MODELE01: Vagabond King

1 Hand made VSTi

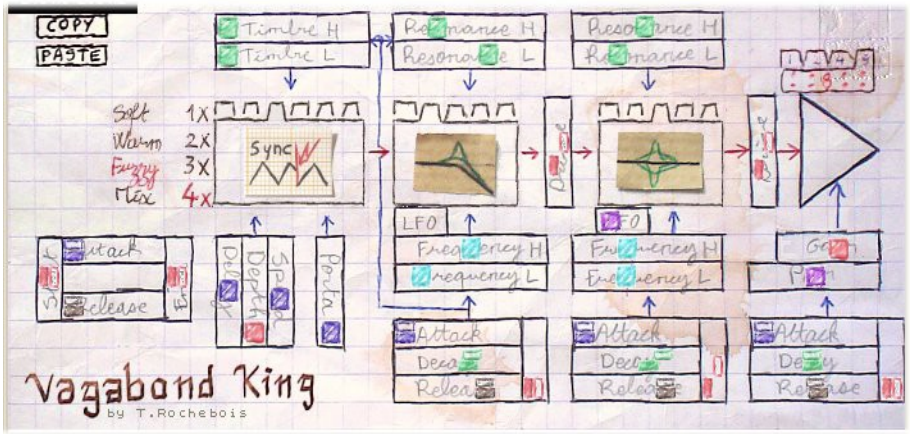
When I designed « Modele01: Vagabond King », I wanted a classic synth with low CPU charge. I intended it to produce pad, bass and lead sounds, not special fx. I did not wanted to emulate a specific vintage synthesizer nor to design the ultimate universal synthesizer.

The first steps of the design consisted mainly in « paperwork »: drawing and imagining what it will eventually do. These steps are very pleasing. « *I'd like to have a bunch of oscillators for unisson: let's draw them. I want them to be multimode. I want one filter... well two filters would be much better. Now let's have ADSR enveloppes one, two, three. An LFO. Let's have velocity control over them.* » And so on...

The next steps are hard and magical. They consist in testing and associating different oscillator and filter algorithms to find out the correct alchemical combinations and tunings. An important step consisted in optimising Vagabond King with SSE code, it does not seem interesting but this allows you to have polyphony at a reasonable CPU cost.

Typically, the last step would consist in designing a sexy graphical interface. To say the truth, I began to do it, designing knobs and sliders with the magnificient Persistence Of Vision raytracer. Then I stopped. It was stupid. All these fancy graphics were just caricaturing hardware devices and I did not wanted Vagabond King to be such a fraud.

Vagabond King is a software synthesizer, it is a bunch of ideas written on sheets of paper and put in the computer. That's why the graphical interface of Vagabond King takes its primal and most natural form: « paperwork ».



2 Architecture

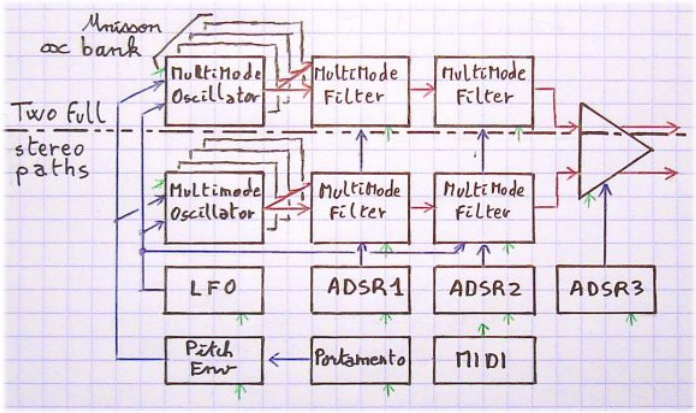
Vagabond King is an oscillator/filter synthesizer. Signals are produced by oscillators and modified by filters. The parameters of the oscillators and filters are dynamically modified by three ADSR enveloppe generators and a low frequency oscillator.

The oscillators are multimode so that you can change the « grain » of the sound from analog style waveforms to FM like sounds very easily. The « timbre » produced by the oscillators is dynamically controlled by the first ADSR enveloppe. You can activate up to four oscillators in unisson to produce warm sounds (without ab-using chorus nor reverb) with no CPU overload.

You have a series of two multimode filters to shape the sound. Each one has its own ADSR enveloppe so that you can control dynamically cutoff frequencies and resonance.

Factually, the Vagabond King is much richer that it seems at first glance. All audio units are *duplicated* to provide true stereo.

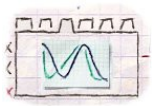
So here it is: 8 oscillators, 4 filters, 3 ADSR, a pitch enveloppe and an LFO per voice and up to 8 voices.



3 Features

- 1,2,4, or 8 note polyphony.

- full stereo[1] for a warm sound and broad stereo without adding reverb nor chorus.
- 2(stereo) x 4(unisson) multimode[2] free-running[3] oscillators with timbre[4] modulated by an ADSR.

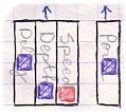


- 4 unisson modes[5].
- 4 unisson levels.

- 2(stereo) x 2 multimode[6] filters with ADSR modulated cutoff and resonance.

- Two drive stages (smooth saturation).
- 3 ADSR enveloppes.

- A multiphase[7] LFO with delay, frequency and depth control.
- Polyphonic portamento (good for theremin fx).



- A pitch enveloppe provides pitch inaccuracy.
- All the controls are calculated at audio rate to avoid « digital graniness ».

- Extensive velocity control[8] provides expressivity.
- All the controls are automatable.
- Full SSE optimisation and polynomial anti-aliasing for balanced quality vs performance.
- The ugliest graphic interface in the world forces you to close your eyes and to listen to the sound.

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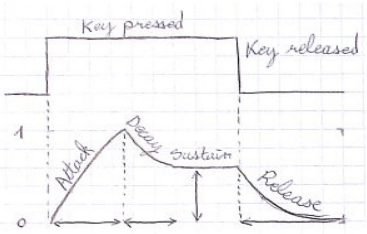
1 Two complete paths including oscillators and filters.
2 PWM, saw, synched triangle, fm1, fm2:bell, paradoxical.
3 The oscillators are always running, even when you don't hear them. On « note on », their phases are not synched.
4 The timbre parameter depends on the type of the oscillator. For a PWM oscillator, you control the pulse width ; for a saw oscillator, you control a phase offset ; for the fm oscillators, you control the modulation index, for the paradoxical oscillator, you control the brilliance.
5 Soft, warm, fuzzy, mix. No, you can't detune yourself the oscillators !... but you will gain much time especially if you are playing live.
6 Low-pass, high-pass, shelving, EQ, all-pass (phaser).
7 Left and right channel modules are modulated with a 90° LFO phase shift.
8 Velocity controls the drive stages, the pitch enveloppe and the three ADSR.

4 Modules

4.1 ADSR

This is the most classic enveloppe generator. You have horizontal sliders for the Attack, Decay and Release times and a vertical slider for the Sustain level.

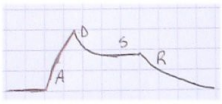


In fact, there is two handles per slider. They allow velocity modulation. When you strike a key slowly the effective value will correspond to the filled handle. When you strike the key very fast, the effective value will correspond to the outlined handle. Some people would call that « morphing ».

Here are the handles

Here are the envelopes

For a low velocity



For a high velocity

4.2 Dynamic controls

The main parameters of Vagabond King are dynamically controlled by the ADSR enveloppes: "timbre" of the oscillators, cut-off frequency and resonance of the filters.

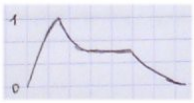
With most of the synthesizers this would be presented as two knobs or slider: one for the base value, another for the modulation depth. Vagabond King does not work this way.

For every dynamic controlled parameter, you have two sliders namely H(igh) and L(ow).

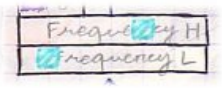
The position of the L slider corresponds to the value of the parameter for a Low enveloppe signal, the position of the H slider corresponds to the value of the parameter for a High enveloppe signal.

Let's have examples to sort this out.

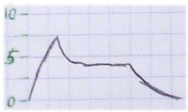
Here is a typical ADSR enveloppe signal:

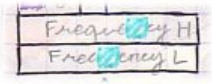


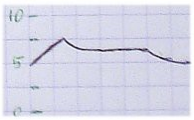
If the settings for the cut-off frequency of the filter are set this way

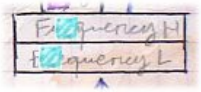


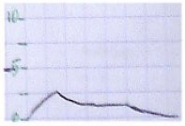
Then the cut-off frequency will evolve this way

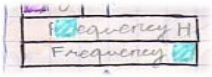


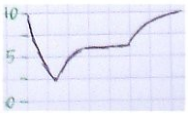












4.3 Oscillators

The oscillators are multimode: you have 6 oscillator types at hand. Their timbre can be controlled by the dynamic timbre control.

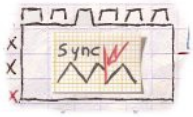
a) PWM (Pulse Width Modulated) oscillator

A very classic analog waveform, mainly because it was easy to produce with analog hardware. The timbre parameter controls pulse width. The pulse width changes the harmonic structure of the sound from pulse (all the harmonics are present) to square (half the harmonics are present).

b) Saw oscillator

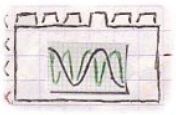
Another classic analog waveform. Here the timbre parameters adds and offsets a secondary sawtooth.

c) Sync



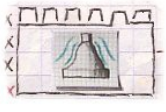
This produces a signal based on a synched sine wave. The timbre parameter controls the ratio between the internal master and slave oscillators. The resulting signal is much like a low-fi formant filter.

d) FM1



This produce a two operator FM sound (with fixed and simple ratios). The timbre parameter controls the modulation index (brilliance).

e) FM2 Bell



Again a two operator FM sound but this time, the ratios are complex. It provides almost dissonant and metallic sounds.

f) Paradoxical

It is inspired by JC Risset early studies on paradoxical sounds. It provides organ like sounds, the timbre parameter controls the brilliance of the sound. You may notice that if you go up one octave you will obtain exactly the same sound as the lower octave. The musical scale is perfectly cyclic with this kind of sound.

4.4 Filters

Both filters are multimode: you have 5 filter types at hand. Both frequency and resonance can be controlled dynamically.

a) Low-pass

It is the classical -12dB/oct low pass filter with resonance. You can use both filters in this mode to obtain -24dB/oct filters.

b) EQ

It allows you to add a peak or a notch. Very useful for adjusting the « color » of a sound.

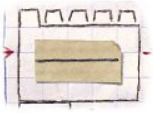
c) High-pass

It is usefull for removing low harmonics vs high harmonics. Can be usefull for bass sounds if you don't want to saturate the low frequency dynamics of mix.

d) High-Shelving

It can be used to amplify or attenuate high harmonics. The resonance parameter controls the amplification/attenuation. If you use dynamics on the resonance parameter, you can obtain punchy sounds.

e) All-pass (phaser)



An all-pass filter does not change the harmonic contents of a signal but it changes phases. It is almost transparent, almost...