Software 2 WS 2016 #6

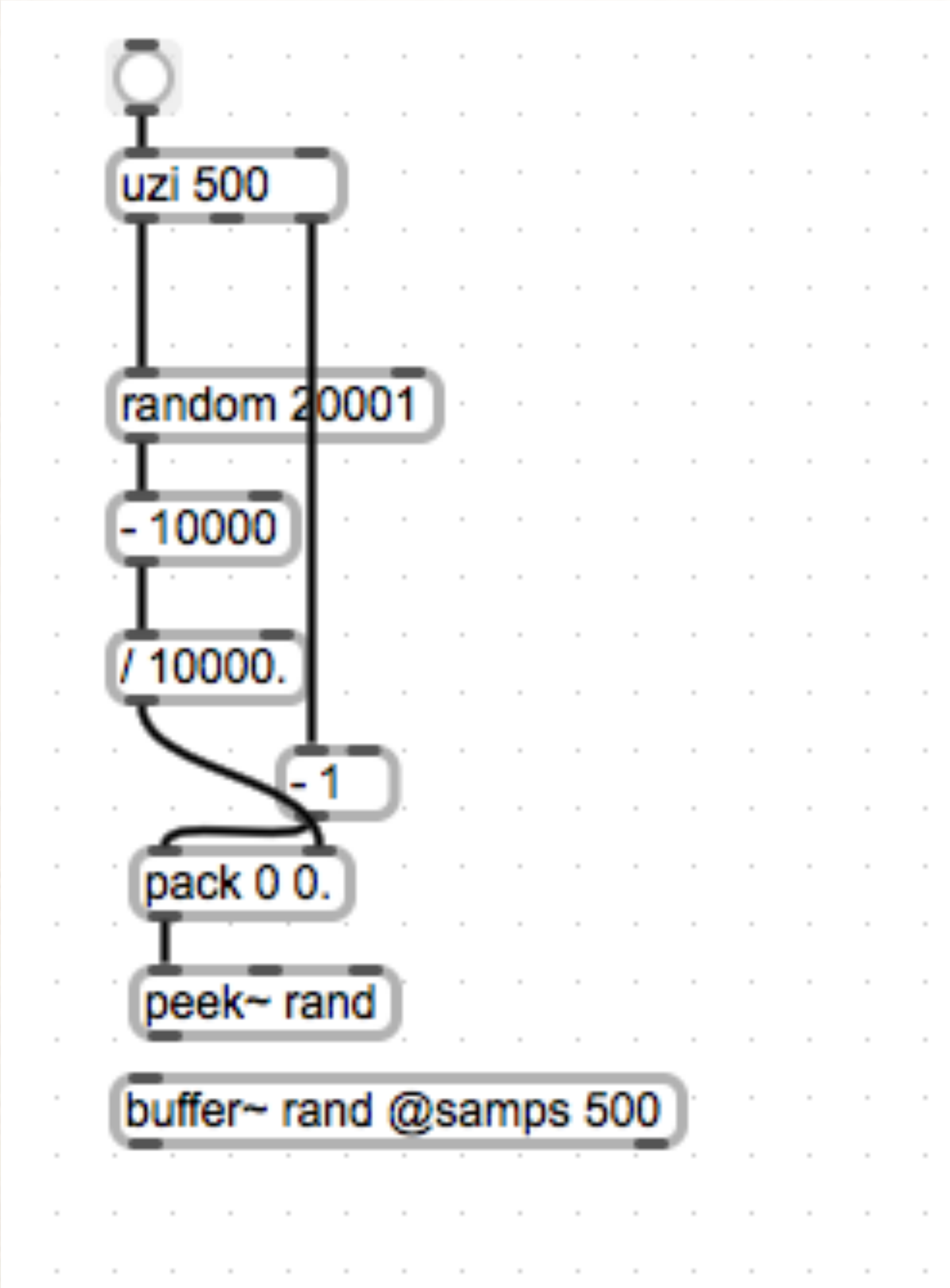
Chikashi Miyama

Karplus-Strong Synthese

Mechanismus

The basic KS algorithm starts with a wavetable of length p filled with random values

Experiment mit Max



Recirculating Wavetable

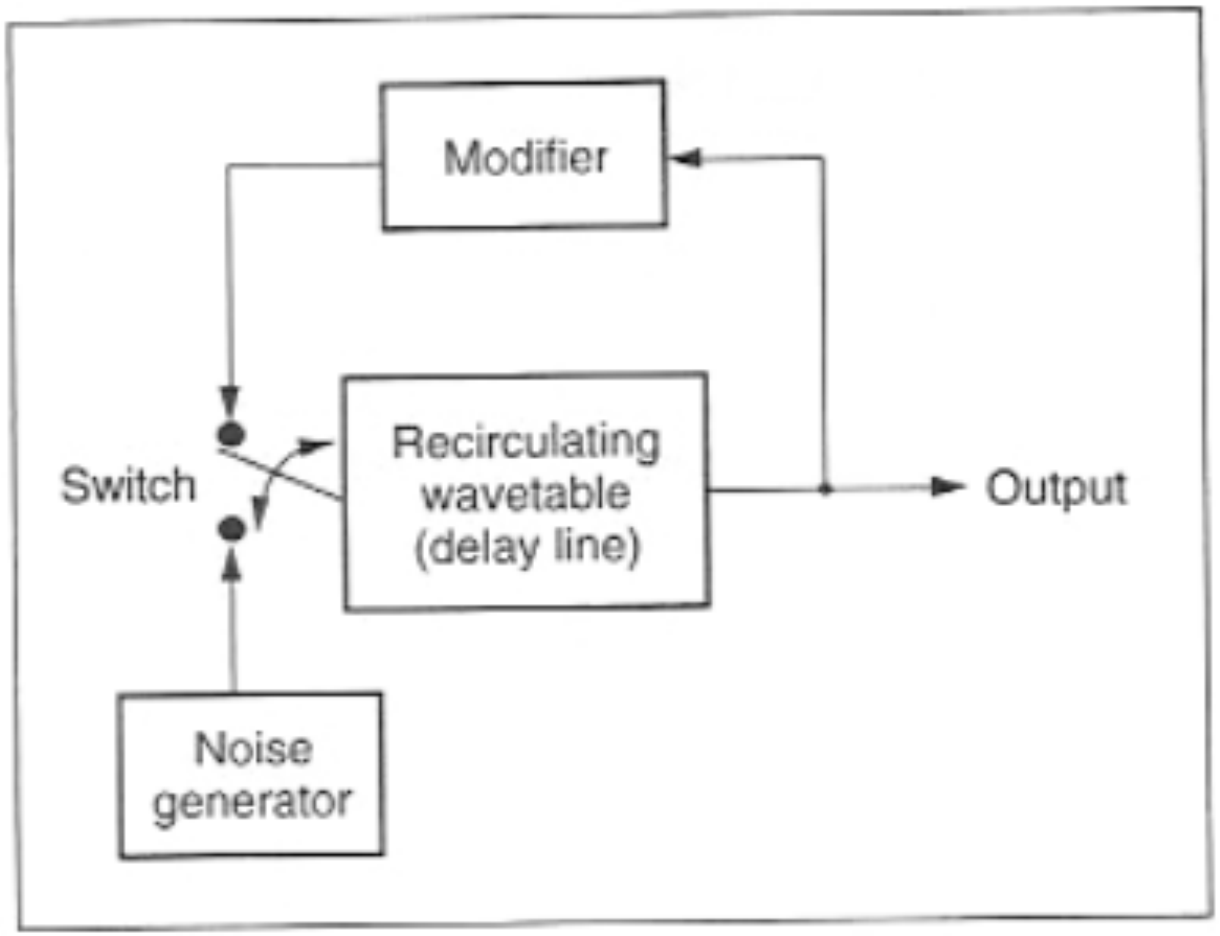


Figure 7.12 Core of the Karplus-Strong recirculating wavetable. The input to the recirculating wavetable switches to the noise source at the beginning of each event, then switches back to the modifier loop for the rest of the event. The modifier averages successive samples, simulating a damping effect.

Mechanismus

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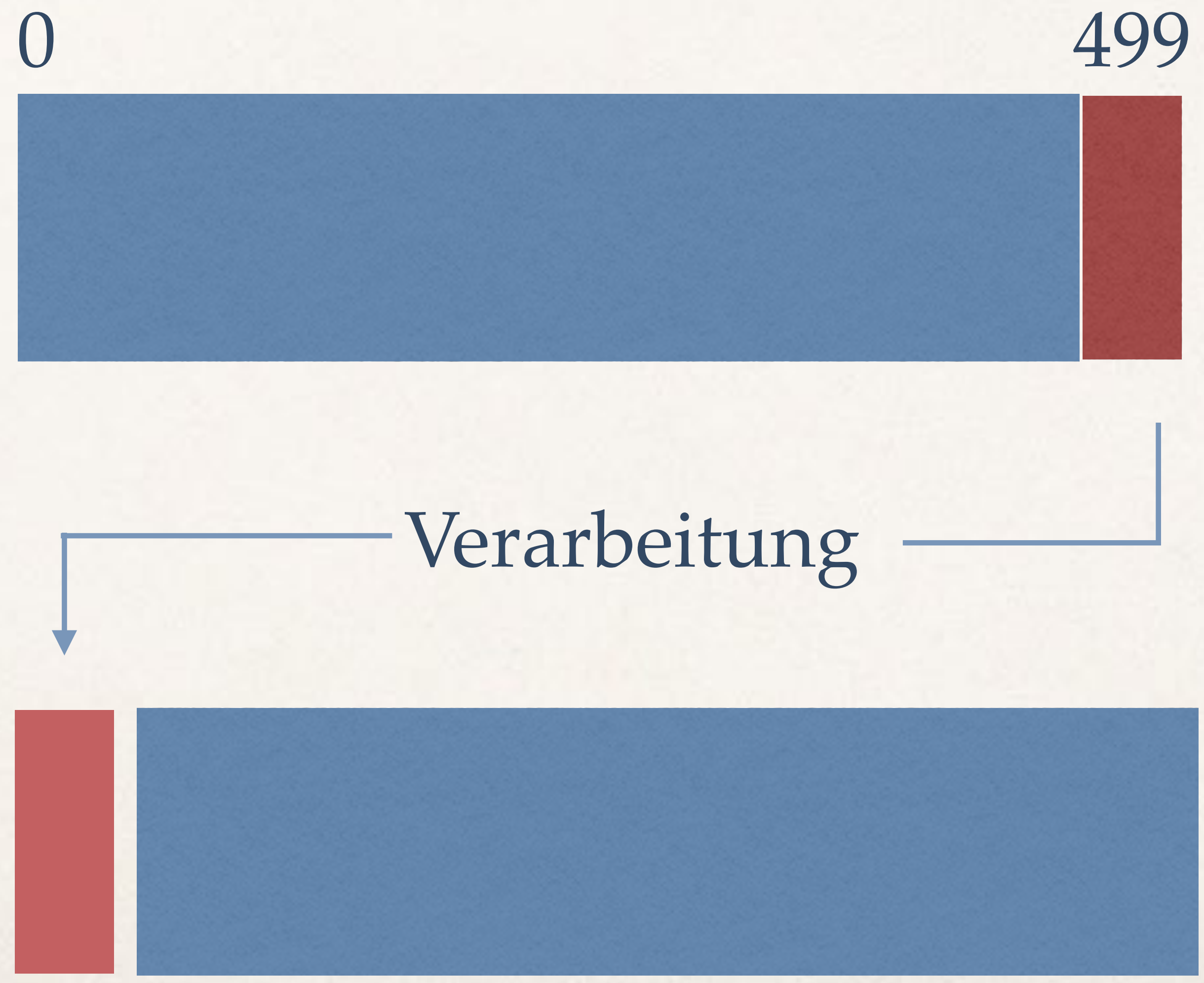

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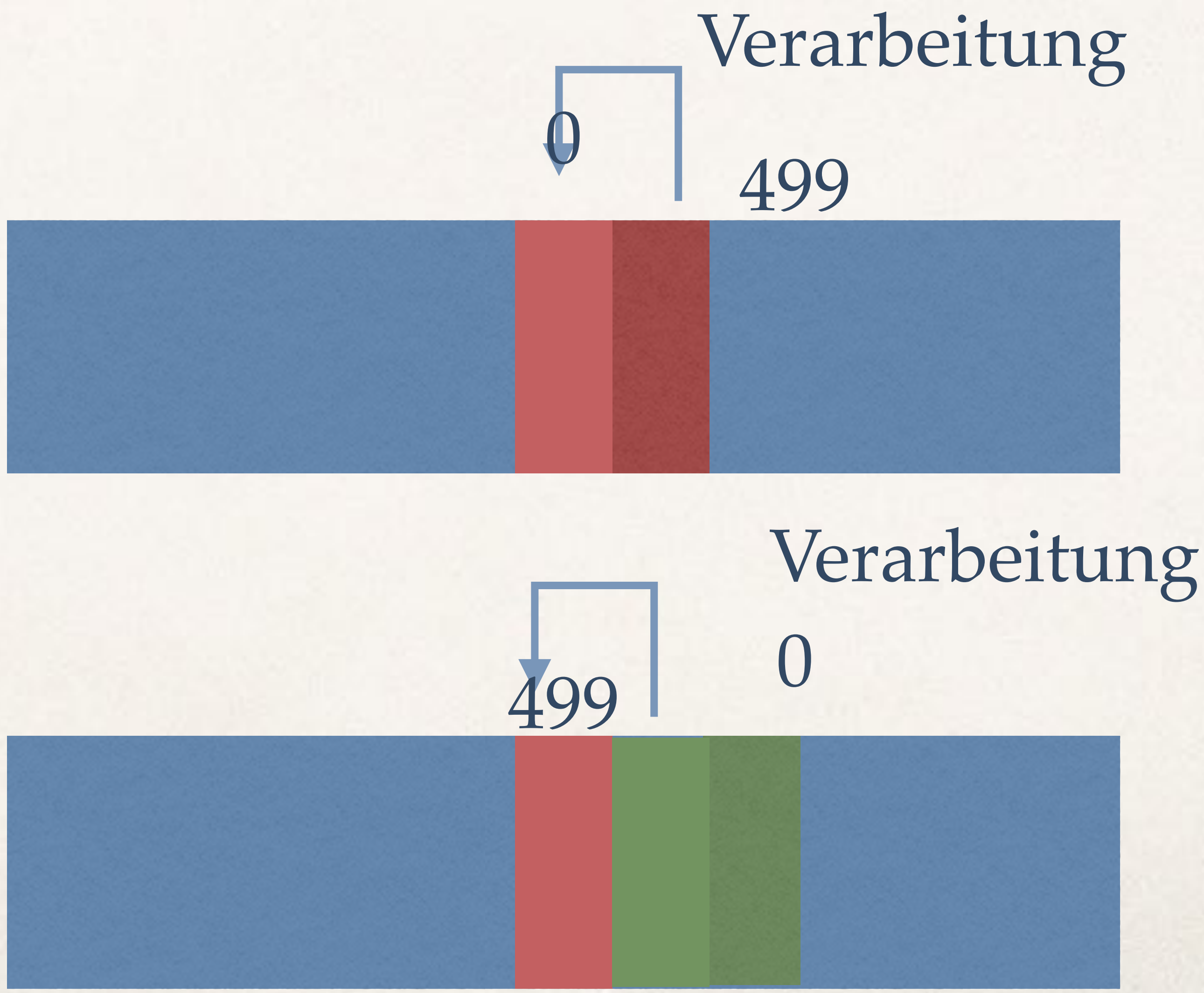
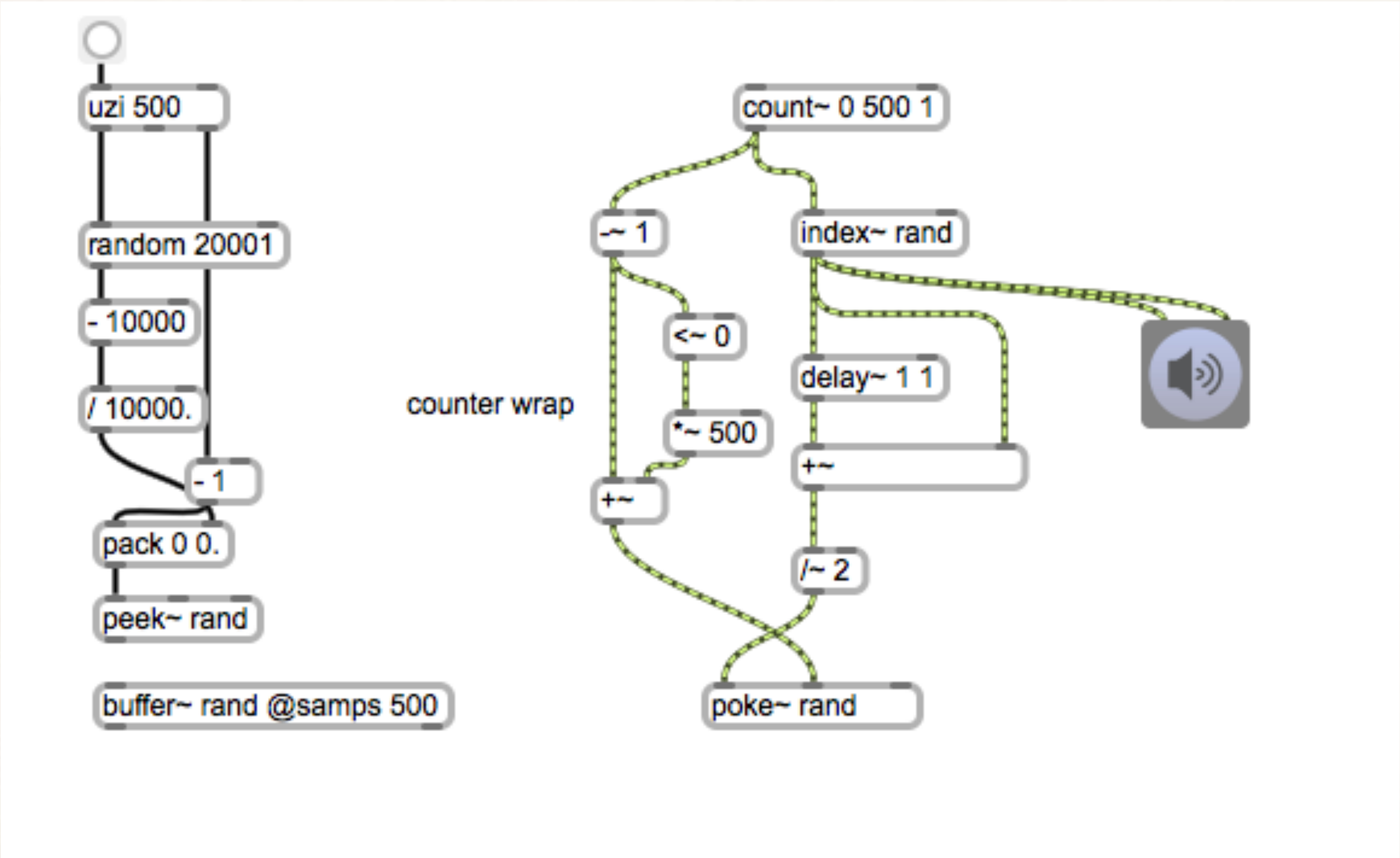


Mechanismus

The simplest modification is an averaging of the current sample with the previous sample- the core operation of a simple low pass filter.

At each sample interval, the wavetable read and write pointers and incremented. When the pointer reach the end of the wavetable they wrap around and start at the beginning again.

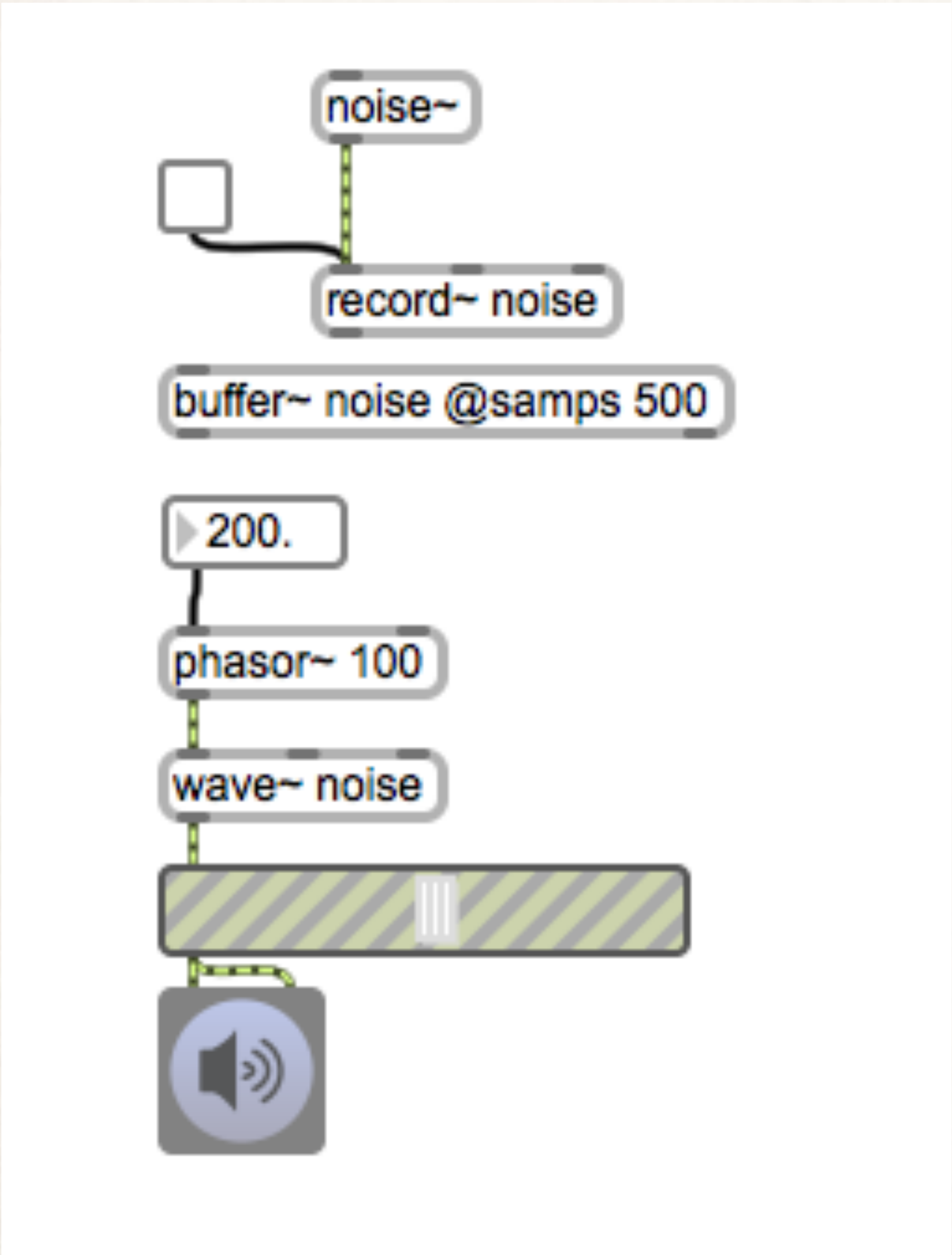
Experiment mit Max



Frage

- Warum kann man eine Tonhöhe wahrnehmen?

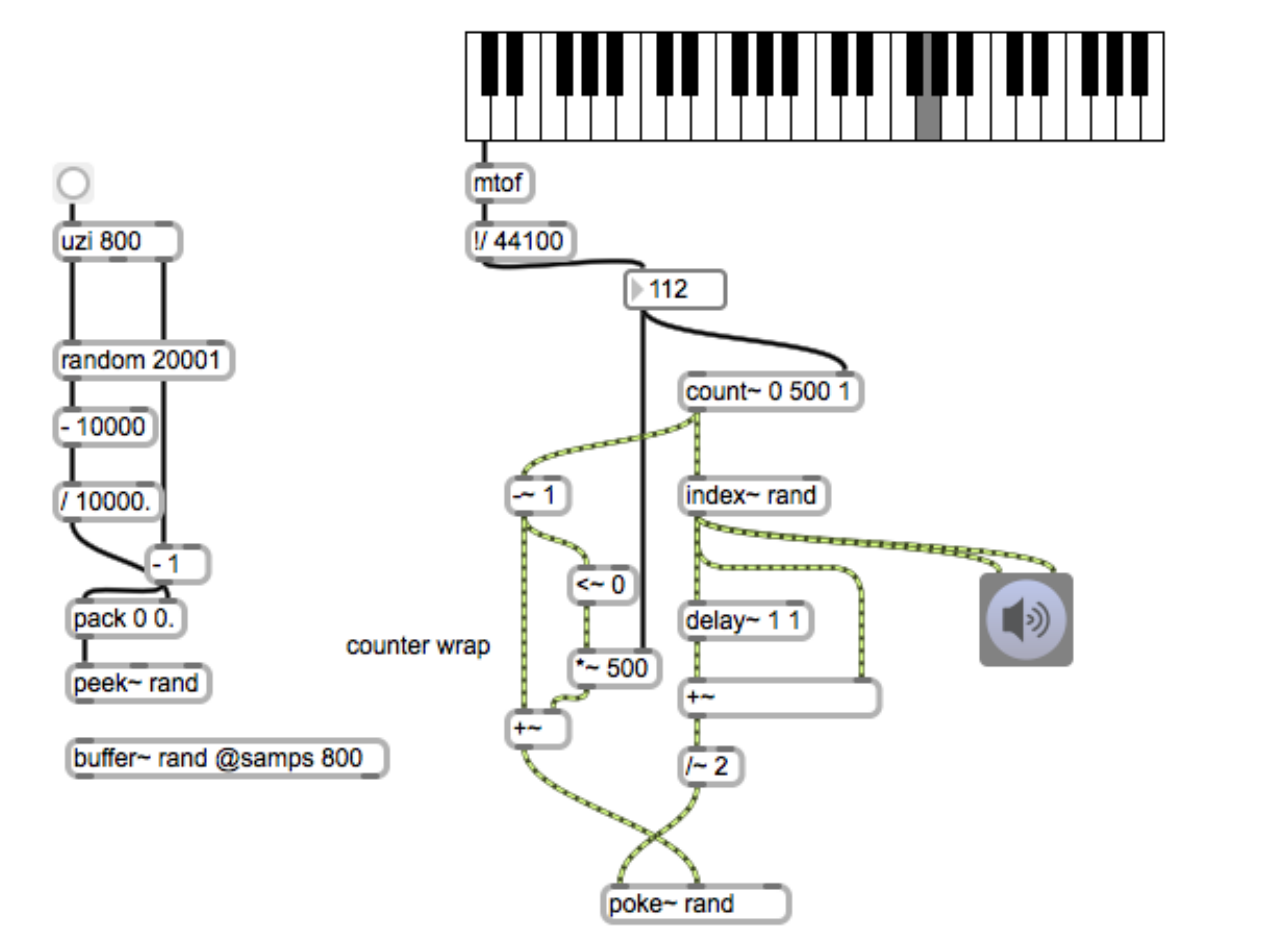
Rauschen + Wiederholung = Tonhöhe



If the wavetable is initially filled with random values, the reader may wonder why the result does not sound like noise - at least at the out set of the tone

The reason it sounds pitched is because the wave table is being repeated.

Tonleiter



uzi 800
random 20001
- 10000
/ 10000.
- 1
pack 0 0.
peek~ rand
buffer~ rand @samps 800
mtof
!/ 44100
112
count~ 0 500 1
-~ 1
index~ rand
<~ 0
*~ 500
counter wrap
+~
delay~ 1 1
+~
/~ 2
poke~ rand

Drumlike Timbres

- Wie kann man mit der KS-Synthese einen Schlagzeug-ähnlichen Klang erzeugen?

Mechanismus

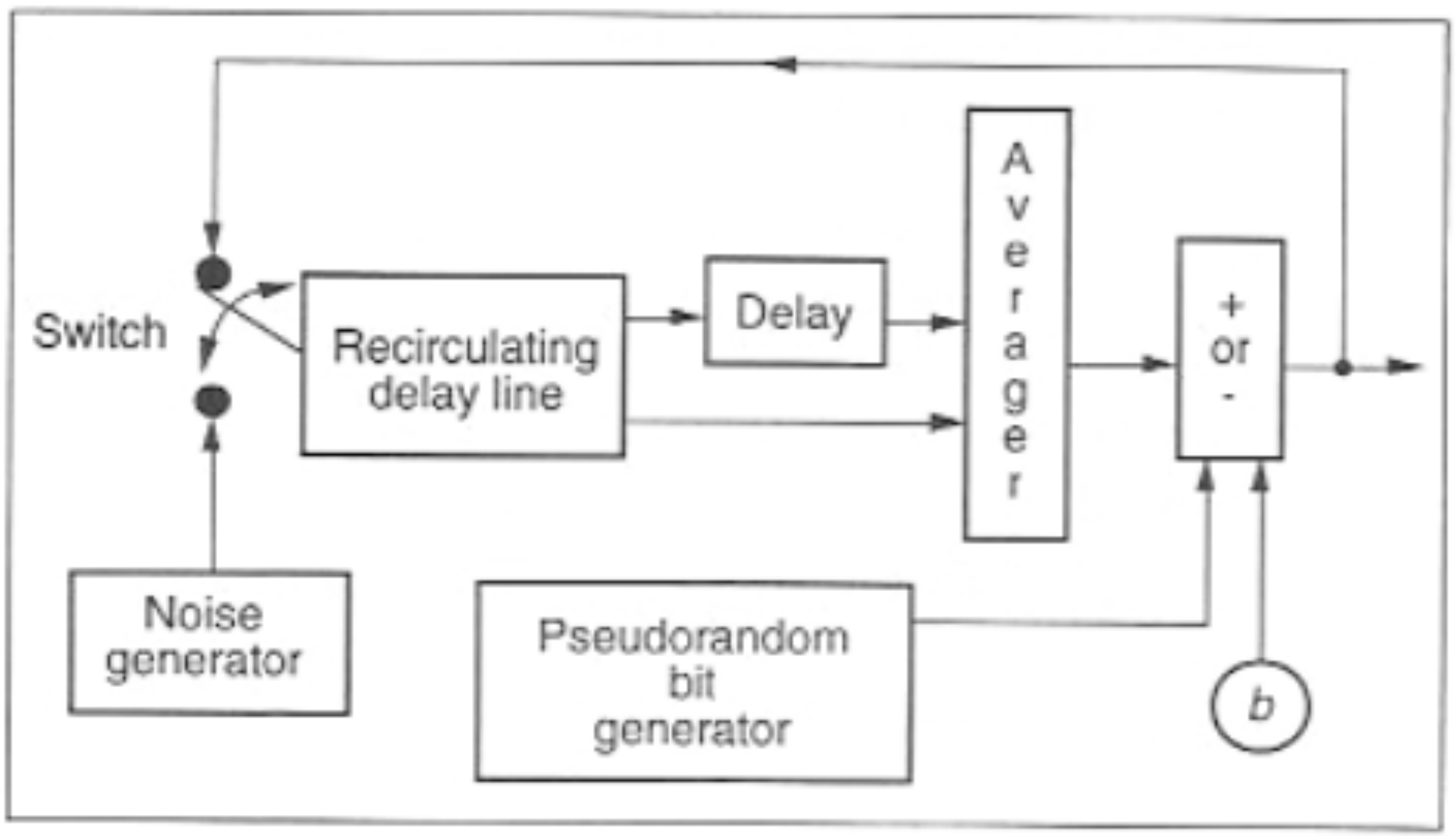
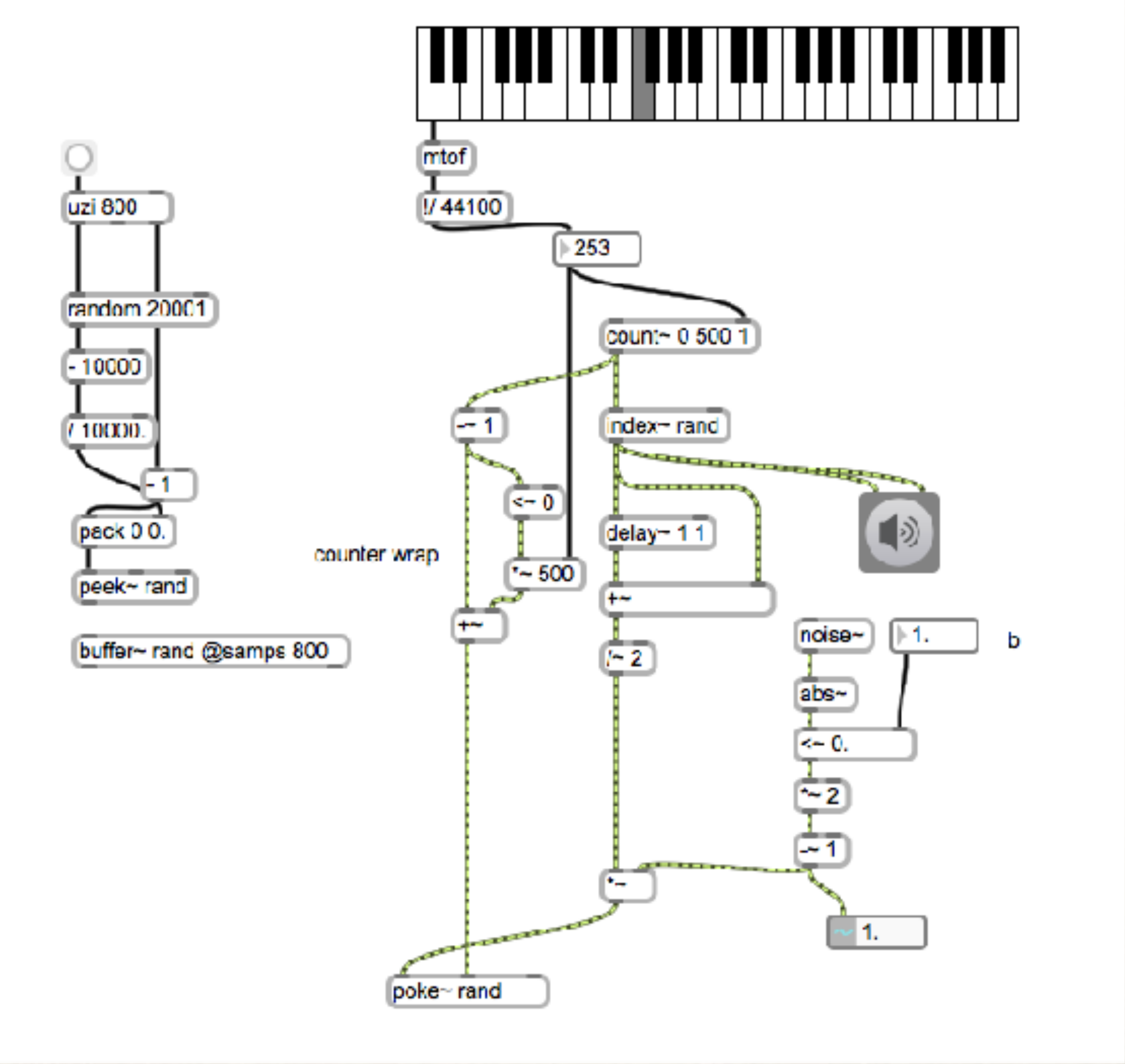


Figure 7.13 The Karplus-Strong drum synthesis algorithm. The quantity b is the blend factor (see text).

$$Signal_t = \begin{cases} +1/2\,(Signal_{t-p} + Signal_{t-[p-1]}), & \text{with probability } b \\ -1/2\,(Signal_{t-p} + Signal_{t-[p-1]}), & \text{with probability } 1-b \end{cases}$$

Experiment mit Max



Parameter und Klangfarbe

When b is close to 0.5, the wavetable length no longer controls pitch

$p > 200 = \text{snaredrum}$

$p < 25 = \text{tom tom}$

To make a resonant drum, the wavetable is preloaded with a ***constant value***

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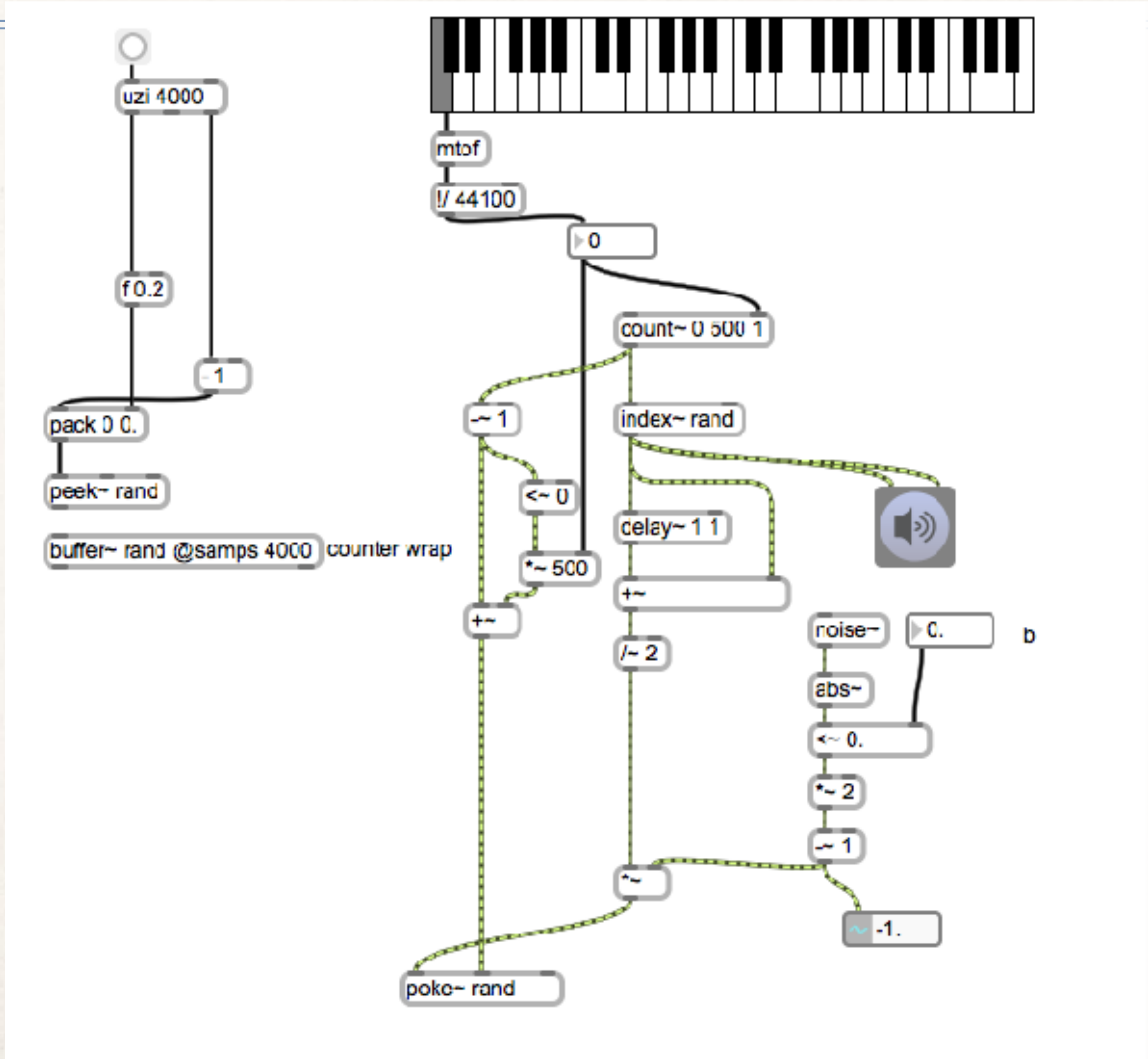

Stretching Out the Decay Time

- Was ist “Decay Time” ?
- Was ist Problem mit “Decay Time”

Stretching Out the Decay Time

Decay time of the sound produce by KS is proportional to the length p of the wavetable.

we want to decouple the decay time from the wavetable length.

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⬇

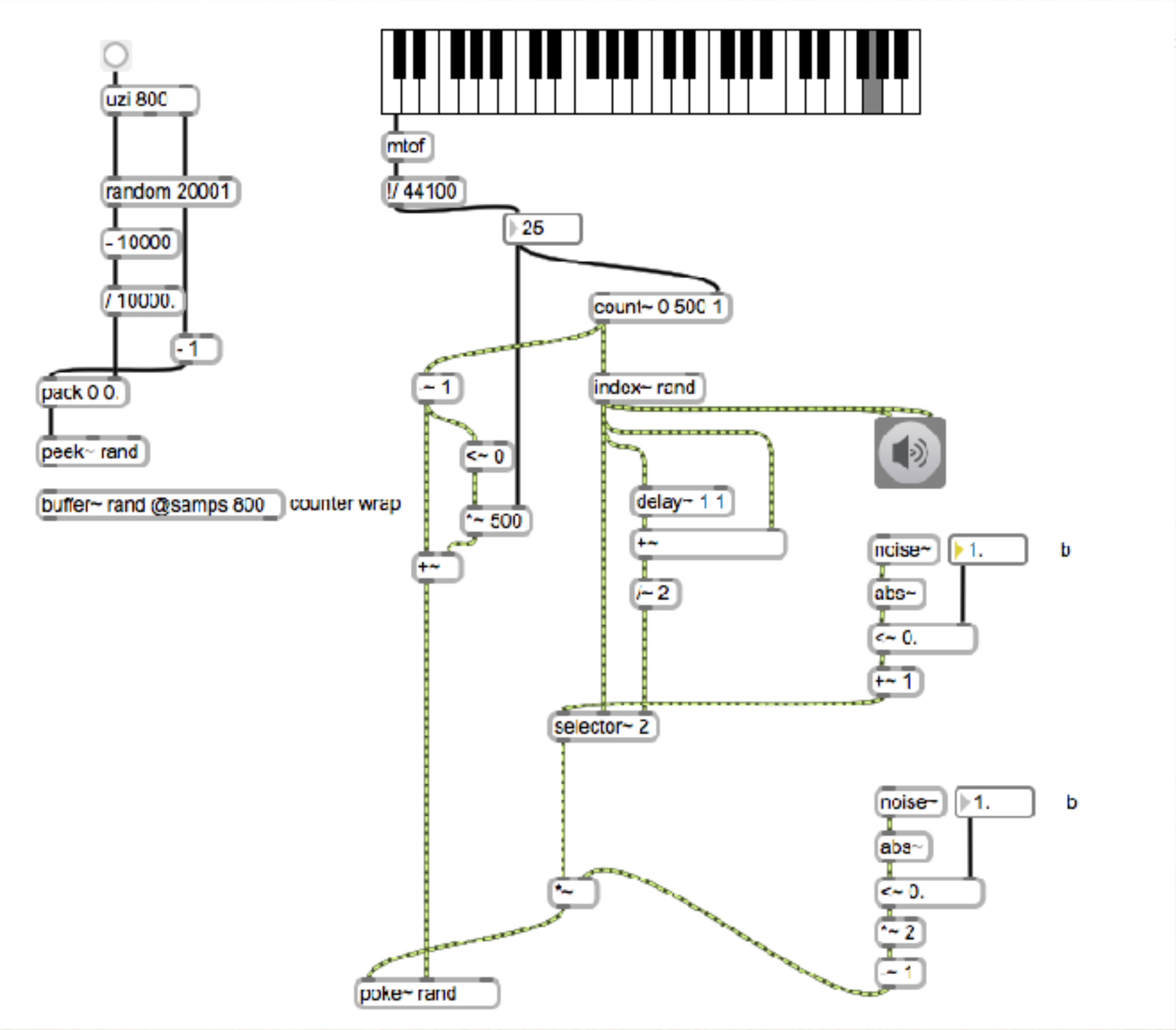
(*Decay Stretching*)

Decay Stretching

$$Signal_t = \begin{cases} Signal_{t-p}, \text{ with probability } 1 - (1/s) \\ 1/2(Signal_{t-p} + Signal_{t-[p-1]}), \text{ with probability } 1/s \end{cases}$$

s = stretch factor

Experiment mit Max



Extension to KS

- Welche Art von Weiterentwicklung ist mit KS möglich ?

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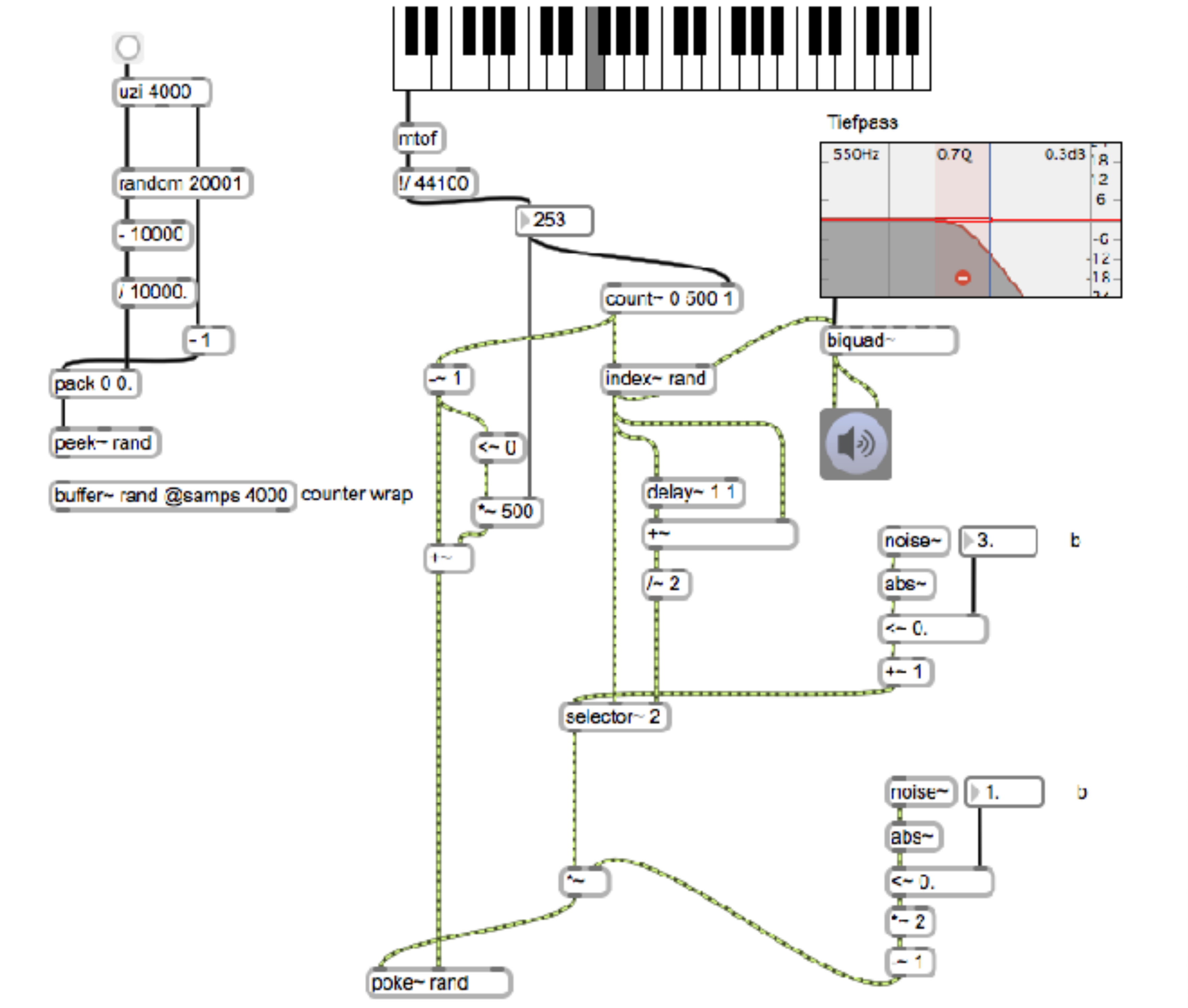
Filter

- Eliminating the initial “plucked” sound
- Varying the loudness of the tone in relation to its bandwidth
- Glissandi and Slurs
- Mimicking the effects of sympathetic string vibrations
- Simulating the sound of a pick that moves in relation to its distance fro the bridge
- Simulating up and down picking

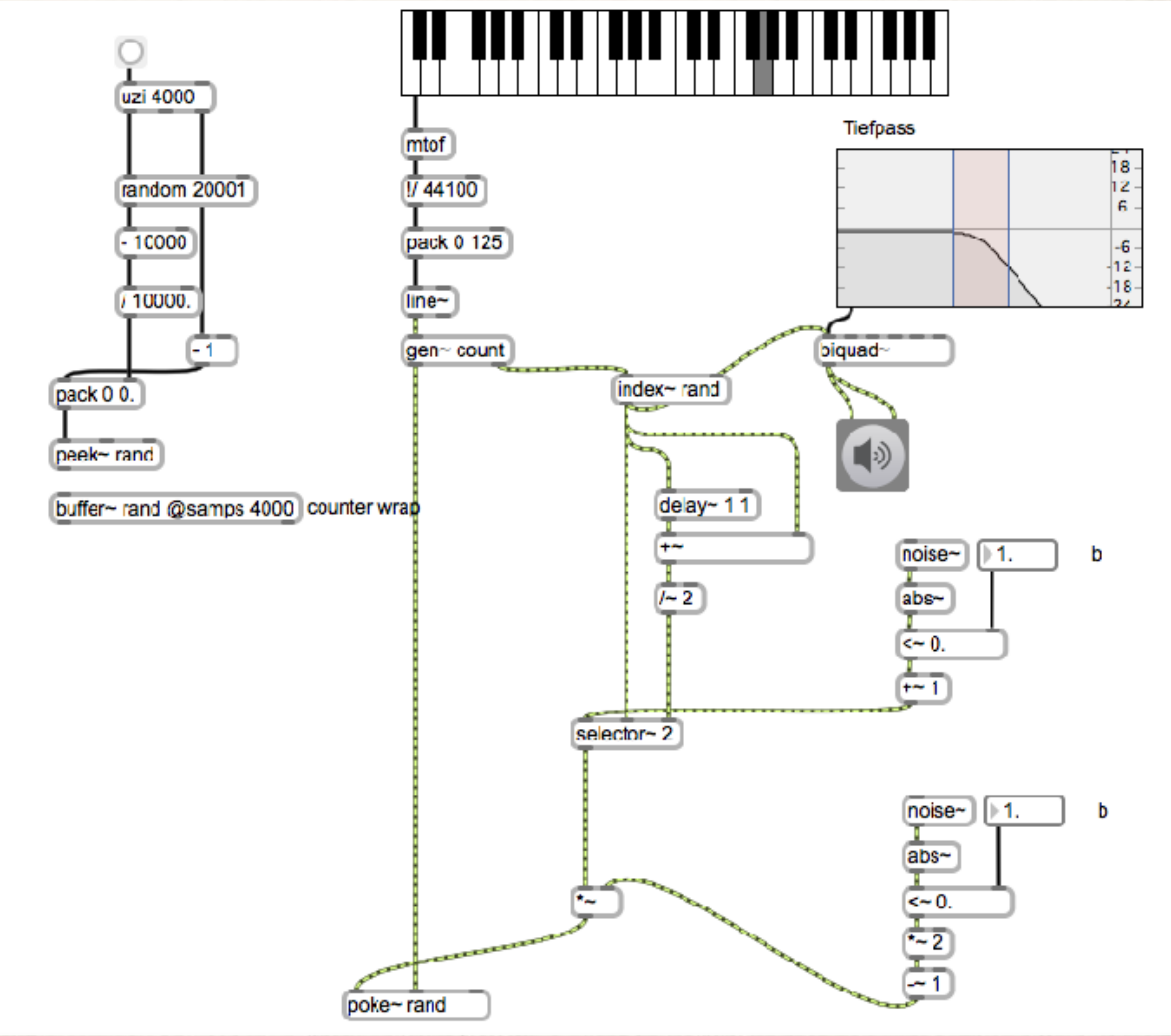
Experiment

Mit Tiefpass

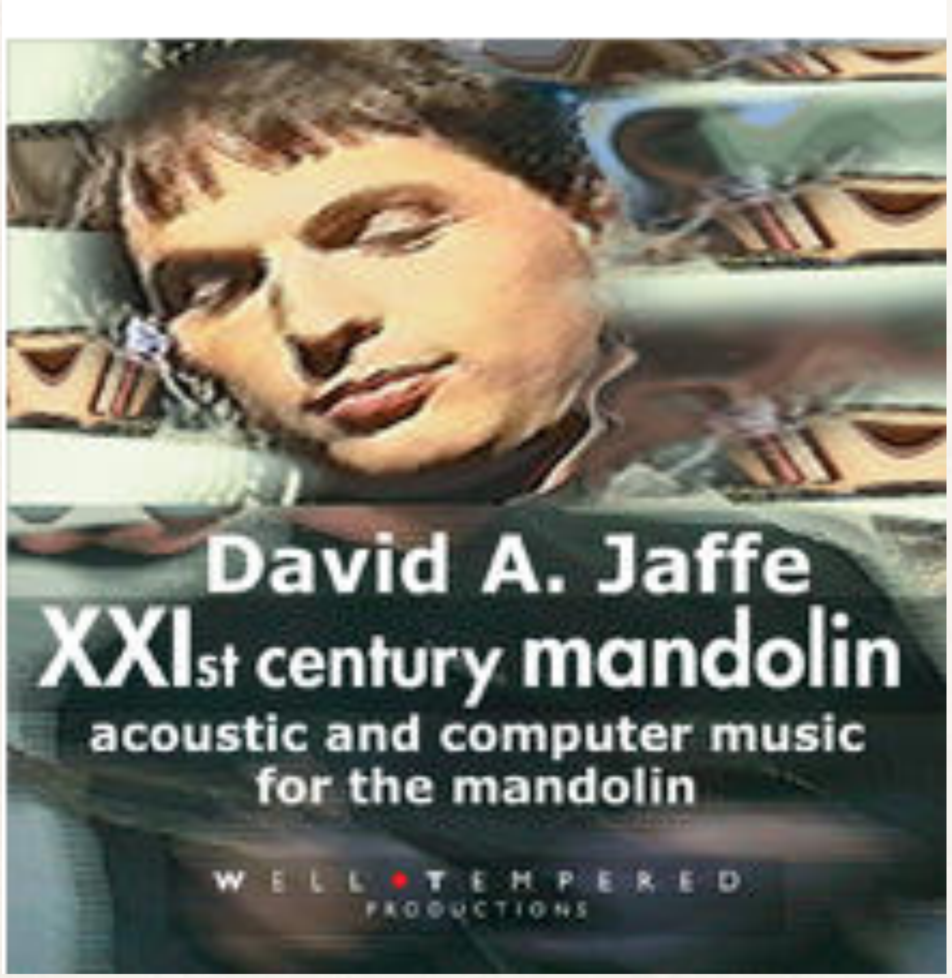


Experiment

Mit Gliss



Beispiel Stück



David A. Jaffe

Silicon Valley Breakdown

Waveguide Synthese

Korg Prophecy

https://www.youtube.com/watch?v=gJyoPBK3rdM&index=1&list=RDgJyoPBK3rdM

Mechanismus

A Basic building block is a pair of digital delay lines.
Each delayline is injected with an excitation wave propagating in the opposite direction and reflecting back to the center when it reaches the end of the line.

Waveguide Model of Plucked Strings

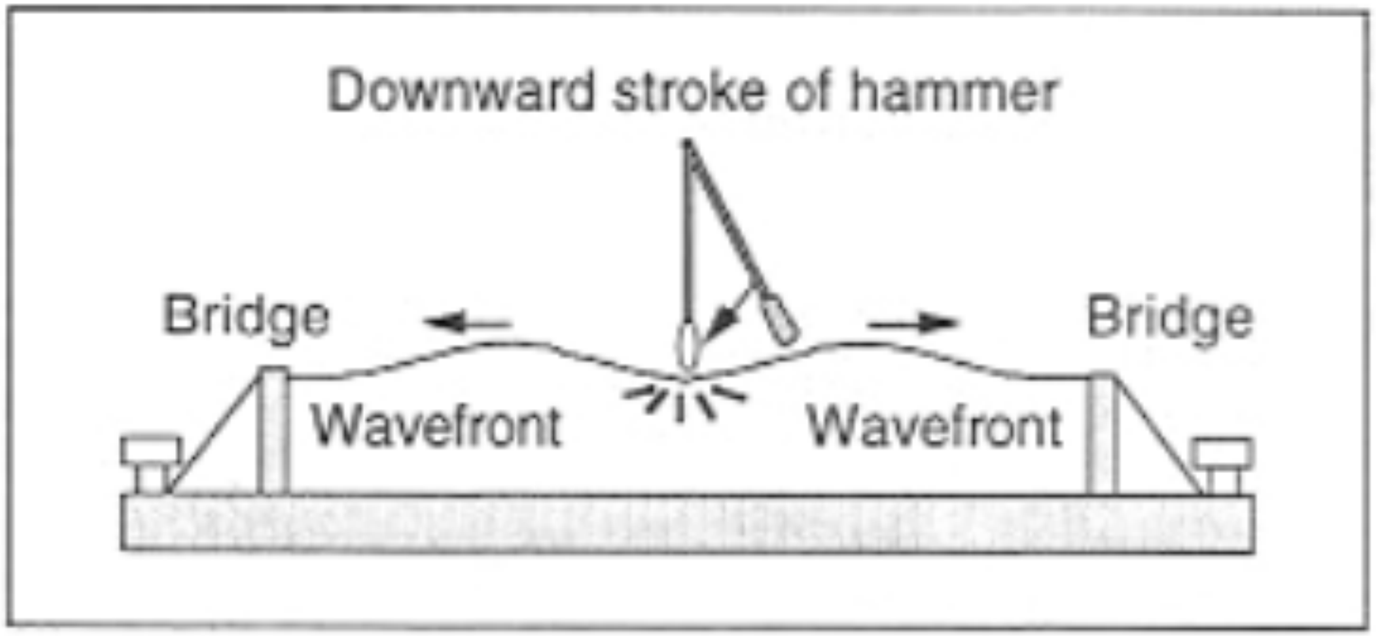
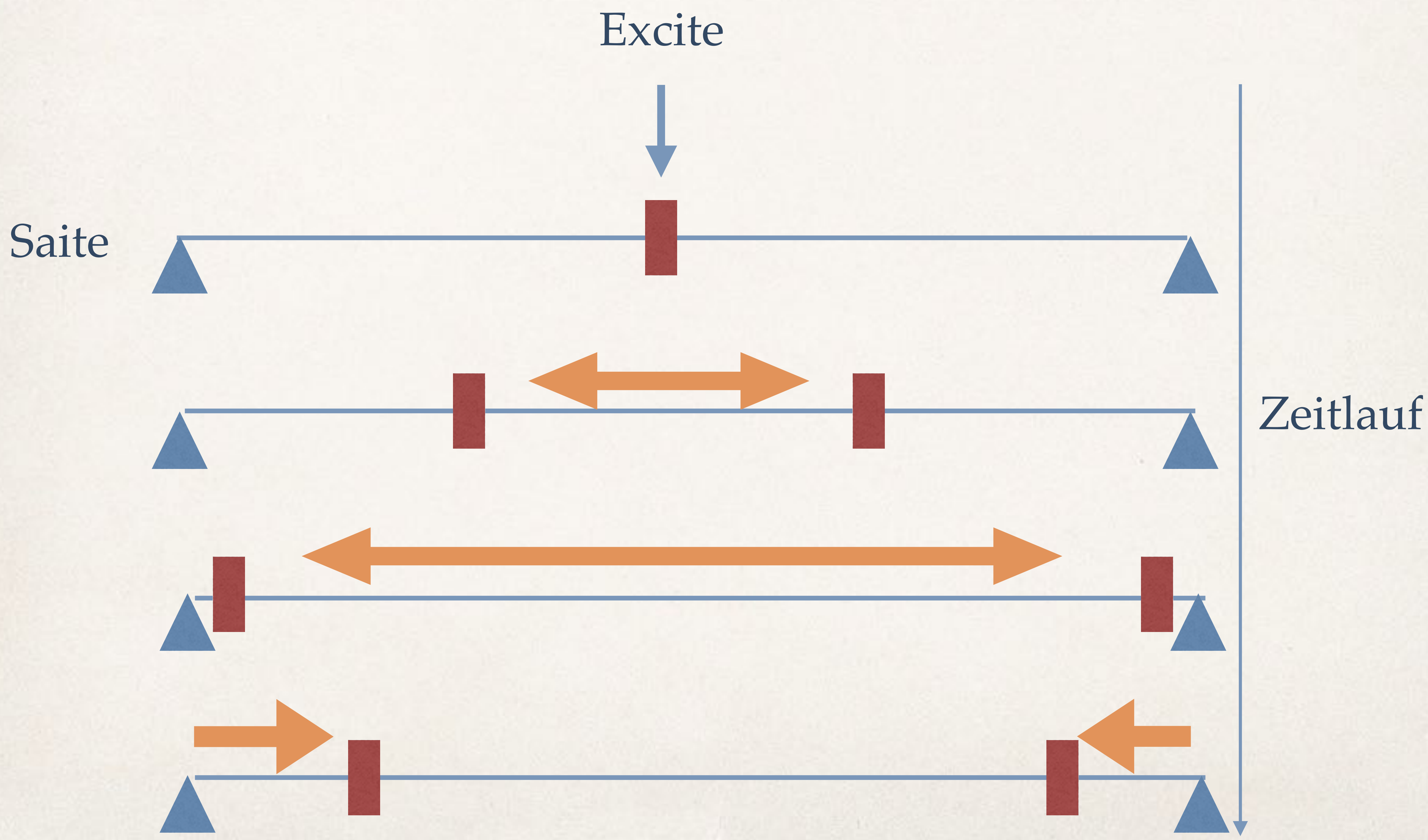
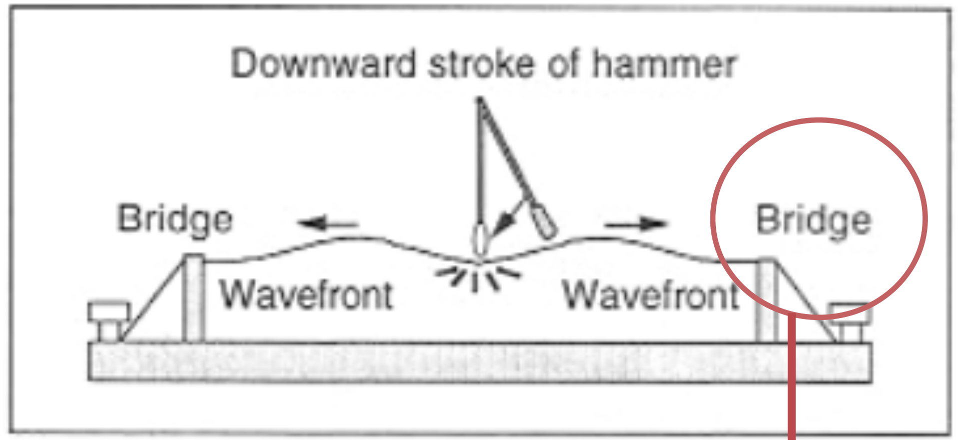


Figure 7.5 A string struck at the center generates two waves moving in opposite directions. This behavior is the basis of the delay line paradigm of string vibration.

Mechanismus



Model



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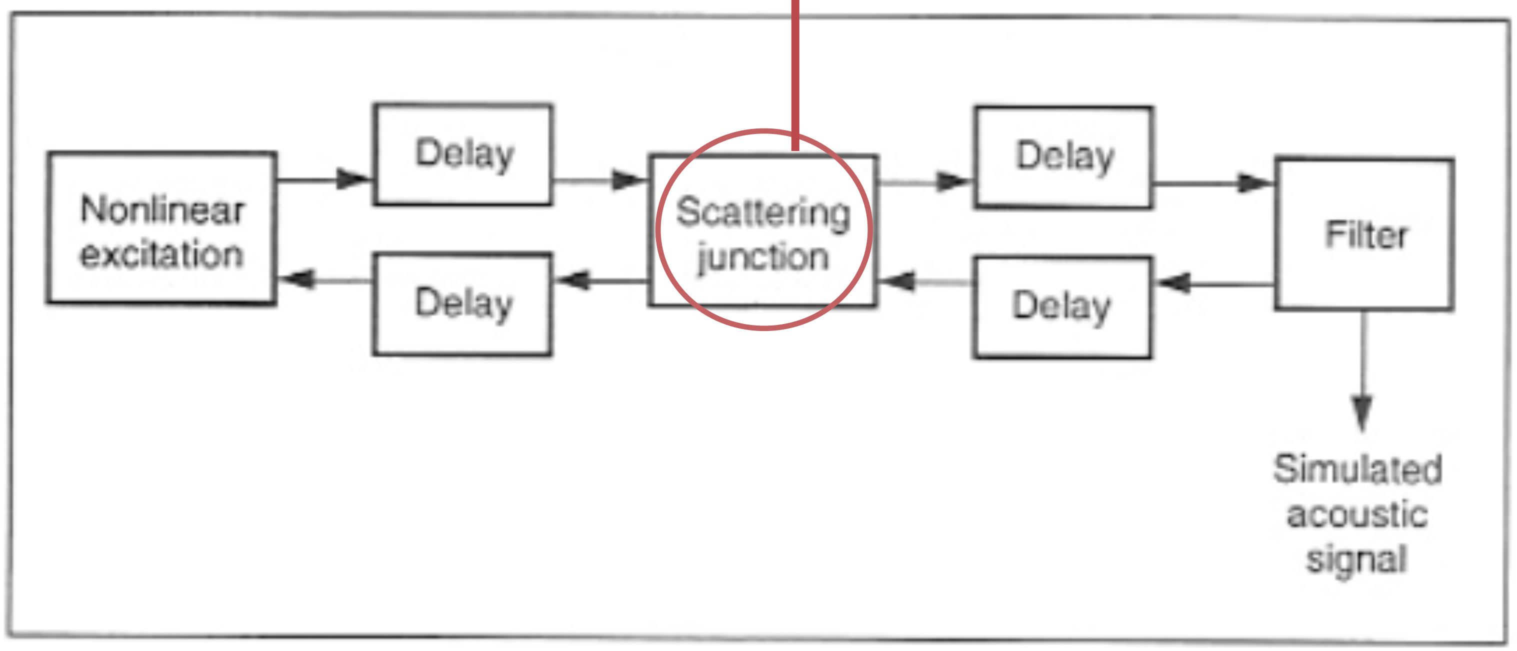
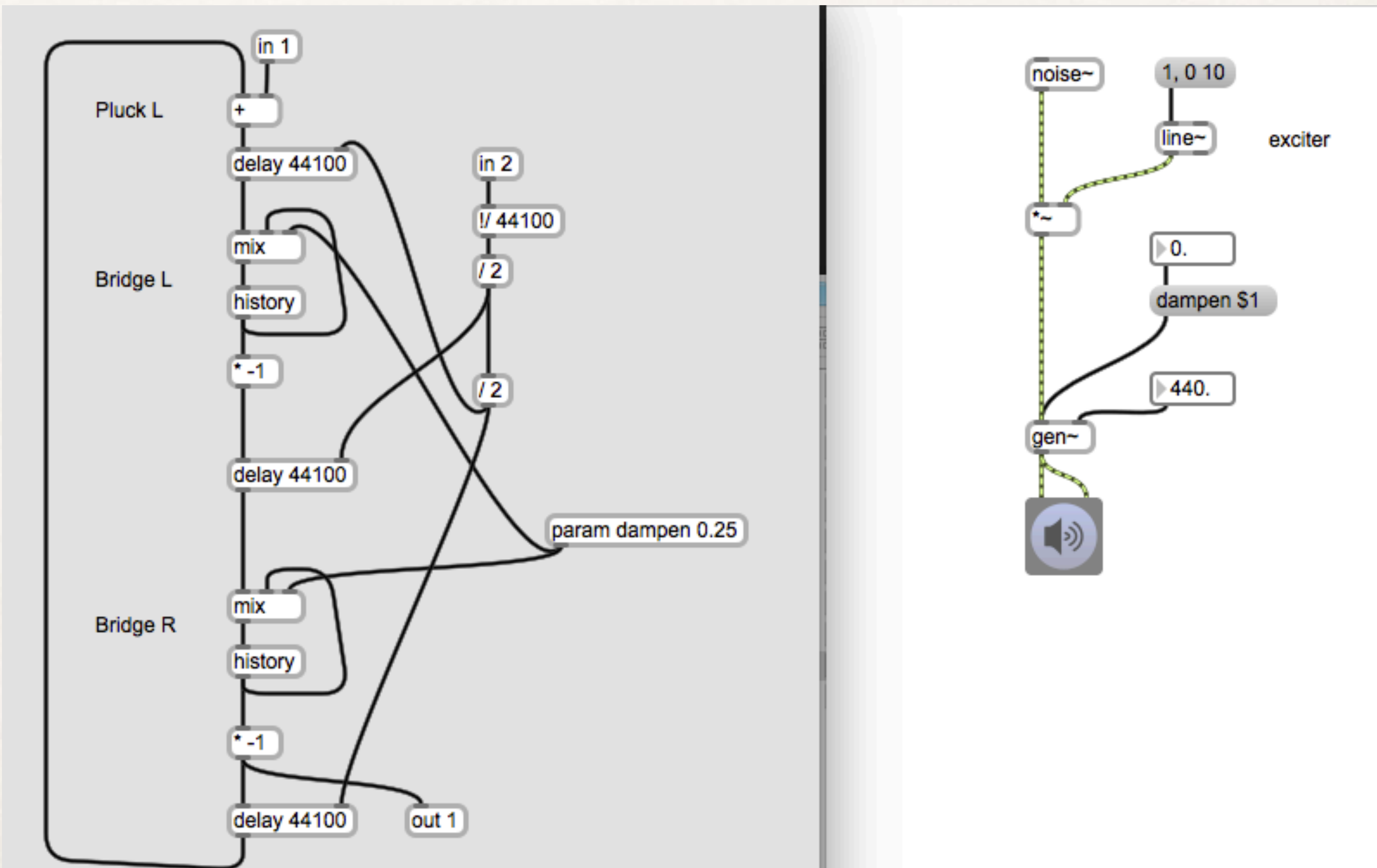
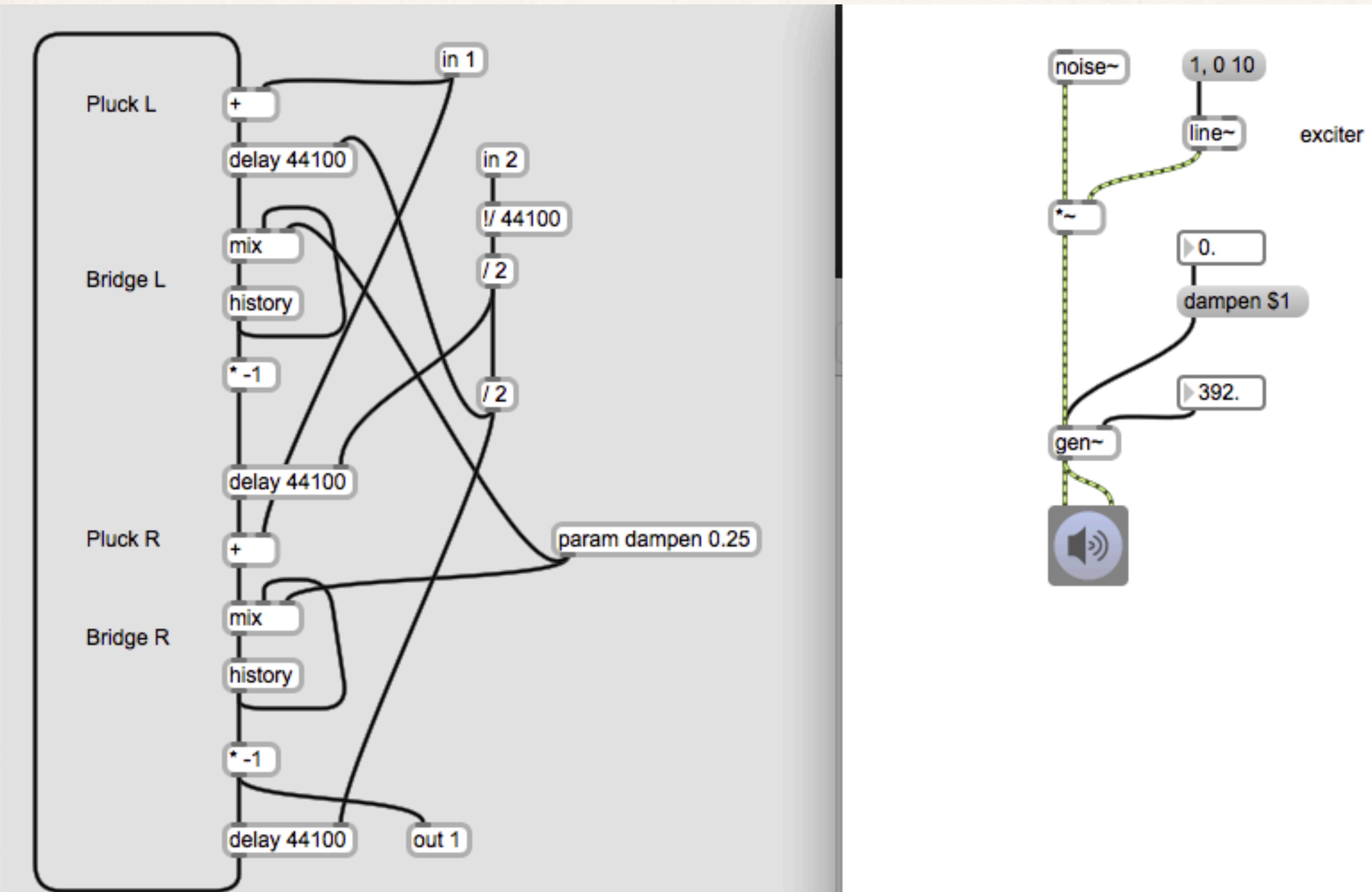


Figure 7.6 Generic waveguide instrument model capable of simulating stringed or wind instruments (after Cook 1992). A nonlinear excitation injected into the upper delay line travels until it hits the scattering junction, which models the losses and dispersion of energy that occur at junctions in acoustical systems. Some energy returns to the oscillator junction, and some passes on to the output junction, modeled by a filter.

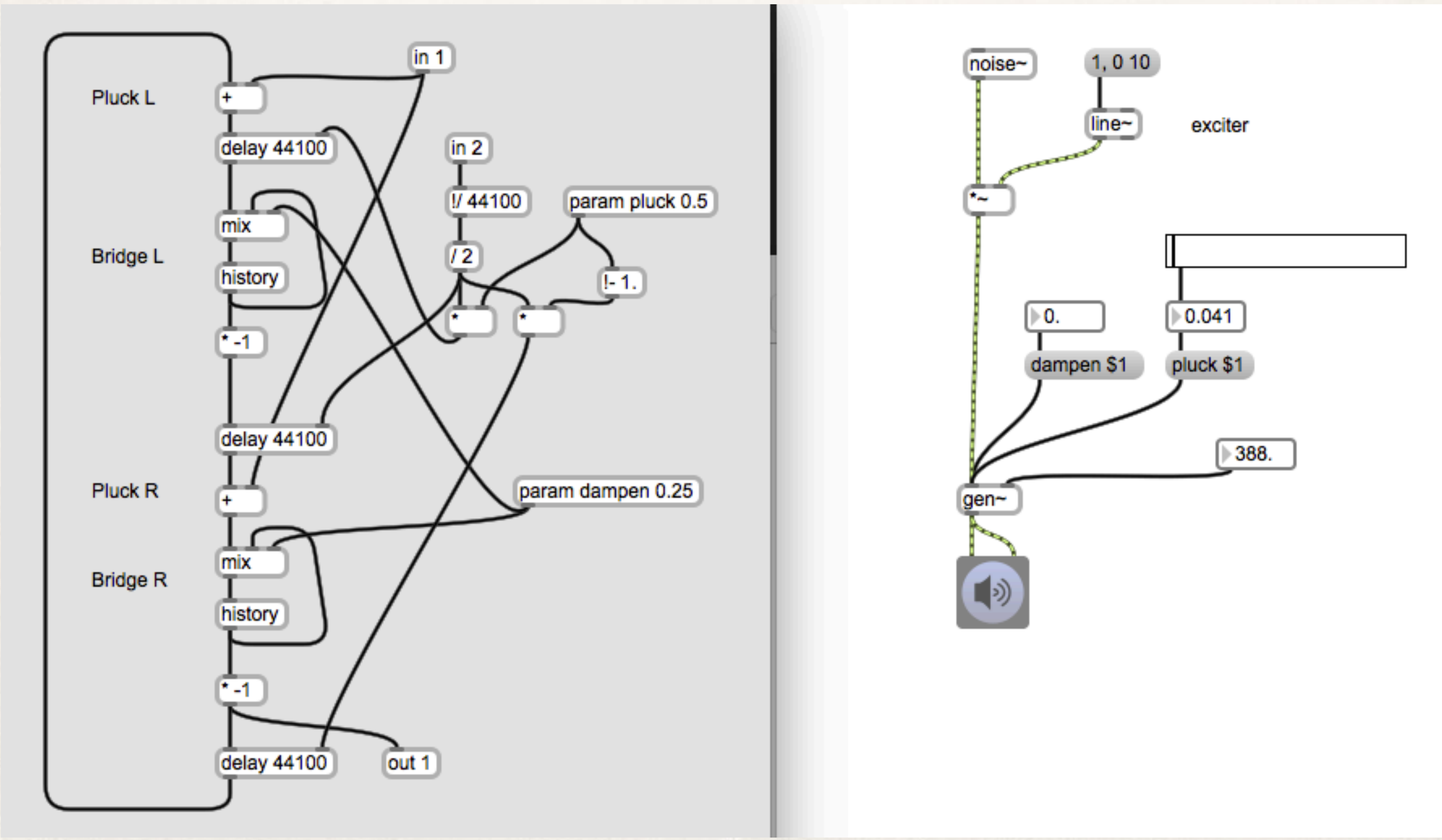
Experiment mit Max (Schritt 1)



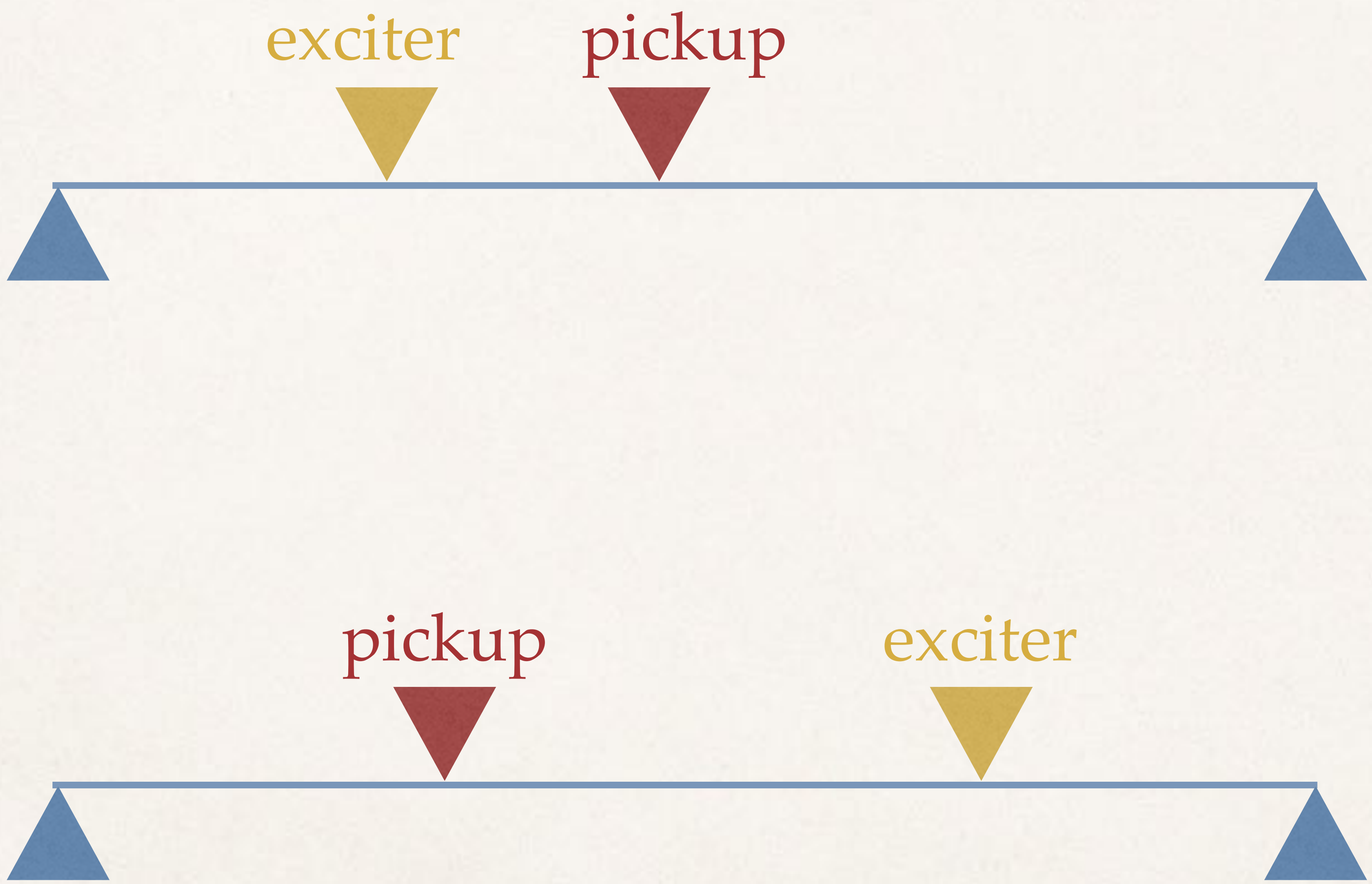
Experiment mit Max (Schritt 2)



Experiment mit Max (Schritt 3)



Experiment mit Max (Schritt 4)



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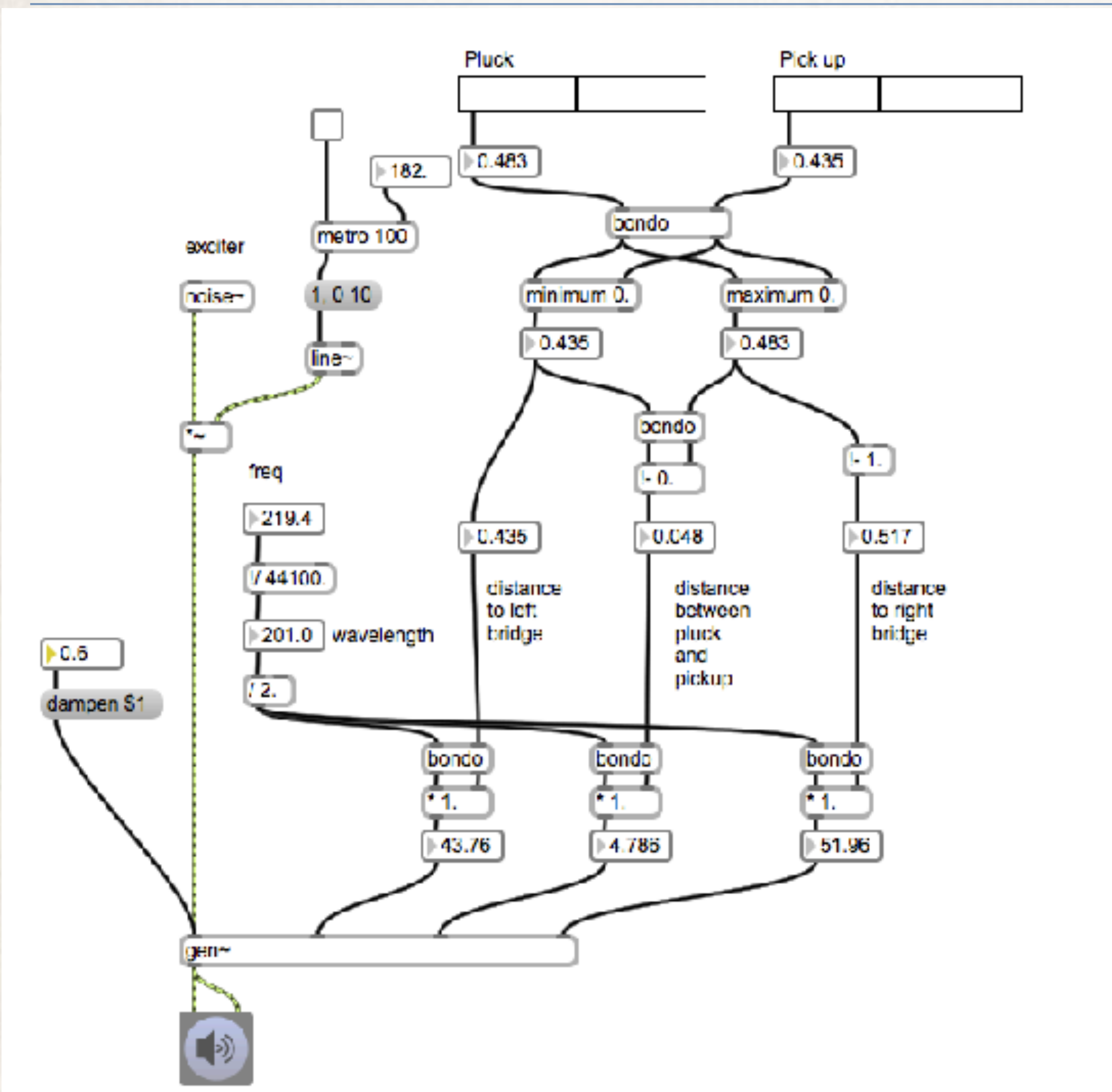

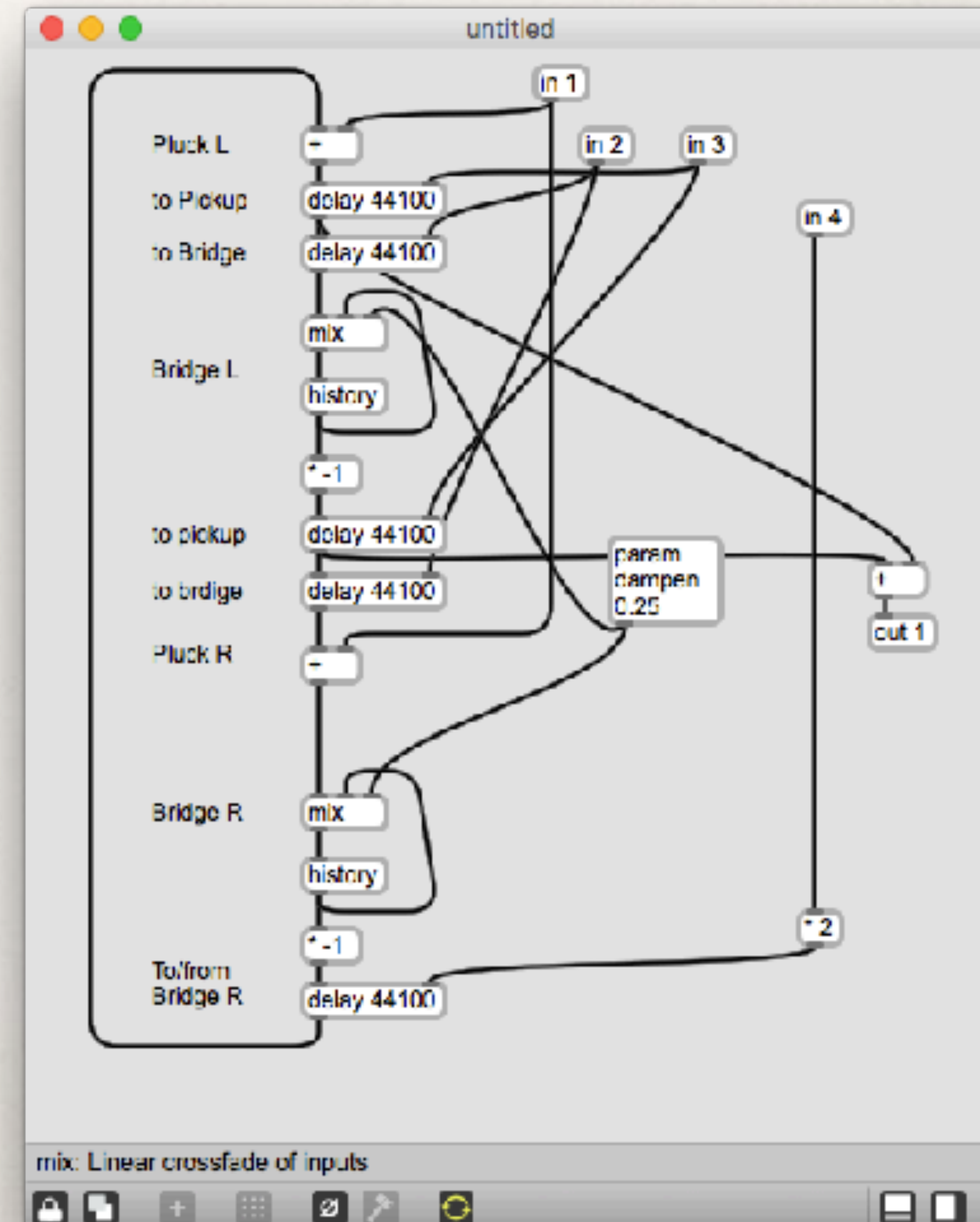

Experiment mit Max (Schritt 5)