Obiwannabe

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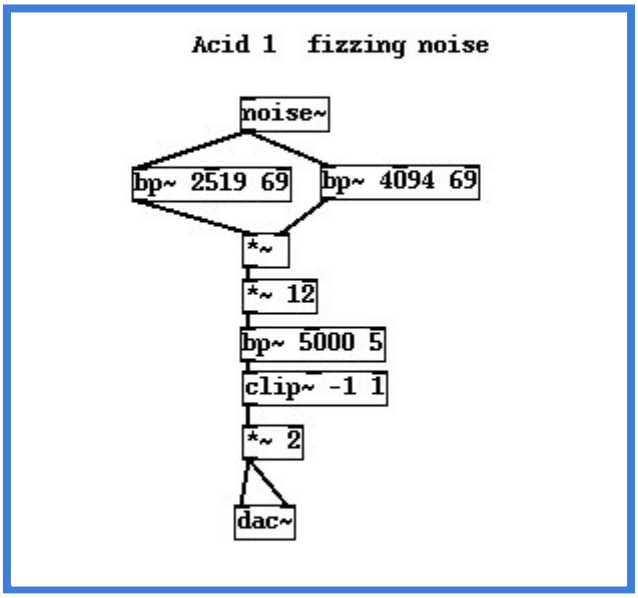
Acid

Whether you need something like a Half-Life Bullsquids venom or the corrosive blood of an Alien Facehugger, a few bottles of acid will come in handy. The sound of acid is the sound of the chemical reaction between a liquid and solid in open space. It is a sound that varies as the chemical reaction progresses and the amount, shape, and distribution of each reactant changes. This should be seen as a general texture which can be scaled up to make good "lava". We introduce a new technique of modulating noise bands together to create denser more focused frequency peaks.

This sound is based on my experience as a laborer cleaning concrete with hydrochloric acid. You are supposed to mix the concentrated acid with water (never the other way round) to get a diluted solution, but like every other kid on the job I wondered to myself, "What happens if you pour a little bit of 14 molar fuming hydrochloric directly onto the concrete - just like it tells you NOT to do on the warning label?" Concrete is a mixture of sand (silicon dioxide) and limestone (calcium carbonate). The sand particles don't react because silicon dioxide is a relatively stable and quite inert compound in the environment. But calcium carbonate is a different story. Hydrochloric acid combines with it to produce two new, quite harmless compounds, calcium chloride, and large amounts of CO_2 gas. It's the bubbling of the carbon dioxide gas that makes the sound, otherwise the acid would just silently react with the solid. The reaction can be quite violent if the acid is strong, enough to spit drops of acid and flakes of cement up into the air. But it doesn't start off this way. When you first apply a strong acid to a tarnished surface, either concrete or metal, the first thing that happens is nothing much. A tarnished surface is oxidised and coated with a protective layer of a much less reactive compound. But slowly the acid finds a way underneath this layer and it begins to react. At first very small bubbles form, what we hear is a high spectrum hissing sound as you would expect to get from bubbles less than a few tenths of a millimeter in diameter. As the acid eats into the solid the surface becomes pocked with cavities. The acid reacting inside these cavities takes on a much more resonant sound. As the cavities widen a larger surface area is exposed to the acid and the speed of the reaction increases. The shape of cavities formed, especially in a mixed aggregate of unreactive and reactive compounds like concrete, are deep complex tunnels which create a lot of spitting and high pitched screaming sounds as gas is expelled. Sometimes bubble cavitation deep inside a material cavity can make quite powerful knocking sounds as small shockwaves excite the material, leading to a lot more bass than you might expect. For the effects of acid on metal you might like to temper the noise bands with a little metallic formant. You can extend this model to acid on rock or other materials. Acid doesn't just keep on dissolving stuff forever though. It's unlikely that the Alien blood on Ripleys ship would have burned through 3 decks. Thermite would do it, but not acid. As the reactants combine the acid looses its strength, so the reaction gradually gets less and less vigorous. Eventually all you will hear are slight bubbles.

We will start with the fizzing, hissing sound made the small bubbles. To shape the spectrum of a white noise source we will use three bandpass filters, [bp~], a [*~] multiplier and a [clip~] unit. Remember that as we increase the resonance of a filter it lets less of the signal through, focusing the spectrum into a thin band. The two parallel [bp~] units create a couple of peaks focused strongly around 3kHz and 4kHz, but the resonance (Q) is quite high (69) so that these two bands don't overlap. The two thin noise bands on their own don't sound much like a fizzing sound, but see what happens when we use them to modulate one another with a [*~] unit? We get a couple of new peaks, one at 1kHz and one at 6kHz. The combination of two filters like this has the effect of creating a more complex filter, which works well on noise because every frequency in each band is modulated with every frequency in the other, giving us two clusters of frequencies which are much denser than either of the originals. To create a better fizzing at the high frequency we add a clipping function. First we boost the signal to a higher than normal level and remove any new artifacts caused by the modulation with a gentle bandpass near the higher of the two bands, then we clip it. By doing this we cause intermodulation, such that peaks in the lower 1KHz band cause the signal to "max out" in the clip unit and break the 6kHz noise band into bits, now instead of a constant hissing sound we get a broken, more "fizzy" sound.



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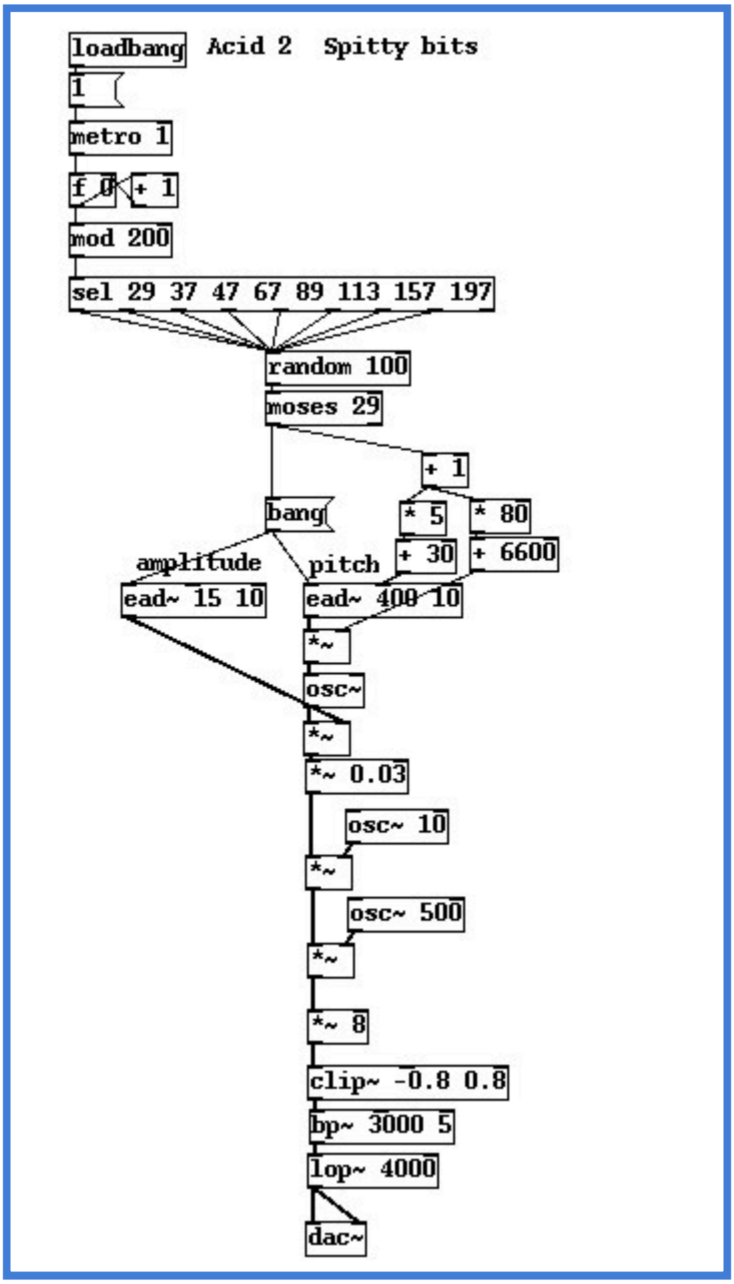
So far our sound is lacking a certain dynamics that suggests a violent or dangerous reaction. Right now it could be frying bacon or some very fizzy pop in a glass. We need something to create the impression of a more powerful process with spitting and boiling noises. The segment below should look familiar, it is our old bubble patch from an earlier exercise. To run through it once more quickly - we have a fast metronome selecting relatively prime intervals which are then culled in the ratio 1:2 (two thirds of the events are thrown away) driving a pair of envelopes which control the frequency sweep and amplitude of a sine wave. A random number generator creates a spread of different frequencies and timings. Notice we can reuse the random values from the culling stage, but bear in mind that they are not between 0 and 100, the only useful ones that coincide with any sound are in the 1-30 range, so we may as well take them from after the [moses] splitter to save routing useless values around. I had to experiment a bit with the offset constants [+ 30], [+ 6600] and the scaling values [* 5] and [* 80] to get the kind of bubble sounds required. Remember that they are not independent parameters so twiddling one affects the other and the only practical way to get this right is to hook up a couple of faders to the values and play with them for a while. On their own the high frequency bubbles don't quite sound right. The problem is that their maximum rate is determined by the minimum period of one metronome cycle, but this isn't enough, we want a denser boiling sound. We could duplicate this entire circuit, but that would be inefficient. The hack I have applied here is to add a bit of extra amplitude modulation. Modulating by an oscillator [osc~ 10] at 10Hz makes the bubbles seem to be much finer bursts of faster events. Another problem is the limitation of sweep range. The same codependency in our patch makes us have to observe a compromise where the pitch range of possible bubbles and the rate of them fight against one another. We can have very fast bubbles in a narrow pitch range, or slower bubbles that sweep wider, but not both. We want both, and a pony. And by screaming enough we can get both. Actually screaming doesn't help, but the [osc~ 500] used as a modulator shifts in some extra sidebands that brighten up our bubbles enough to create the illusion they occupy a wider spectrum. Notice the same trick is used twice, but to solve quite different problems. Finally I have overdriven the signal a bit to roughen it up and applied a fairly harsh filter combination to tame the foldovers from some of wilder pitch sweeps.



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Here is the combination of both parts. It seemed like a good idea to optimise by sharing the last two [clip~] and [bp~] stages and making a compromise between their values, but when I tried this the sound really lost something because of the interaction of the two parts. Improvements: To create the effect of a blob of acid thrown onto a surface for something like a Biorifle you would want to apply two separate amplitude envelopes, one to the fizzing and one to the bubbles, having an initial burst of fizzing, maybe at a slightly higher frequency too, followed by the bubbling slowly emerging.

Audio .mp3

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