: 3222.4 ms.
Amt: +100%

Modulation:
Dest1: Lev-04
Depth [1]: 100%
Dest2: Off
Depth [2]: 0%

[Low Frequency Oscillator Section]

LFO1: Enabled

Set: SMONO
Tempo Sync: Off
[Wave Shape]: Sine
Sync Offset: 0%
Keys: 0%
Polar: Off

[LFO Sliders]:
Phase: 0 deg
Delay: 588.6 ms.
Depth: 5.8%
Speed:
Modulation: 653.8 Hz.
Dest1: Pitch
Depth[1]: 24.8%
Dest2: Off
Depth[2]: 0%
Dest3: Off
Depth3: 0%

Control:
Wheel: 0%
After: 0%
Breath: 0%

LFO2: Enabled

Set: SMONO
Tempo Sync: Off
[Wave Shape]: Sine
Sync Offset: 0%
Keys: 0%
Polar: Off
[LFO Sliders]:
Phase: 0%
Delay: 0 ms.
Depth: 100%
Speed: .3 Hz.
Modulation:
Dest1: PWM-01
Depth[1]: 100%
Dest2: PWM-04
Depth[2]: 100%
Dest3: Off
Depth3: 0%
Control:
Wheel: 0%
After: 0%
Breath: 0%

LFO3: Enabled

Set: SMONO
Tempo Sync: 1/2
[Wave Shape]: Saw Down
Sync Offset: 0%
Keys: 0%
Polar: Off

[LFO Sliders]:
Phase: 0%
Delay: 1069.3 ms.
Depth: 100%
Speed: N/A
Modulation:
Dest1: Lev-01
Depth[1]: 100%
Dest2: Off
Depth[2]: 0%
Dest3: Off
Depth3: 0%
Control:
Wheel: 0%
After: 0%
Breath: 0%

[Performance Control Section]

Bank: N/A
Program: N/A

Polyphony: 16
Tune: 0 cents

Unison: Off
Detune: 0%

Portamento [Type]: FVAR
Time: 5.0 ms.

Bend:
Mode: Norm
Up: 2
Down: 2

Output:
Pan: 0%
Volume: -6.2 dB

PSYN-tology 15 [Complex Filter Layers]

This one's closely related to the last installment (PYSN-tology 14 [Crystalline Layers]) in that the patch presents a sound with an evolving texture that's controlled by your playing technique. A parallel concept, perhaps, but a completely different process & effect. Lest you think that complex layering dictates that you must tweak all the oscillators and involves tedious programming of all the other modules, I give you the Complex Filter Layers patch. It only uses one oscillator, 2 EGs (in addition to the virtually wide-open master envelope: EG A), and two LFOs; the latter being somewhat disposable in this patch.

I'm running out of time this evening, so this'll have to be a quick explanation for now. I promise that I'll follow up with a complete de-construction later on. [Please note: The Resonance on both filters is set a bit high to demonstate the techniques. Watch those levels, and feel free to tone them down for less of a 'in-your-face' filter sweep(s).]

What does it do? Quick taps on the keys give a bell-like pluck with a moderate release time (I'm a guitarist at heart). If you catch it just right, Filter 1 clamps down on your notes for a very rapid decay. A second "attack" from Filter 1 achieves a false 'echo' for your played notes with a moderate hold. A longer hold brings in the steeper Filter 2 sweep, crossing with Filter 1's envelope control. Soon a sforzando burst jumps out from LFO 1, and quickly disintegrates into random filter pops (LFO 2) and filter 2's second sweep repetition before decaying into silence. As with the last patch, interrupting the progression at various points by lifting your fingers from the keyboard (Note Offs) can yield some surprising results. And the best results can come from mixing legato, staccato, and held sustained notes.

After you plug in the numbers, disable both filters and both LFOs. It's basically a boring '80s synth patch. Enable Filter 1 to hear the unique character that a negative Amount (-100%) of EG 1 brings to the patch. Enabling Filter 2 alone demonstrates a standard fare usage of lowpass filters, but it's the interaction in parallel between both filters that gives this patch its variety. Enable both Filter 1 & 2 to see what I mean. Then add LFO 1 and listen, followed by LFO 2. You may or may not want these trailing effects as permanent residents in the patch.

I left the Detune up, but Unison disabled, and the Portamento type in, but at 0 ms. Try testing what these controls will add to the patch. Oh, no, look at the time! I've got 10 hours' work to pack into the next 5! Then there's always the possibility of actually sleeping some ... Get those questions ready; I'll be back with the reverse-engineering soon.

Complex Filter Layers patch

[Oscillator Section]

Osc 1: Enabled
Wave:: Square & Saw Up
Width: 40%
Phase: 0%
Tune:
Oct: 0
Trans: 0
Keys: On
Fine: 0%
SubOsc: Off
Level: 0%
Mod Sens:
EG: 0%
LFO: 100%
Level:100%
Mode (for Osc 1 & 2): Norm

[Filter Section]

FLT 1: Enabled
Set: LP12
Cutoff: 670.4 Hz.
Reso: 20.98 dB
Keys: 0%
Vel: +38%
Config: Par
Link: Off
Feedb: 0%

FLT 2: Enabled

[Set]: [LP24]
Cutoff: 56.8 Hz.
Reso: 24.70 Hz.
Keys: 0%
Vel: +40%

[Envelope Section]

EG A: Enabled

Set: Norm
St Lev: 0%

[Shapes]:
Attack: Linear
Dcy/Slp: Linear
Rel: Linear
Vel: 100%

[Envelope Sliders]

Delay: 0%
Atk: 5.1 ms.
Decay: 10000 ms.
Sus: 100%
Slope: 2048.7 ms.
Rel: 1599.9 ms.
Amt: +100%

Modulation:
Dest1: Off
Depth [1]: 0%
Dest2: Off
Depth [2]: 0%

EG 1: Enabled

Set: Norm
St Lev: 0%

[Shapes]:
Attack: Linear
Dcy/Slp: Slow (Curve Up)
Rel: Slow (Curve Up)
Vel: 0%

[Envelope Sliders]
Delay: 198.7 ms.
Atk: 422.0 ms.
Decay: 15.1 ms.
Sus: 40.4%
Slope: 2305.0 ms.
Rel: 5356.6 ms.
Amt: -100%

Modulation:
Dest1: Cutoff1
Depth [1]: 100%
Dest2: Reso1
Depth [2]: 100%

EG 2: Enabled

Set: Rep
St Lev: 0%

[Shapes]:
Attack: Slow (Curve Down)
Dcy/Slp: Slow (Curve Up)
Rel: Slow (Curve Up)
Vel: 47.3%

[Envelope Sliders]
Delay: 0%
Atk: 2577.9 ms.
Decay: 170.7 ms.
Sus: 61.5%
Slope: 1815.0 ms.
Rel: 3584.6 ms.
Amt: +100%

Modulation:
Dest1: Cutoff2
Depth [1]: 100%
Dest2: Reso2
Depth [2]: 27.9%

[Low Frequency Oscillator Section]

LFO1: Enabled

Set: SPOLY
Tempo Sync: 8
[Wave Shape]: Sine
Sync Offset: 100%
Keys: 0%
Polar: Off
[LFO Sliders]:
Phase: 180 deg
Delay: 2884.2 ms.
Depth: 100%
Speed: N/A
Modulation:
Dest1: Lev-01
Depth[1]: 100%
Dest2: Cutoff1
Depth[2]: 100%
Dest3: PWM-01
Depth3: 85.4%
Control:
Wheel: 0%
After: 0%
Breath: 0%

LFO2: Enabled

Set: SMONO
Tempo Sync: 1/2
[Wave Shape]: Random
Sync Offset: -100%
Keys: 0%
Polar: Off
[LFO Sliders]:
Phase: 0%
Delay: 3580.1 ms.
Depth: 100%
Speed: N/A

Modulation:
Dest1: Reso1
Depth[1]: 50.2%
Dest2: Cutoff2
Depth[2]: 50.6%
Dest3: Lev-01
Depth3: 50.7%
Control:
Wheel: 0%
After: 0%
Breath: 0%

[Performance Control Section]

Bank: N/A
Program: N/A

Polyphony: 12
Tune: 0%

Unison: Off
Detune: 50%

Portamento [Type]: FFIX
Time: 0%

Bend:
Mode: Norm
Up: 12
Down: 12

Output:
Pan: 0%
Volume: -6.2 dB

Still not enough time for the complete patch explanation (soon), but something came to my mind today that needs addressing. I have a default programming project that I usually start from for the PSYN tutorials, with a medium-slow tempo of 100 BPM set there. It makes for easy calculations of BPM for envelope programming, and represents a median tempo to me for compatibility across the many possible tempo rates of your projects.

I realized that this may be a little slow for the up-tempo electronica people here, but there's a more important item to consider. When mixing LFOs that are locked to tempo, and EGs with specific settings in milliseconds, there's the distinct risk of these patches becoming "un-sync'ed" with changing the tempo in P5. Please keep this in mind, as perhaps a possible reason that the actual sounds you're hearing don't quite match the description given.

There really should be a way to lock the EGs to tempo, as well, just like the LFOs: beat divisions or Off. This is especially important when using the Rep Set mode in an EG, but useful as well in the Norm mode.

I usually adjust the envelopes by feel, as opposed to strict numbers, with a comparative LFO locked on to tempo, if only as a temporary 'metronome'. Consider using one of the BPM converters mentioned in earlier tutorials, a software calc like this, this chart, or use the formula variation here (DJs: go here & MIDI freaks: go here; everyone else: go here) if you need strict EG compliance to the project tempo.

Remember, it's the sum total of all the milliseconds in the Delay, Attack, Decay, (Sustain is a level Decayed to & Sloped from), and Slope parameters (Release occurs after Note Off) that constitute one envelope 'cycle'. Add these together to approach the required number of milliseconds for the appropriate beat division. I say "approach" the number because of the lack of accuracy of many controls within PSYN (as displayed in the Tooltips). While you'll be lucky to get within a few dozen milliseconds of your target sum (for example: 600 ms. for a quarter note beat @ 100 BPM), that isn't much of a problem in practice with a long EG cycle, or a busy patch masked by other activity.

Also note that the Help file is in error with regards to the Rep mode. The parameters listed above are all involved in the 'cycle', not just the Attack-Decay-Sustain as described there. BTW: Does anyone else get those lingering tooltip readouts 'stuck' to the screen after switching focus? I'm always multi-tasking & dragging across displays; that might contribute to the frequency of this phenomenon. It remains even after closing P5, if you don't click back to the parent knob, switch, or slider; usually from an LFO.

This information might be obvious or boring, but there are many components to a sucessful patch, and attention to detail can be the difference between a good patch and a great one.

Addendum:

Well, it's been weeks since I've been seduced by the charms of z3ta+, so I'll apologize for the delay with an explanation here. This tutorial concentrates on filter interaction, so most of this can be deciphered there, but let's begin with the oscillator. Osc 1 rides alone with a combination Wave that is born by selecting the Square and Saw Up waveforms. This harmonically-rich combination is altered further by a Width setting of 40%. The LFOs are given total access to this oscillator in the Mod Sens section.

The sounds' basic envelope is set in EG A, providing a long potenial contour, which opens up the options of having different sounds contained in one patch. Think of this envelope as the maximum limit on how long a held note will continue. There's the reasoning behind the maximum Decay and Sustain settings, and the 2 second Slope & second-and-a-half Release time. Velocity playing has a large influence over this maximum.

Think of EG 1 & EG2 as Filter 1 & Filter 2's own envelopes, in this case. EG1 controls Filter 1's Cutoff and Resonance, but with a twist: The -100% Amount inverts what you would normally expect from these EG settings. Try moving it to a positive 100%. Down becomes up, and the entire sound changes. It may be less than intuitive to deal with negative amounts of EG control, but don't overlook its usefulness. The best way to experiment with this is to strip away most of the 'outside influences', and concentrate on the settings of just one envelope. Tweak until it sounds good to you. I've found that substituting an easily recognized parameter destination, like Pitch, really goes a long way toward understanding the mechanics of the EGs, LFOs, and the modulation matrix in general.

I've lengthened the Dcy/Slp and Rel times with Shapes here, and tweaked until I got a subtle 'wah' sound that's slightly delayed (198.7 ms.) from the original note's attack. EG 2 belongs to Filter 2, with only a 27.9% influence over its Resonance. I also altered the Shapes to taste in this EG, and delayed its entrance this time with a long (2577.9 ms.) Attack time, instead of a Delay time. In this way it 'fades in', rather that abruptly jumps in as in EG 1. Another key difference is switching the Set from Norm to Rep, changing the EG in effect to an un-sync'ed LFO. The sum total of all the EG parameters (with the exception of the Release time) combine for a long envelope that has enough time within the EG A limits to almost repeat a second time.

The lowpass filter of Filter 1 begins with a fairly high Cutoff of 670.4, to allow some initial sound to come through, and to accommodate the downward sweep of EG 1 with it's negative modulation. The Resonance is somewhat (20.98 dB) high to accentuate the filter action, with Filter 2's Res being even higher (24.70 dB). You'll nearly always see a Vel of around 40% in my patches; I'm a firm believer in playing technique alteration of patch parameters.

In parallel with Filter 1 is that sweet LP24 sound from Filter 2. Due to the long Attack setup in EG 2, the Cutoff here is low (56.8 Hz.) for a near maximum filter sweep buildup. Disabling Filter 1 (and/or the LFOs) illustrates this clearly.

I've described the LFOs as "throw-away" above, but they add a dimension to the later stages of this patch. LFO 1 is complex in it's control over the level and pulse-width modulation of Osc 1, along with the Cutoff Frequency of the first filter. But none of these changes occur until nearly three seconds into holding a note/chord. By virtue of the Delay, 180 degree Phase, Sync Offset, and a Sine waveform, a very complicated combo sweep ensues well after the filters' entrances. The 8 beat Tempo Sync almost makes this a one-shot LFO, as the filter's and EG A's decay disguise the cyclical nature.

The masquerade continues with the entrance of LFO 2 after a 3 & 1/2 second Delay. This one cross-influences the first filter by kicking in a fast Random resonance there, while also popping the second filter's Cutoff and the level of Osc 1, as well. Note that the potential control is lessened somewhat by a 50% destination Depth setting in each of those parameters. The faster 1/2 beat Tempo Sync adds some movement at the end of the patch cycle, and all this interaction slowly fades to a close.

Hope I didn't keep anyone waiting for this too long. As always, feel free to ask about any questions that this may have raised, or didn't cover thoroughly.

PSYN-tology 16 [One Tweak Challenge]

I've had this idea floating around about a tutorial that demonstrates how PSYN patches can be completely altered with a simple flick of one parameter. I have different drafts littering my HD, because listing a few tweaks wasn't enough, and doing a whole bank was too time-consuming [read: too much typing]. Then it hit me: why not make this a group participation tutorial?

I'll throw out a few to get started, and if I have to, I'll alter an entire bank, if this idea falls flat. But I'm counting on everyone here for a quick contribution to the thread for a cross-section of ideas from the whole community. It won't take much time to post, and by the very nature of this tutorial, everyone at all levels of programming expertise can participate.

The only potential downfalls that I can see are that if this doesn't take off, it'll have to be removed from the PSYN-tology series as an abject failure, or I'll have to desperately try to salvage this to make it informative. That, and I've created an updating nightmare for our very own Techead, who's gracious enough to compile these tutorials into a .pdf [see the PSYN-tology- the Book post] that makes sense. Sorry, Bob.

The only two rules [and you know that I hate rules!]: It has to be a tweak involving a readily available patch to everyone, as in the included patches with P5, and the downloadable set from Cakewalk. The other rule is that it must involve changing the complete character of a patch by adjusting only one parameter. One slider, one button, one knob; only one move to alter the patch, to help illustrate the range of options for programming, and the relative ease with which this can be realized. It would be helpful if the patch bank letter and patch number were listed, along with a patch name, for easy navigation for the readers.

[BTW: Don't get thrown off by the fact that I call individual programs "patches". It's a holdover from the days of patch cords, and it's stuck with me. Besides, I find the term "programs" to be potentially confusing, but I use the two terms interchangeably in these tutorials.] You with me? I'll start with a few:

Digital E. Piano 1 [Bank F / Patch 000 -downloadable set]: Changing the Tune Octave parameter in Osc 1 from +5 to -5 yields some otherworldly spaceship sounds, especially with chords.

Ring Mod Clavinet [Bank F / Patch 004 -downloadable set]: Changing the Osc Mode from Ring to E-FM brings out a distorted guitar for solos or power chords.

Phasor Lead [Bank F / Patch 036 -downloadable set]: Flip the Set in Filter 1 from BR12 to LP12 to mutate to a sweeping, evolving patch with volume fade in/out.

Noon Sync [Bank A / Patch 041 -included set]: Change the Osc Mode from Sync to anything else for a variety of nastiness. I particularly like the total breakup of a Ring setting.

Special Syncer [Bank A / Patch 065 -included set]: Alter the Tune Transpose setting in Osc 2 through the whole range of options for a different timbre change, rather than a pitch change.

Plaintive [Bank C / Patch 032 -included set]: Crank the Mod Sens EG knob in Osc 1 for a hard pitchbend that doesn't release until your MIDI Note Off.

BELL Wind Chimes [Bank D / Patch 026 -included set] I don't know where they get wind chimes here, but change the LFO 2 waveform to Saw up or Down will get you bird-like chirps. [Well, if that's a wind chime, then my patch is a dead-ringer for a sparrow, or a bunch of sparrows with a keen sense of tempo ...<g>]

Well, I could go on all day, but you get the idea. Remember, this tutorial requires participation from our studio audience. No contribution posted can be too big or too small. I'm countin' on ya', folks ...

PSYN-tology 17 [Poly Rain Mutation]

Back to the our old tricks, or the roots, if you prefer. Load the Poly Rain preset/patch/program from the A bank located in the 53rd slot [A052]. This is a thick little patch that relies heavily on the four oscillators combining for the texture, and filter 2 for a cutoff sweep & 'envelope contour'. Polysynth is the name of one of the basic synth sounds carved out in the original GM MIDI spec [Pad 3 or instrument 91 in a 1 to 128 patch scheme]. Here's some background all on one page ; it's a little more concise condensation of some info on the MMA site, and nearly all in English (!). This patch has something in common with what you'd normally hear in that slot on a general MIDI module, and certainly closer than what you normally see in the (patch 97) FX 1 Rain slot. Kinda cool when the polysynths first emerged: full and unlike contemporary monosynth sounds of the era. Today, it sounds a bit ... dated (or is that retro?). Not for long, but first, an explanation:

The first two oscillators are paired together in a Ring modulation modality. The frequencies of both oscillators are added & subtracted from each other, and the results are fed to the output while the original frequencies are (usually) squelched. You can get harsh & dissonant sounds with (cracked) bell-like overtones from this setup, or eke some hauntingly beautiful tones with careful adjustments. Given the additive/subtractive mathematical nature of the process, it does not follow the same rules of octave doubling or harmonic series usually found in musical instruments, resulting in it's unusual timbre. And therein lies the value. [Here's a companion link that briefly explains some of the concepts presented here.]

Many times sine waves are combined for ring mod, but here complexity is introduced in this PSYN patch by pairing a Saw Down in Osc 2 with a white Noise signal from Osc 1. The sums and differences between these two waveforms gives an edgy motion quality to the combination that's not overbearing in it's dissonance. Try 'soloing' only Osc 1 & 2 for a clearer picture. You can add melodic depth to the pair by doubling the Saw Down wave in Osc 1 while keeping the Noise. If you do, you can introduce some cyclical sweeps with a positive/negative Fine control; otherwise, the Fine control is uneffective. After all, white noise shifted a semitone is still white noise. Other than the parameters listed above, the first two oscillator settings are nominal & unremarkable.

Osc 3 & 4 'pair up' in a Norm mode, in that the Fine control differences [-58 cents for Osc 3, & +26 cents for Osc 4] yield a chorusing-type of effect. Further spacing is achieved by a Saw Down wave in Osc 3, and Osc 4 sporting a Square wave with an adjusted Width to 80%. Put 'em all together and your sound has thickened considerably. The Levels, Octaves, etc. all remain in default settings. Disable both filters to preview the brassy basic texture.

Now enable only Filter 1 for the muted version with a Cutoff at 1673.1 Hz. and otherwise nominal settings. You'll notice that the filters are in a parallel Config, so this filter will always pass this particular sound to the output of PSYN. Filter 2 starts out low, at 80.8 Hz., but this figure is swept upward by the contour set in EG 1.

The contour in EG 1 lives to perform only one function: cause the Cutoff2 parameter to follow the shape setup within it. The Attack is set to 4398.4 ms., and further modified by the Fast Shape set above it, but this is deceiving, in a way. The Attack takes nearly five seconds to reach its peak, but the effects of it are reflected nearly immediately in the second filter. You'll hear it shortly building from that 80.8 Hz. base value upwards, while the filter 1 output comes through unchanged. The potential maximum effect is mitigated by a 68% value in the Dest1 Depth knob.

An increase to 100% here will max you closer to the original brassy sound. Subtractive synthesis is basically removing harmonics from a rich oscillator source with the selective filter settings. That's why filter quality is so important: different degrees of sharpness in precisely cutting frequencies (and other qualities, as well, that I've conveniently left out). The other settings in EG 1 are effectively out of the envelope, except for a nearly four second Release time that you'll never hear with the present EG A setup.

EG A follows your hands at the keyboard. An instantaneous Attack & minimal Decay reach a nominal 70% Sustain level which continues until your Note Off. Slope is out of the 'loop', and the sound dies rapidly with only a 24 ms. Release. It's here that the genetic mutation begins ...

Increase the Release in EG A to two seconds or more, to keep the sound alive past note-offs. This is more like a classic brass cresendo/decresendo. We can't have that, so go to Dest1 in EG A and set it to Reso 2 at no more than 35%. Now staccato notes reveal the filter 1 output, and slightly held notes introduce filter 2 packing its Resonance around the sweeping Cutoff Frequency from EG 1. You can 'honk' filter 1 by setting Dest2 to Reso1 at around 60% Depth, but by now your filters are pushing PSYN's output into the red. Might need to back off the Reso or the master Volume. Reset Dest 2 to default [Off] by clicking both your right & left mouse buttons on the window simultaneously. Before we leave EG A, let's try something: Set the Mode from Norm to Rep, and the Attack to around 100 ms. All other controls to minimal, except for the 2000 ms. Release and +100% Amount.

Go to EG 1, Set the mode to Rep, flatten the Shapes to Linear, Decay to 208.5 ms., 3500 ms. Release, and +100% Amount. All other sliders reduce to minimum. Next to the 68% Depth of Cutoff2 in Modulation, bring in Reso 2 at 52.5% depth at Dest2. *Now* we're talking: Both envelopes are now cycling like LFOs, but unsync'ed. The Cutoff is sweeping, the Reso is rotating, and the amplitude envelope mimics the rapid up/down bowing of tremolo string notation. If you purposefully play chords with your fingered timings delayed slightly with respect to each other, you'll get invaded by a whole flock of cosmic birds. Light touch staccato 'plays' the filter, and combination techniques with legato and held notes open up some interesting avenues of exploration.

If you bring in Pitch to the second Destination of EG A at 100%, and introduce some control to Osc 2, 3, or 4 (or all three) by increasing the Mod Sens EG knob in a particular oscillator, you'll hear a pitch fluctuation that's really apparent as a downward pitch-bend on your Release phase (after lifting your fingers from the keys). We could go

further, but this patch is crazy enough already. See if you don't agree by throwing everything at this in terms of performance techniques. Of course, feel free to revert to the patch before the Pitch Dest (turn the destination Depth down to 0%). While novel, that gets really irritating in a very short time. Hack it around, and see what you come up with.

PSYN-tology 18 [Spread the Butter Pad]

We're going to push some extreme filter resonances out of this patch, so I want you to promise me something: please clamp down on the PSYN output with an aggressive high-ratio limiter or compressor. Even though we'll be dropping the output volume significantly, I don't want to cause any ear or monitor speaker damage, and this goes double for you headphone users. Monitor at low levels first!

OK, load up the A102 patch [Bank A / Butter Pad]. It's a creamier version of the Poly Rain patch of the last installment, with a slower, woodwind-like attack and tonality, but with the same type of sweeping filter profile. There are only two oscillators active in Norm mode this time, with a Saw Up & a Square wave, respectively. Nothing else remarkable here; default all the way. Filter 1's Cutoff is again controlled by EG 1, but this time the Resonance is up a bit, and the Keys (tracking) is up to 36%. The base Cutoff Frequency begins at a low 118.9 Hz. for a wide-range filter sweep by envelope.

The EGs are also similar in shape to the Poly Rain patch, with a little faster Attack time for EG 1 and a convenient (for my purposes) long Release time already in EG A. I won't bore you with any more patch setting explanations/details here; it's already been covered for the most part in PSYN-tology 17.

Got your limiter in place? Good, because in order to push these filters near the point of self-oscillation, we'll need to really pump those values. It's like trying to get a nice tube distortion while worrying what your neighbors think; it's never really right unless it goes to 11. That said, drop your master volume down to -30dB, to be on the safe side. You can always adjust up later. Bump the Octaves of both oscillators up to +1 to range the sound. Max out the Resonance in Filter 1. The Config is already in Par, but push the Link button while you're there, and Enable Filter 2. Now without moving any knob settings in Filter 1, carefully click on each one to jump Filter 2's adjustments to the same values. This is as close as you're going to get to copying/pasting modules from one to another of the same type; you might as well take advantage of it.

The key(s) to this patch are contained in the EGs. For EG A, it's a simple matter of increasing the Decay and Release sliders to maximum, for a long, echoing fadeout, independent of MIDI Note On time. EG 1 remains nearly identical to the Butter Pad; I did max the Release time out here, too, and added Reso 1 to Dest2 at nearly a 50% Depth.

Now copy all these EG 1 settings to an Enabled EG 2. The only differences will be to replace the Destinations in EG 2 with Cutoff2 and Reso2 at the same Depths as EG 1. Keep in mind later that varying these destination Depths by the slightest of margins can gain separation, and distinguish one filter from another. A complex interaction of variations can be achieved with some very subtle changes to these four knobs (treat them as pairs per-filter to adjust the 'spacing'.)

That's all we need to do. If everything's right, you'll hear that luscious resonant filter interaction that breaks into discrete 'steps' and reduces in speed while fading out.

[When my daughter was young, we found those plastic tubes that you whirl in a cirde to get a similar pipe resonance sound. (I've still got mine. <g>)] As per-usual, playing style and length of hold reveals different amounts of the resonant 'bell tree' tone progression.

Higher Cutoff Frequencies are equally as musically useful, but remember that we linked the two filters together in Parallel earlier, as a type (albeit parallel) of poor-man's 6-pole (36dB) filter, and jumping both base Cutoff Frequencies to the high side smooths over the discrete filter 'steps'. You might want to try unlinking the filters and sending one Cutoff high, while leaving the other filter's Cutoff where it sits.

But first, try switching the Config from Par to Ser. What a deliciously nasty sound! The filters break up with the Resonance overload being funneled down the same 'pipe', and a wonderfully digital distortion intrudes on only *some* of the filter steps. It borders on a feedback sound, and with enough simultaneous voices will actually appear to change pitch (!). I'd be hard-pressed to approach duplicating that sound, even in iZotope's Trash.

The original Butter Pad patch, that we've since scorched & singed [Do I smell popcorn?], has a Polyphony count of 24 voices. With a crazy patch like this, I usually drop it down to some reasonable number to tidy the sound up a bit. Realize that this in itself will give you different effects: try dropping the count to Mono, or 3/4 voices, then throw more notes at PSYN than it can handle. If you look carefully, you'll see some faint wisps of smoke emanating from PSYN's algorithms: we're really putting it through a workout with this mutation. As always, use this as a basis for your own experimentation, and most importantly, have fun with this.