Software 2 WS 2016 #9

Chikashi Miyama

Hörübungen

A

B

C

D

E

F

G

Sonification

Strömungen

Symposium zur künstlerischen Sonifikation

Ricardo Climent

https://vimeo.com/7607650
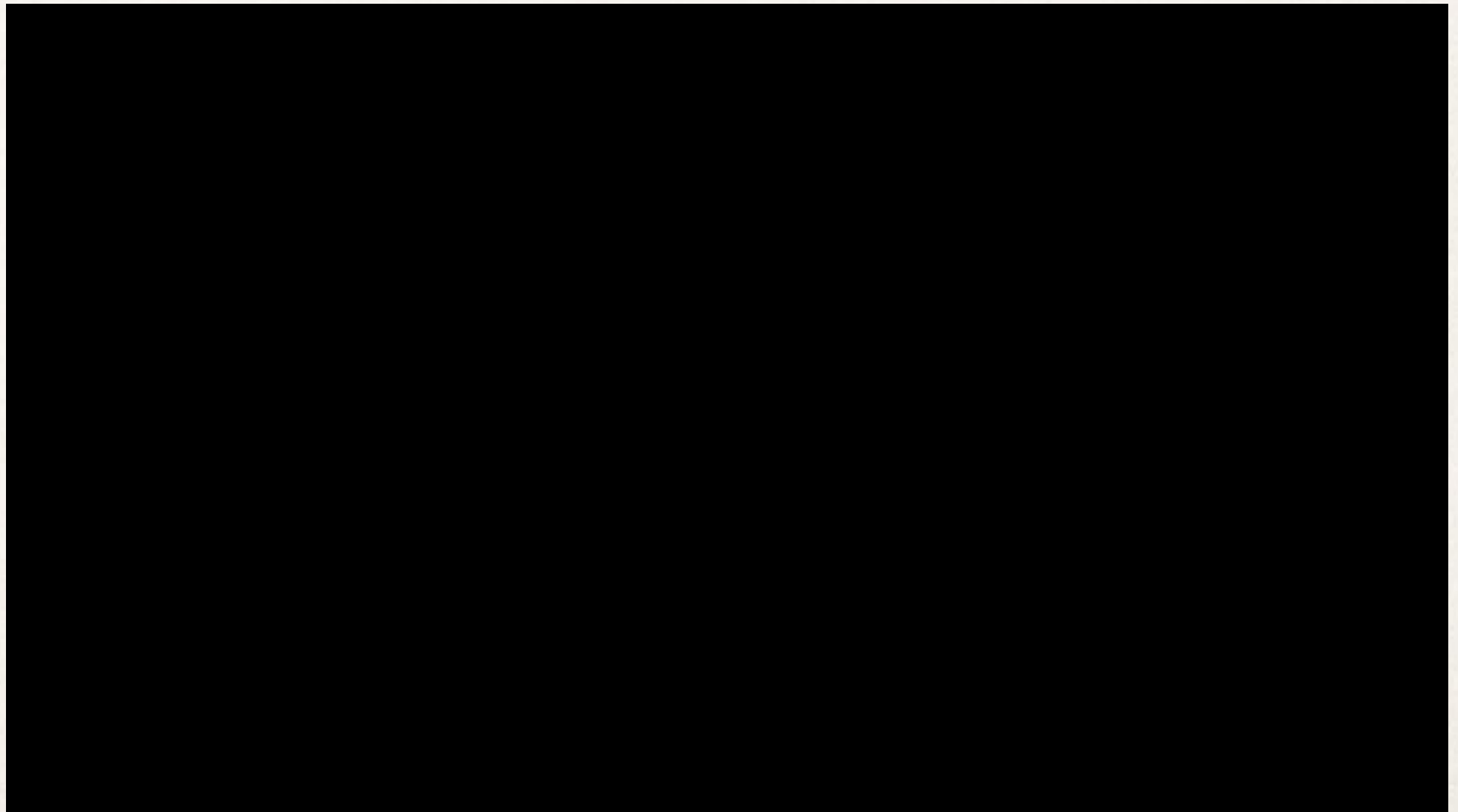
Dr. Jiajun Yang / Thomas Herman

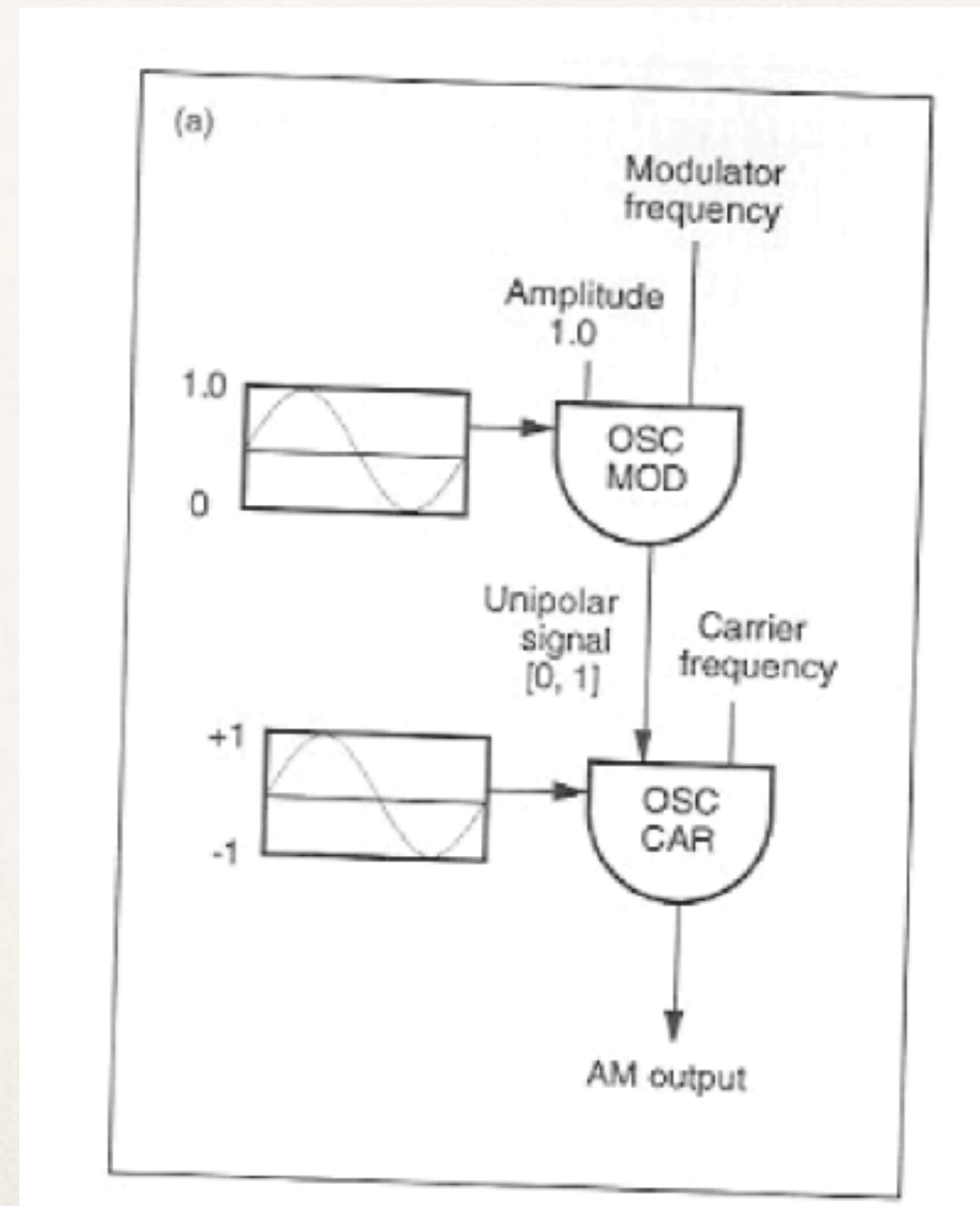## Model-based Sonification
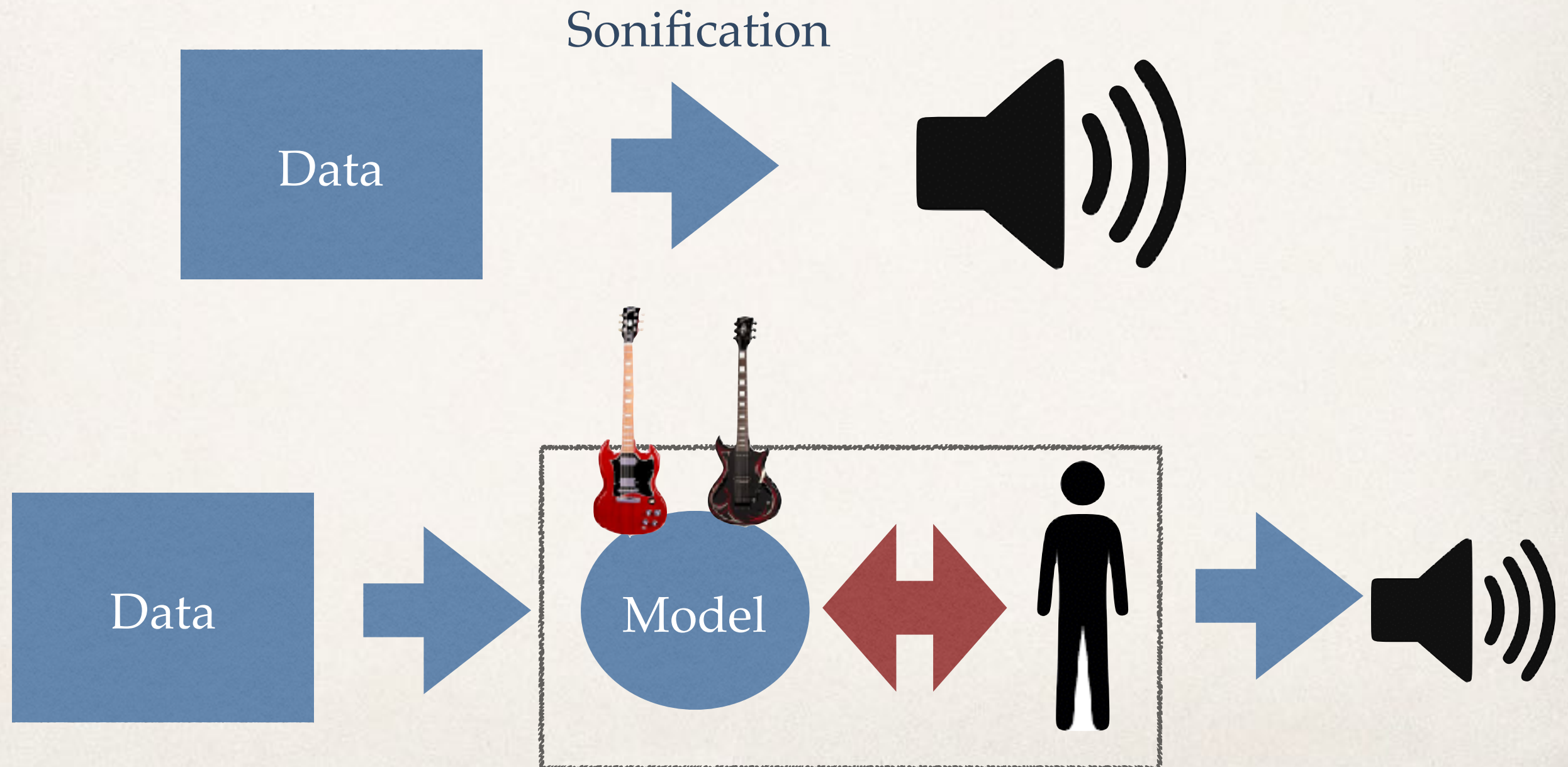
Marcus Schmickler

John Cage

I believe that the use of noise to make music will continue and increase until we reach a music produced through electrical instruments…. Whereas in the past, the point of disagreement has been between dissonance and consonance, it will be, in the immediate future, between noise and so-called musical sounds.

Noise-Modulated AM and FM

AM=Amplitude Modulation

✤ Was ist AM?

✤ Wie kann man AM programmieren?

✤ Spektrale Eigenschaft von AM?

AM=Amplitude Modulation

(a)

Modulator frequency

Amplitude 1.0

1.0
0

OSC MOD

Unipolar signal [0, 1]

Carrier frequency

+1
-1

OSC CAR

AM output

Experiment mit Max

FM=Frequency Modulation

✤ Was ist FM?

✤ Wie kann man FM programmieren?

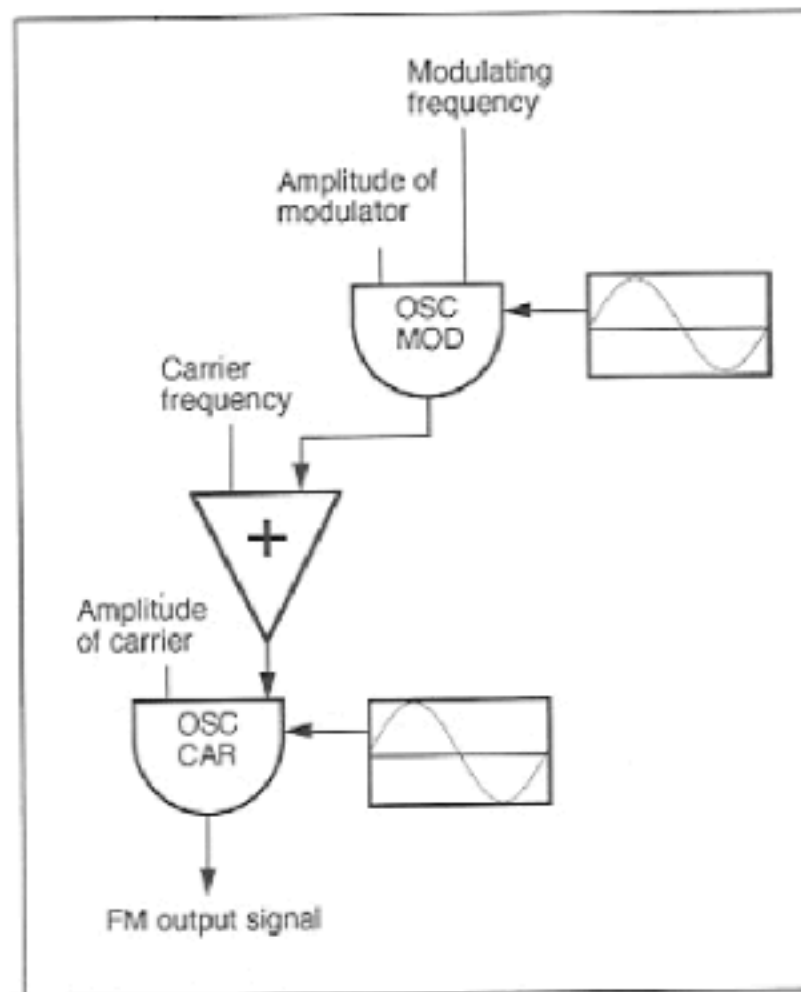✤ Spektrale Eigenschaft von FM?

FM=Frequency Modulation

Figure 6.9 A simple FM instrument. The bipolar output of the modulating oscillator is added to the fundamental carrier frequency, causing it to vary up and down. The amplitude of the modulator determines the amount of modulation, or the frequency deviation from the fundamental carrier frequency.

Experiment mit Max
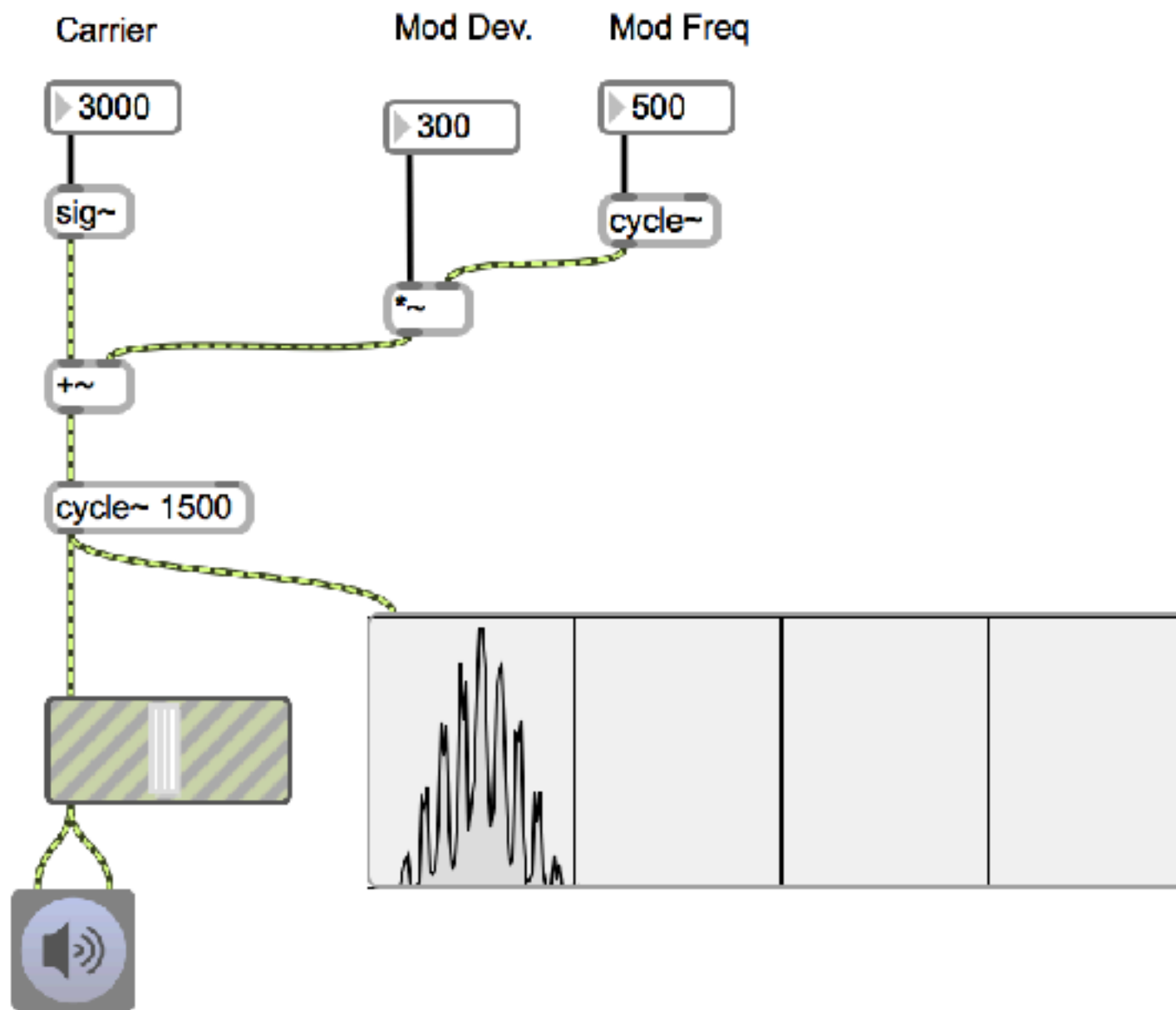
Rauschen + Tiefpass
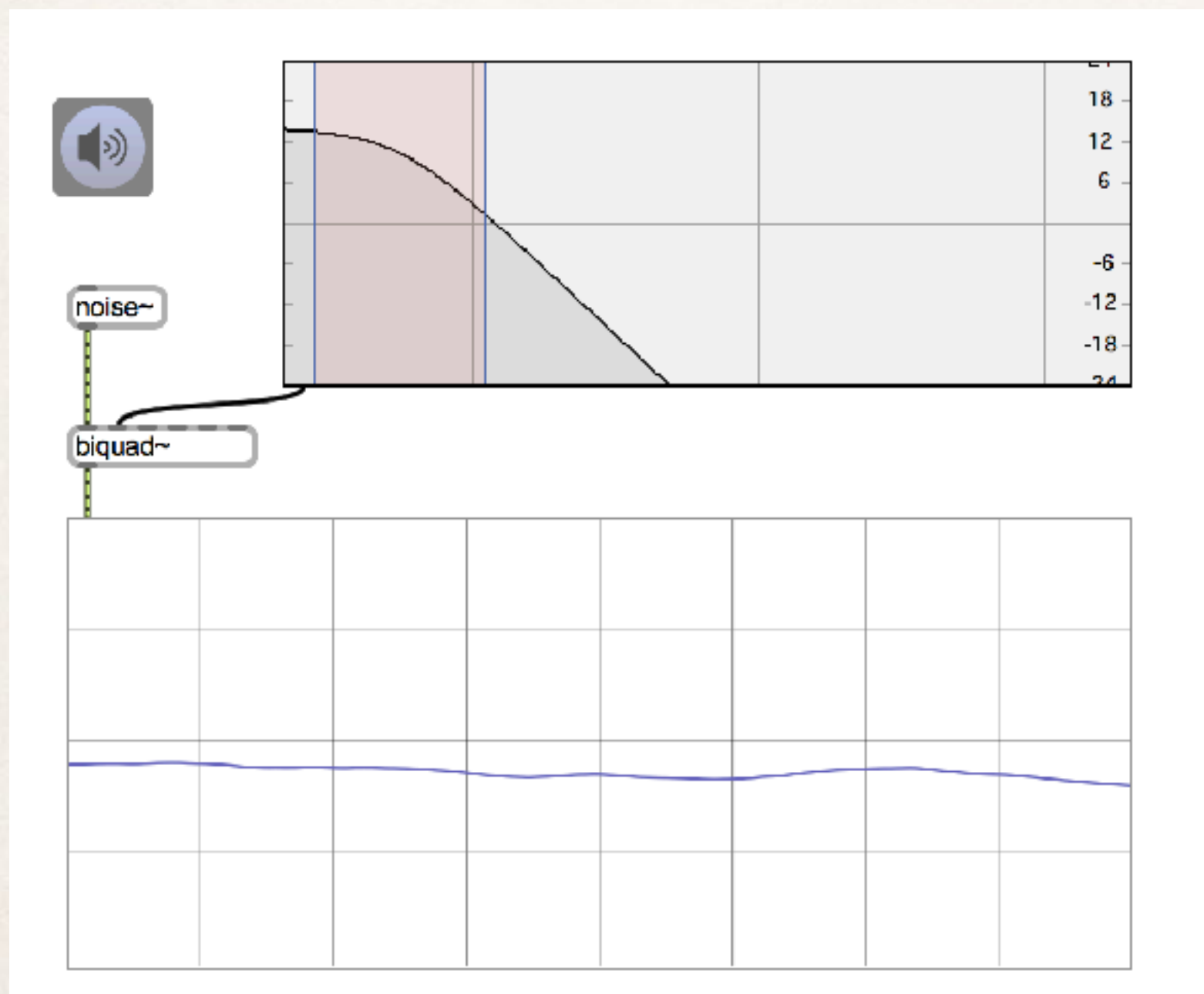
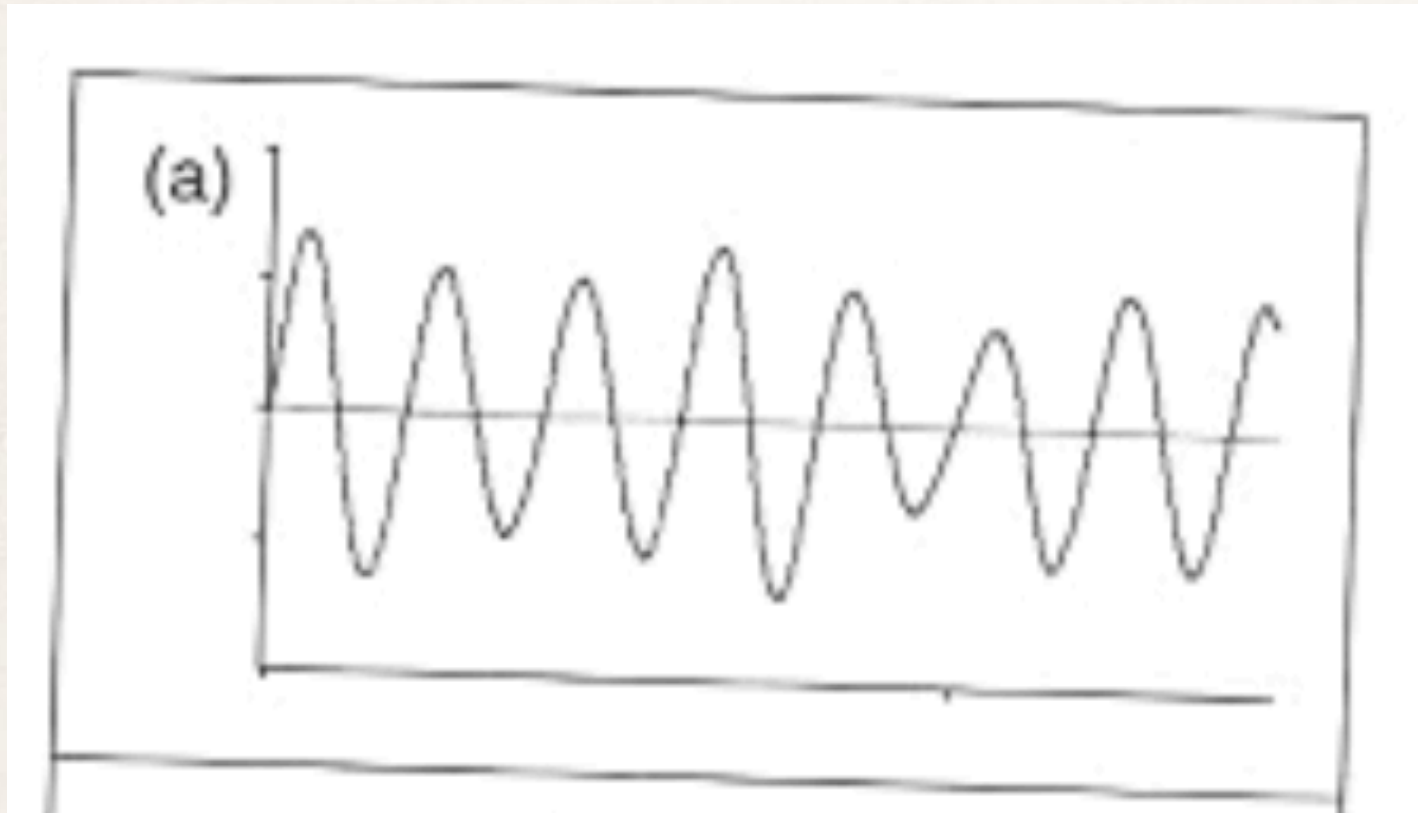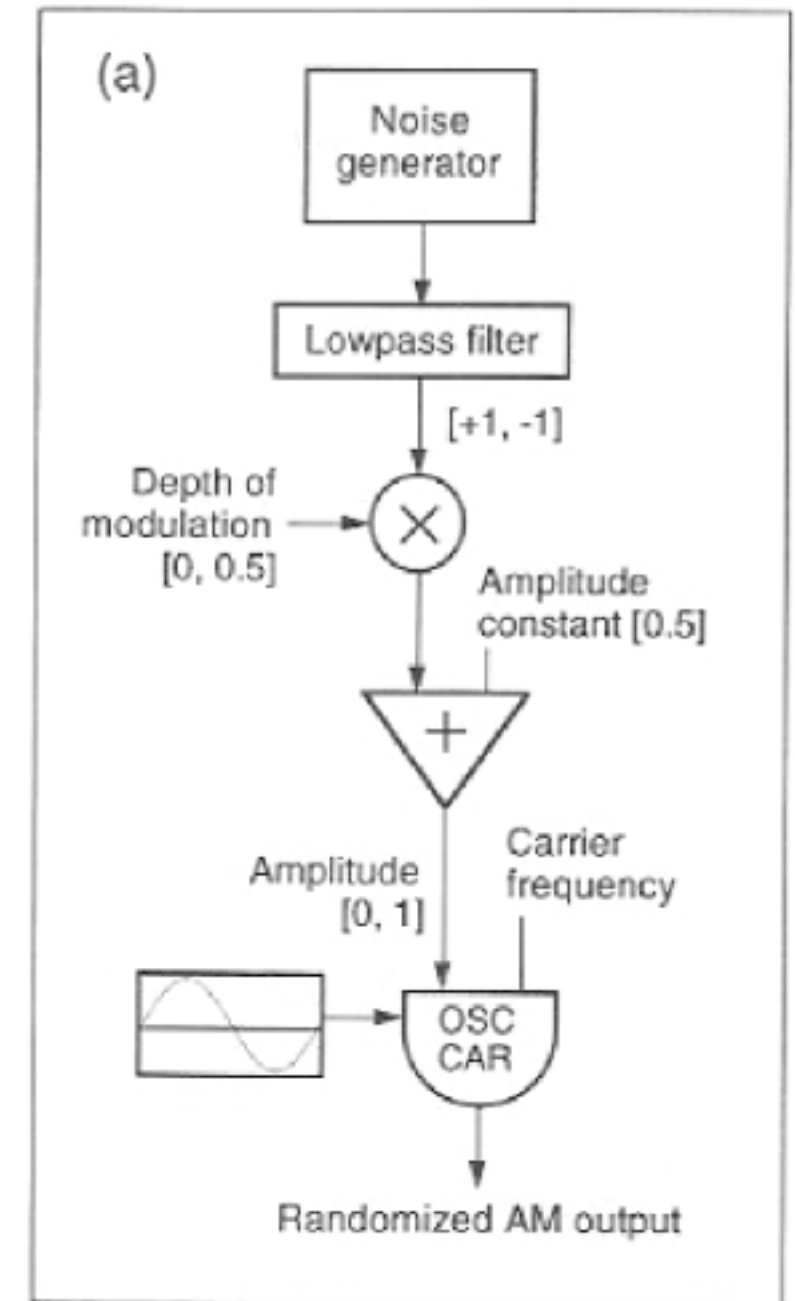*infrasonic noise*
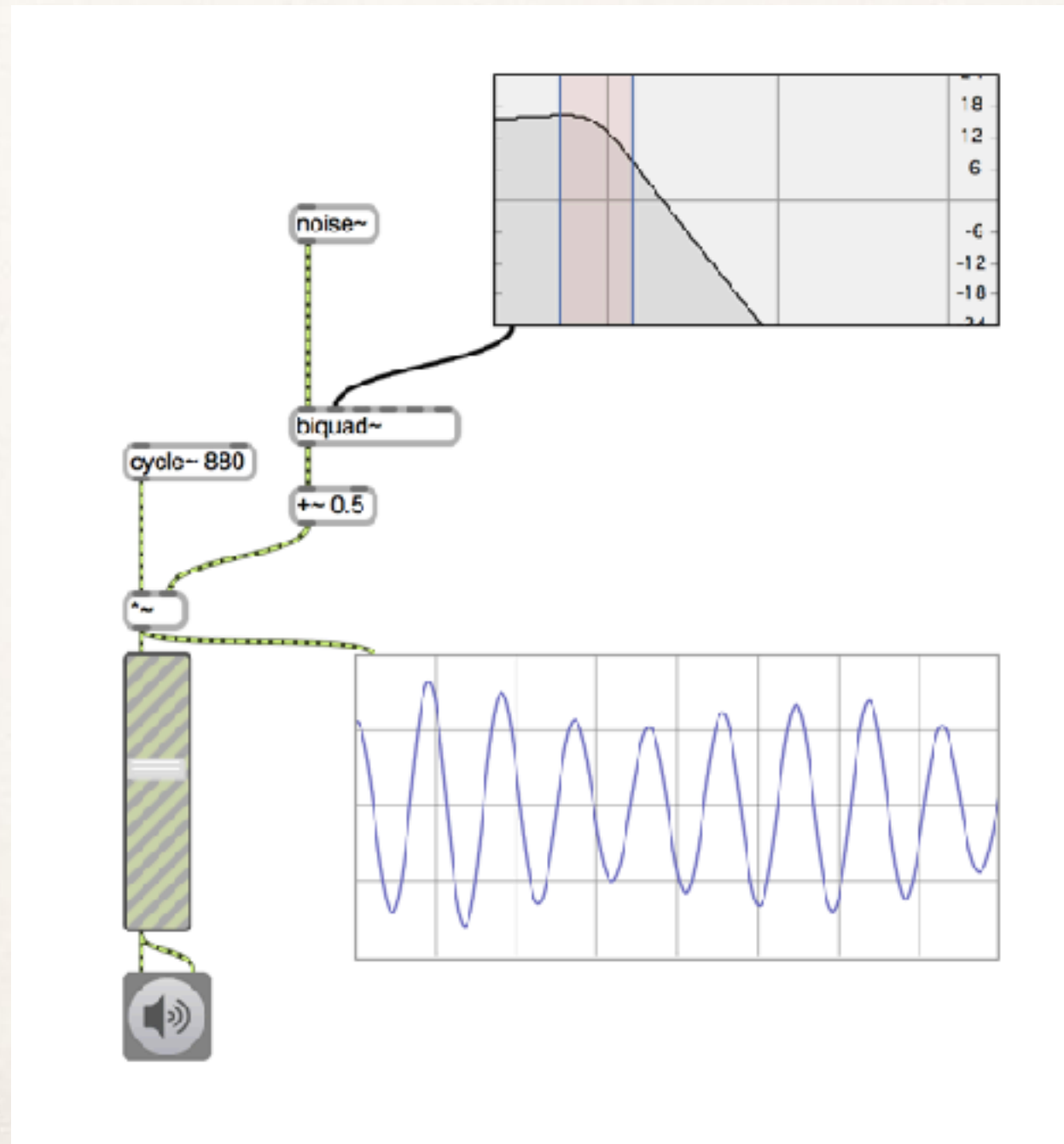
Noise-Modulated AM

Figure 8.9 Waveforms generated by noise modulation. (a) Sine wave that is amplitude modulated 50 percent by lowpass filtered noise. This affects the vertical span of the individual pitch periods. (b) Sine wave that is frequency modulated 50 percent by lowpass filtered noise. Note that the width of each pitch period varies slighty.
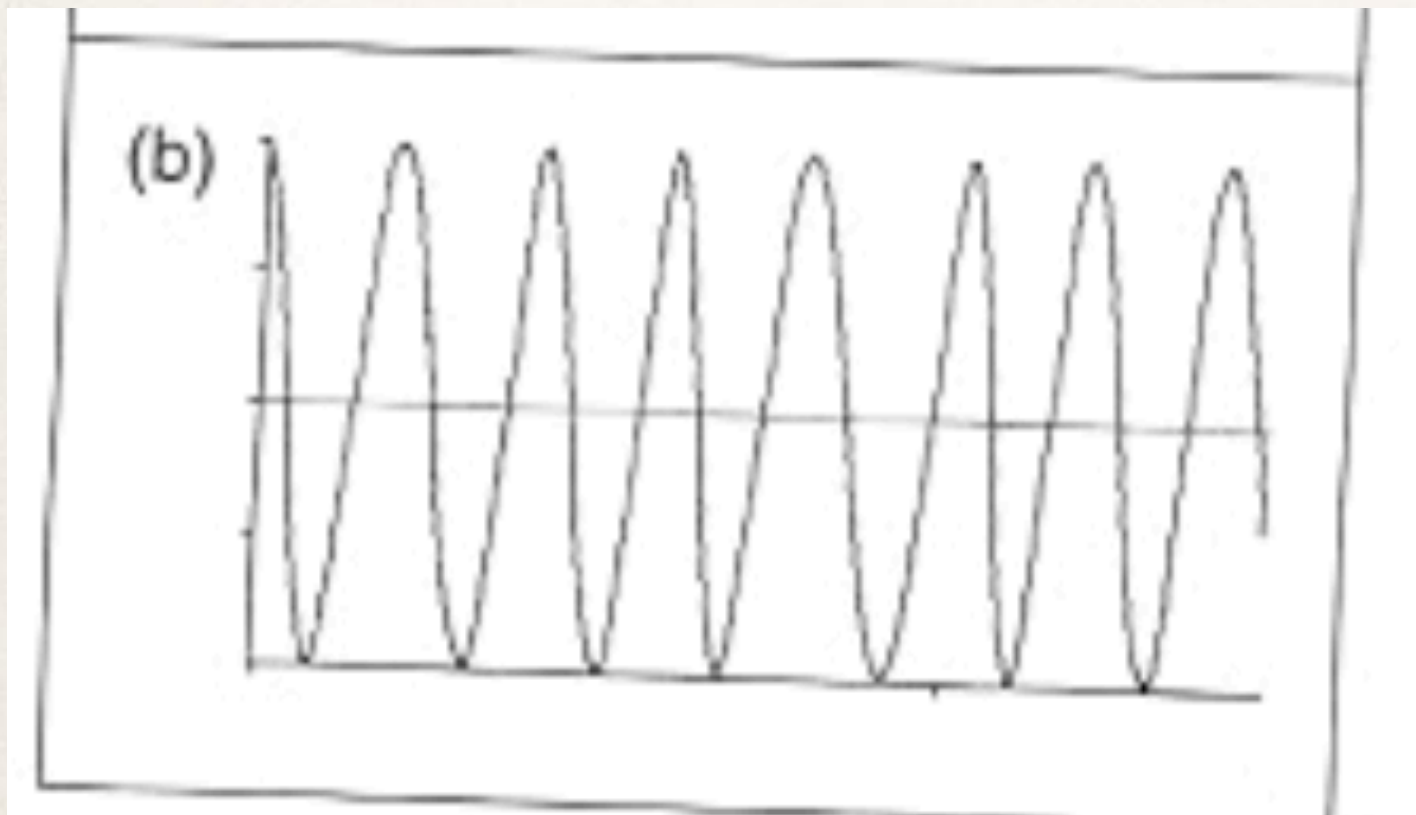
Experiment mit Max
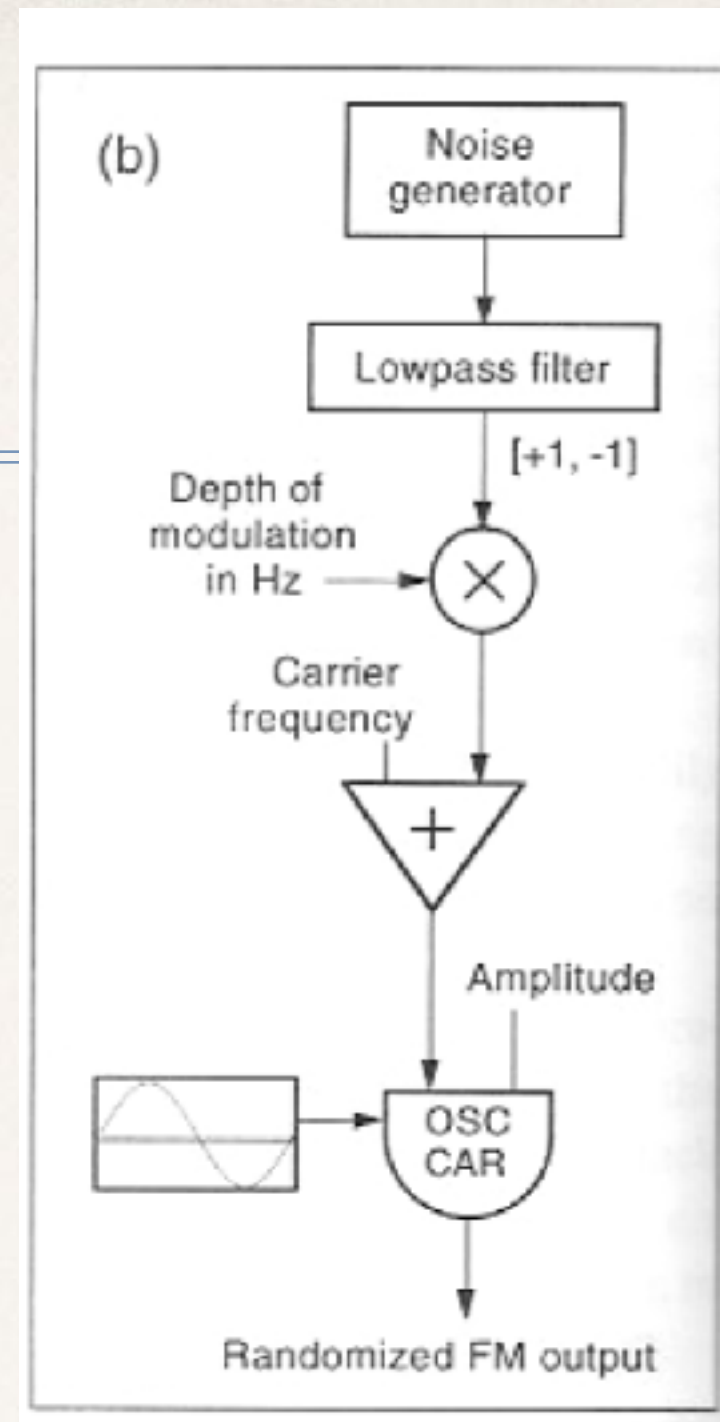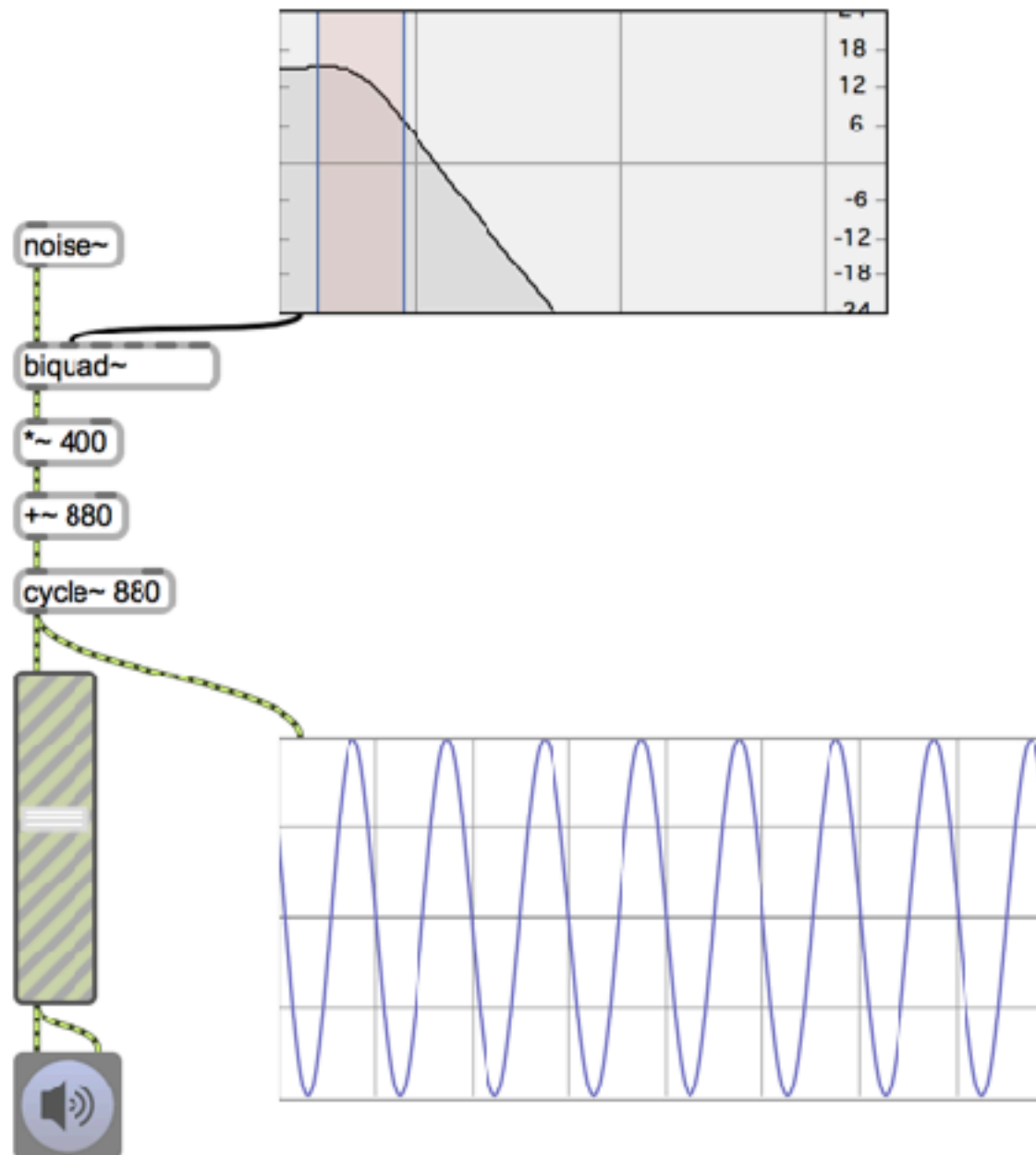
Noise-Modulated FM

Figure 8.9 Waveforms generated by noise modulation. (*a*) Sine wave that is amplitude modulated 50 percent by lowpass filtered noise. This affects the vertical span of the individual pitch periods. (*b*) Sine wave that is frequency modulated 50 percent by lowpass filtered noise. Note that the width of each pitch period varies slighty.
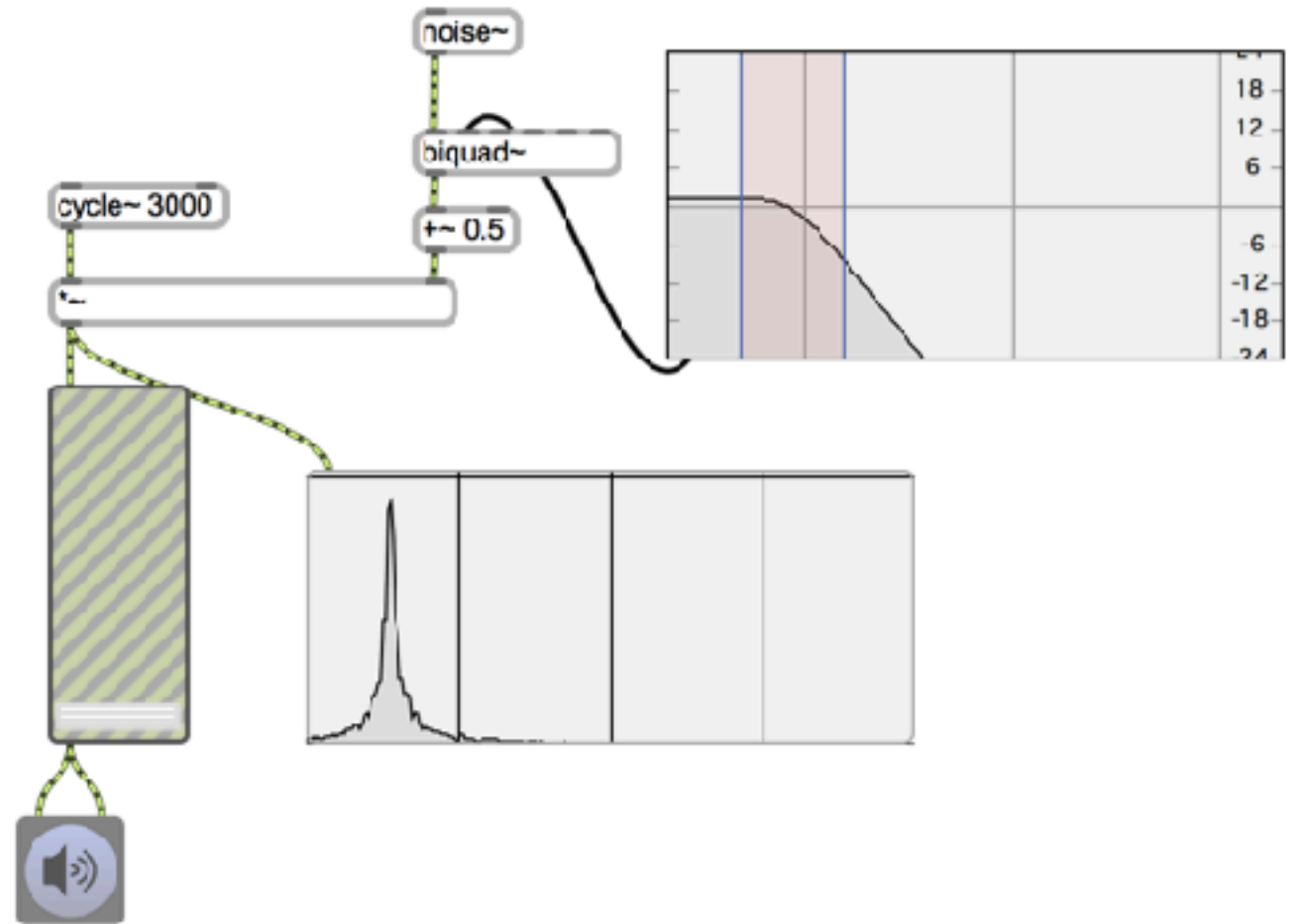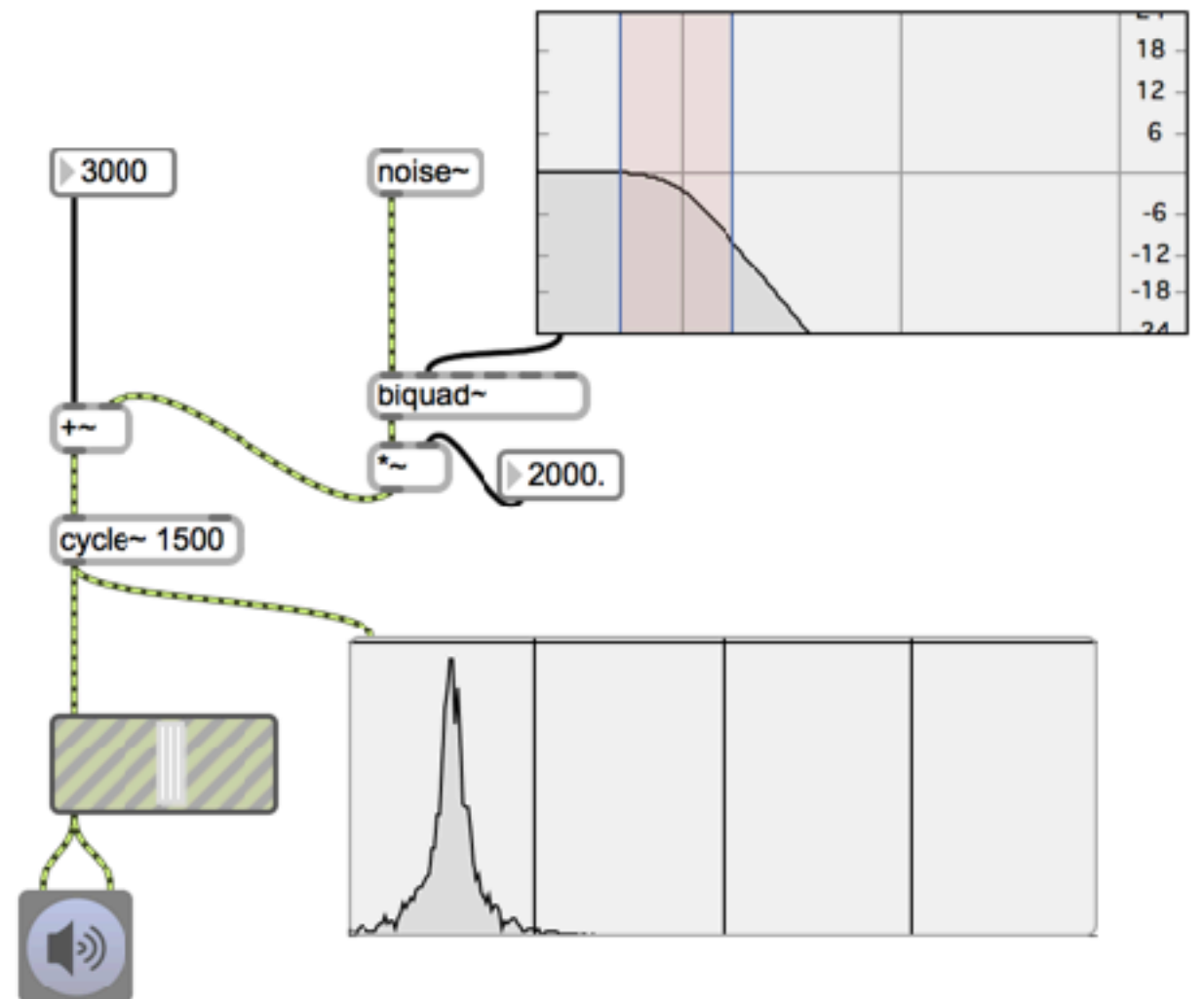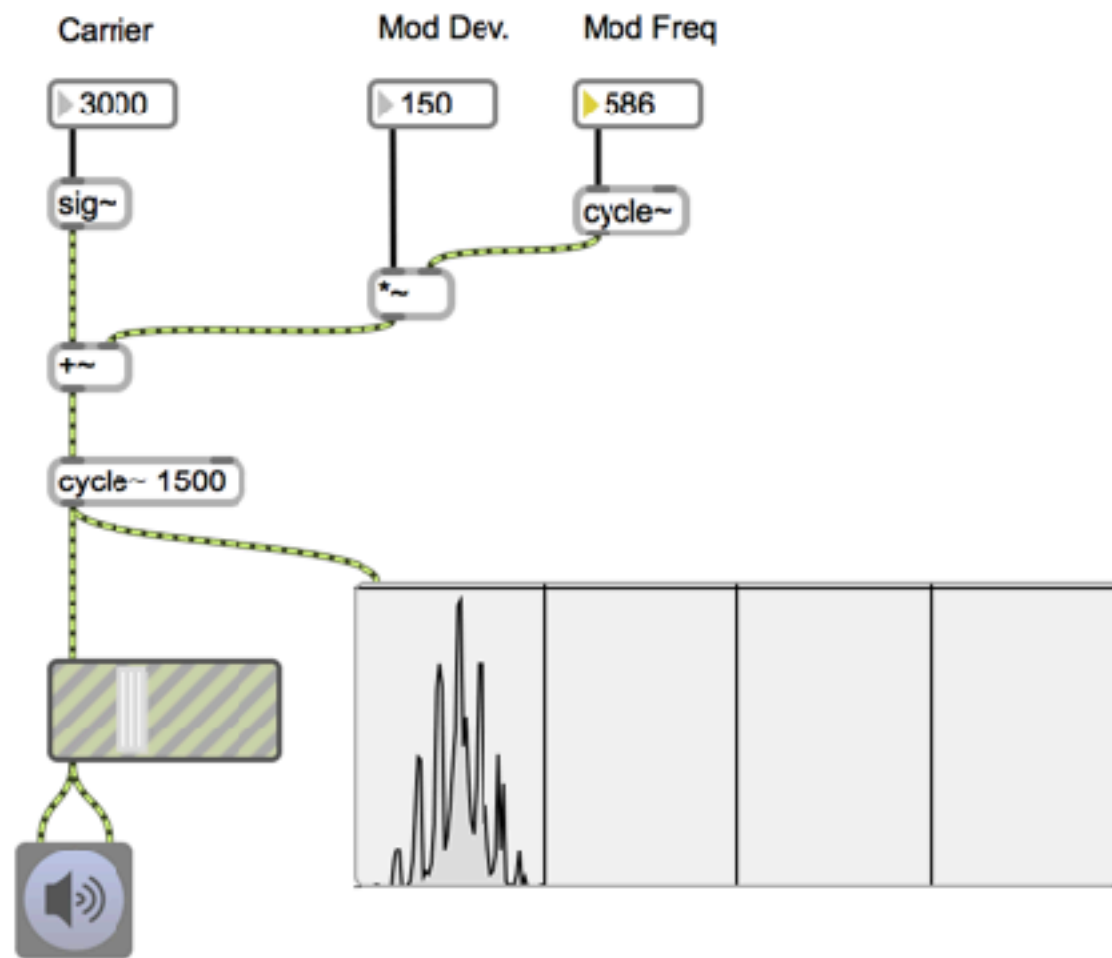
Experiment mit Max

Bandbreite

*When the noise has a wider bandwidth, the result of modulation is a type of **coloured noise**, that is, a noise band centred around the carrier frequency of the oscillator.*

Experiment mit Max

Colored AM

Experiment mit Max

Colored FM

Ohne Tiefpass

In Both cases (AM and FM), it is a good idea to use a noise source that has been lowpass filtered such that the randomness introduced by the noise is itself near the carrier frequency.

If the noise is not filtered, the effect may sound like a high-frequency noise component has been added to the carrier signal.

Experiment mit Max
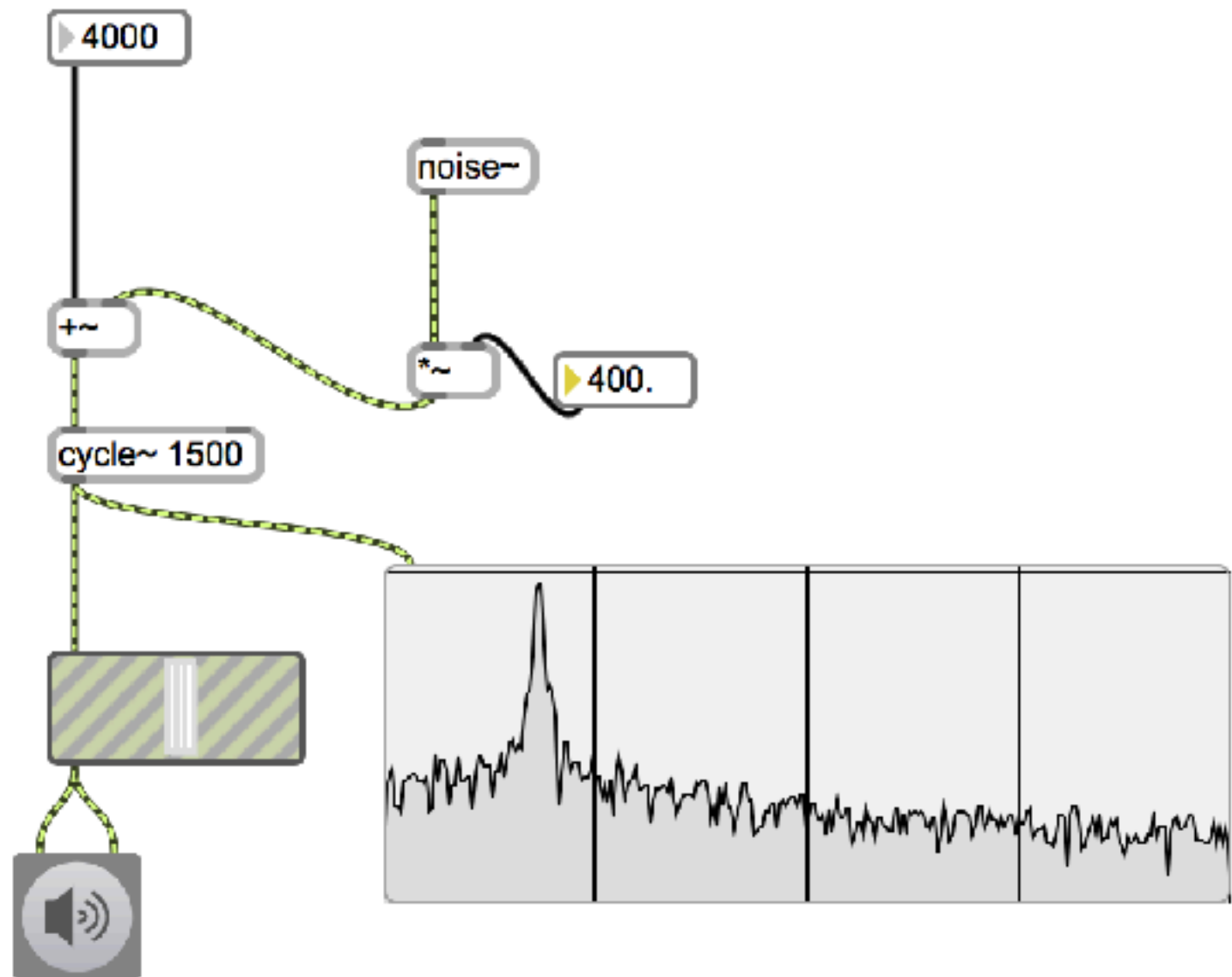
Waveshaping + Noise

Waveshaping

✤ Was ist Waveshaping?

✤ Wie kann man Waveshaping programmieren?
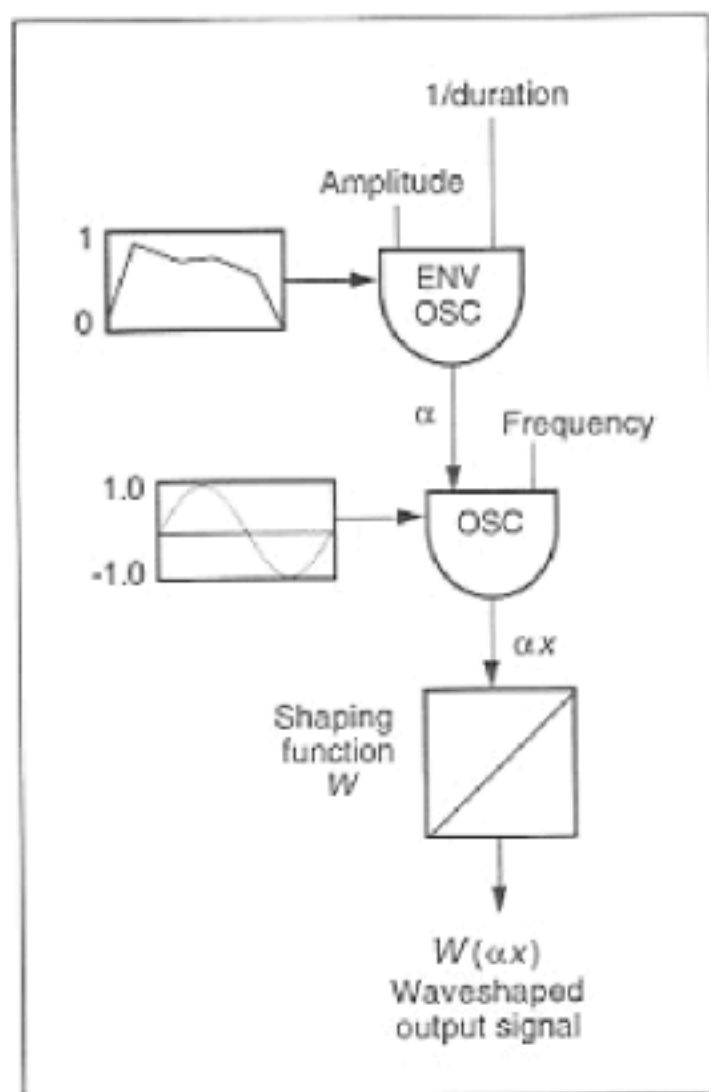
✤ Eigenschaft von Waveshaping?

Waveshaping

Figure 6.26 Simple waveshaping instrument. A sinusoidal oscillator, whose amplitude is controlled by the amplitude envelope signal α, indexes a value in the shaping function table w. As in other example instruments, the input *1/duration* that is fed into the frequency input of the envelope oscillator indicates that it goes through one cycle over the duration of the note.
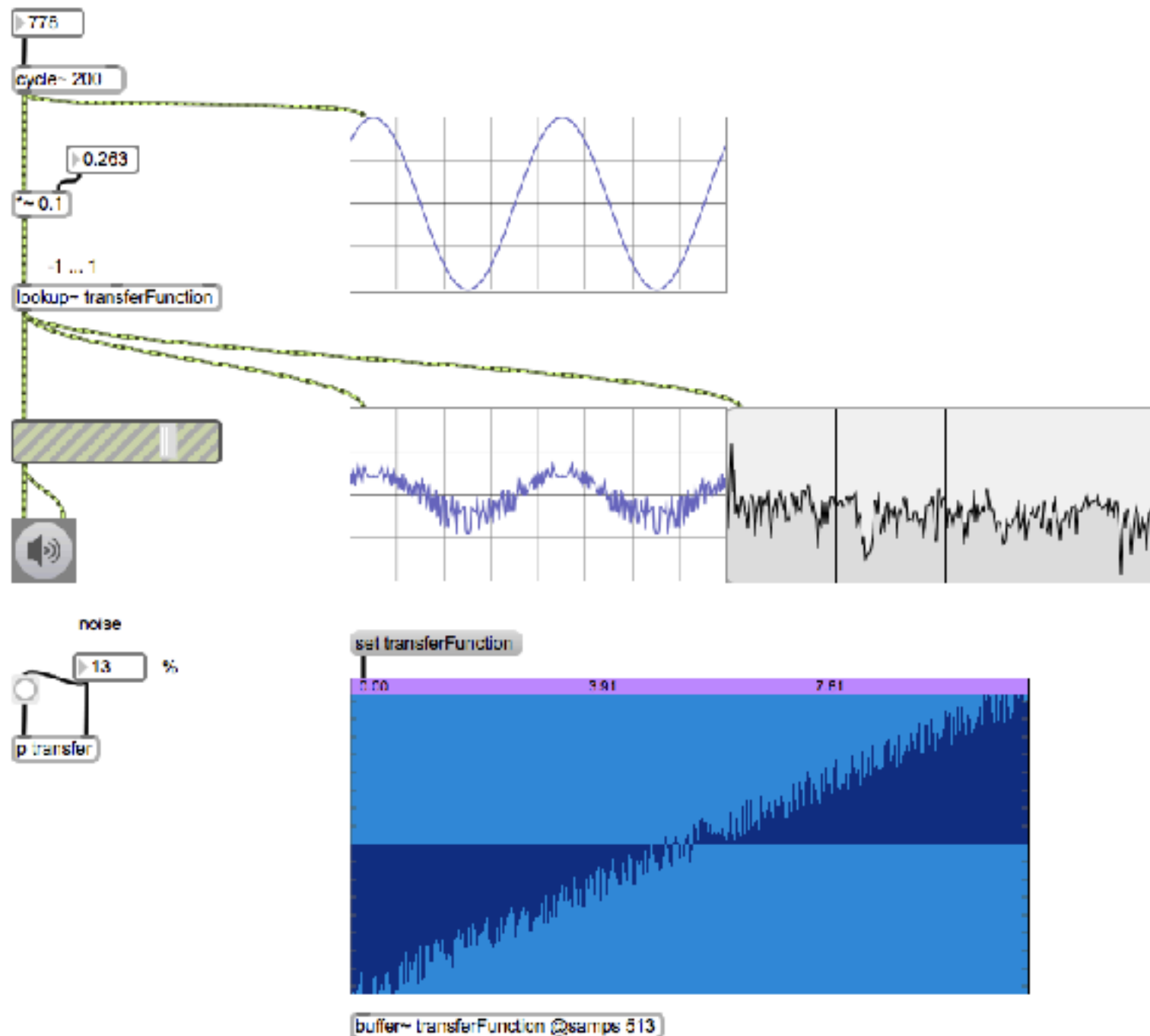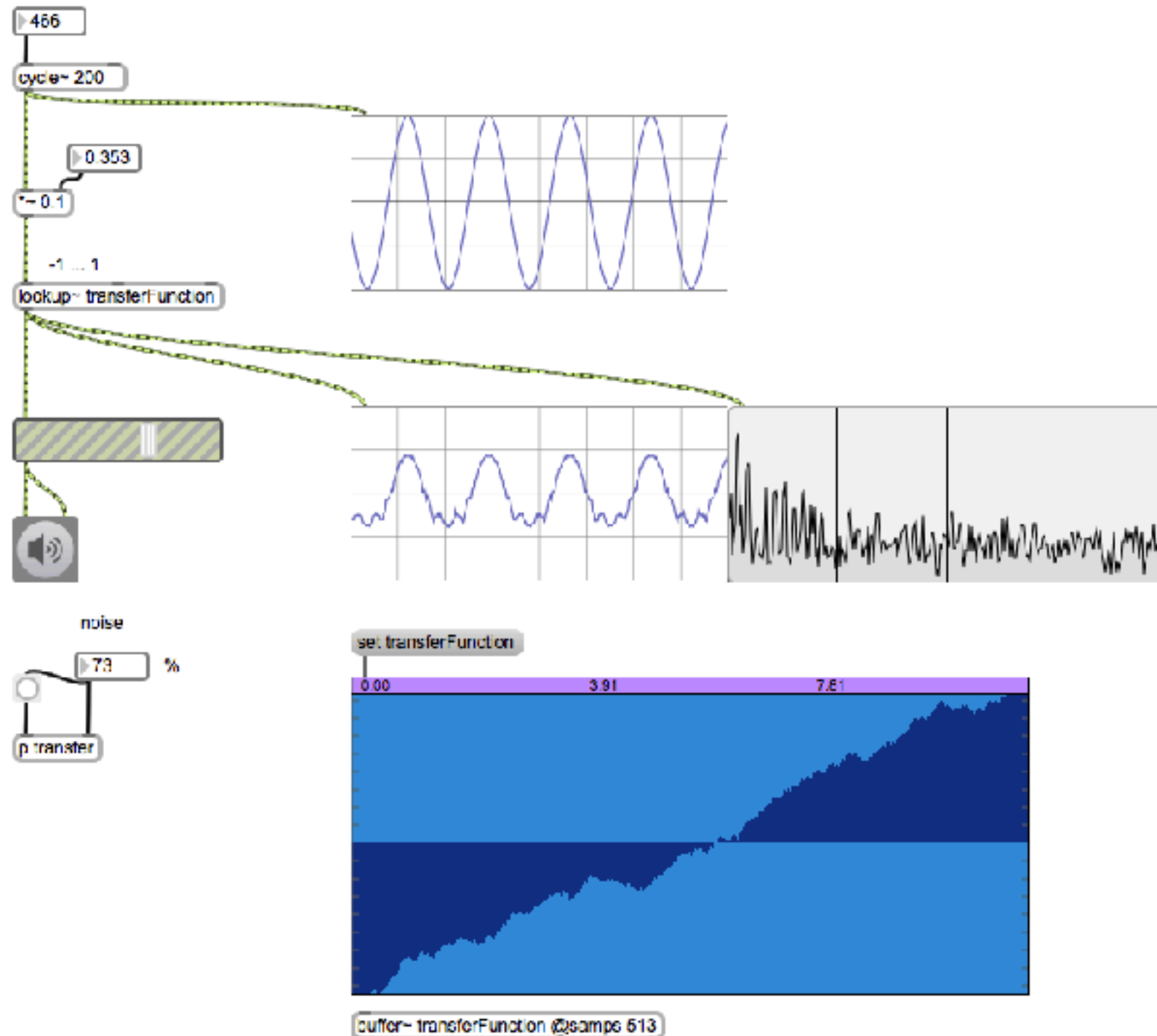
Experiment mit Max
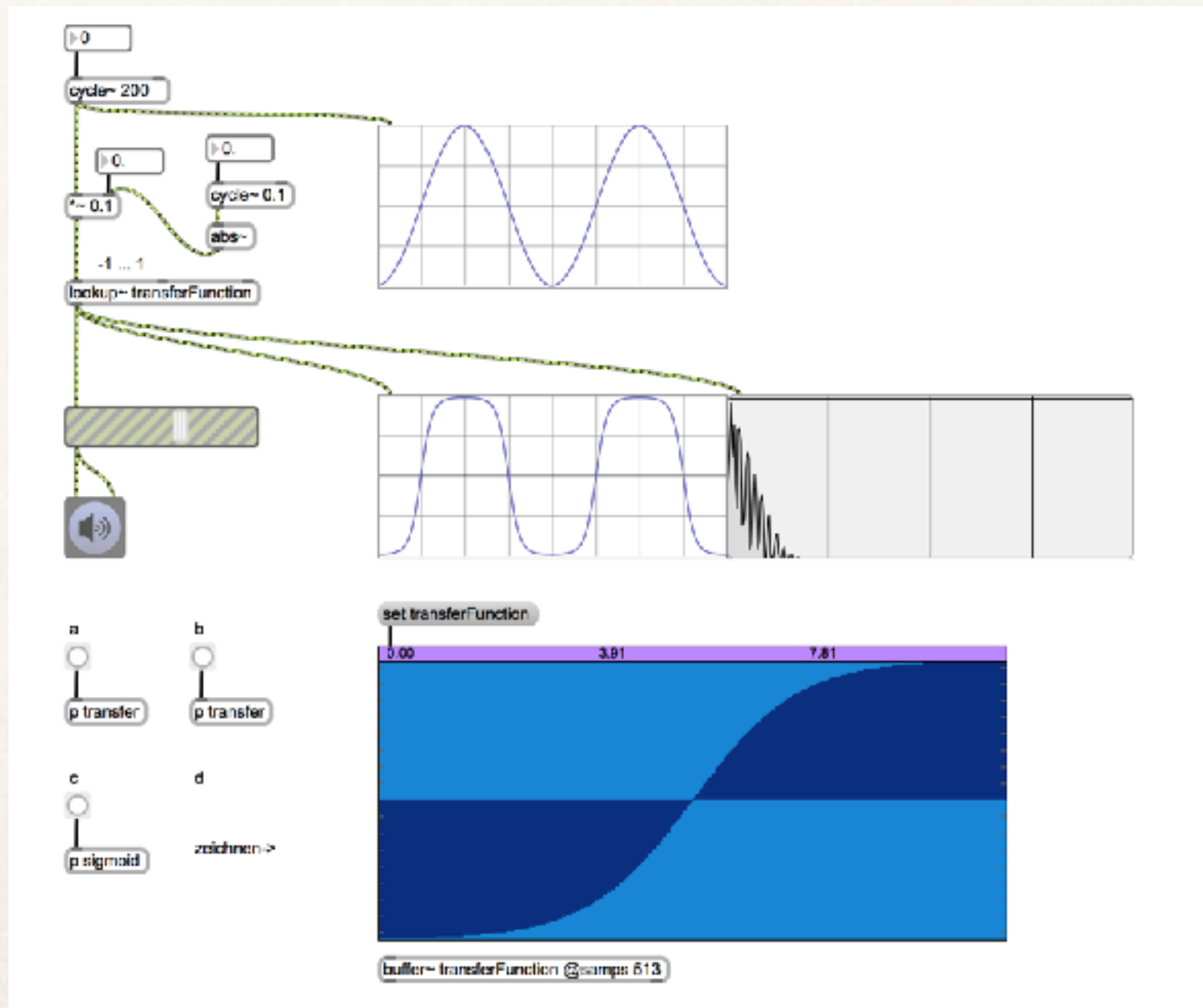
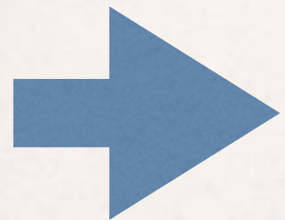# Randomisierung
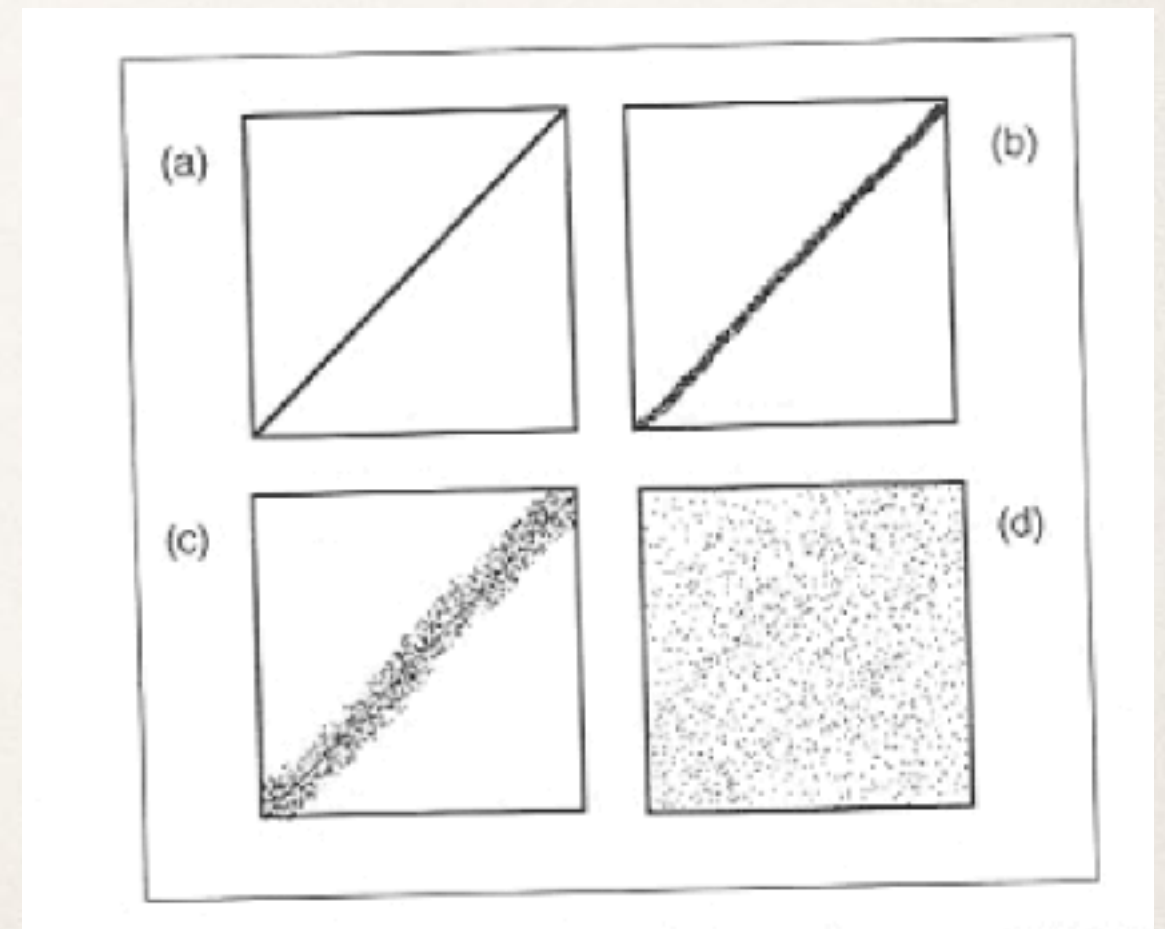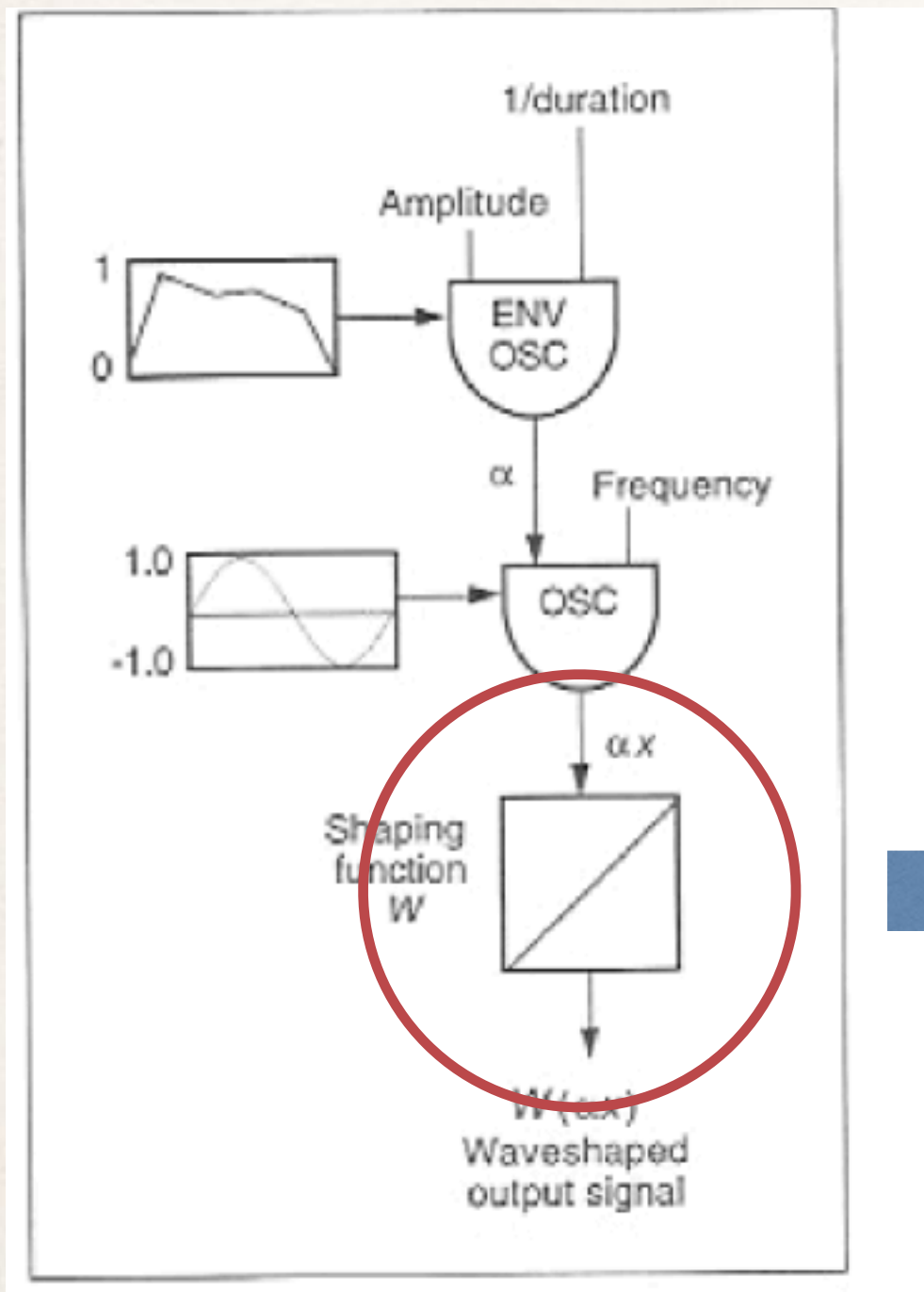
Experiment mit Max

Experiment mit Max

mit Tiefpass

Zwei Vorschläge

1. *A more subtle use of randomness in waveshaping employs a smooth waveshaping function at low amplitudes and introduces increasing randomness at high Amplitude.*
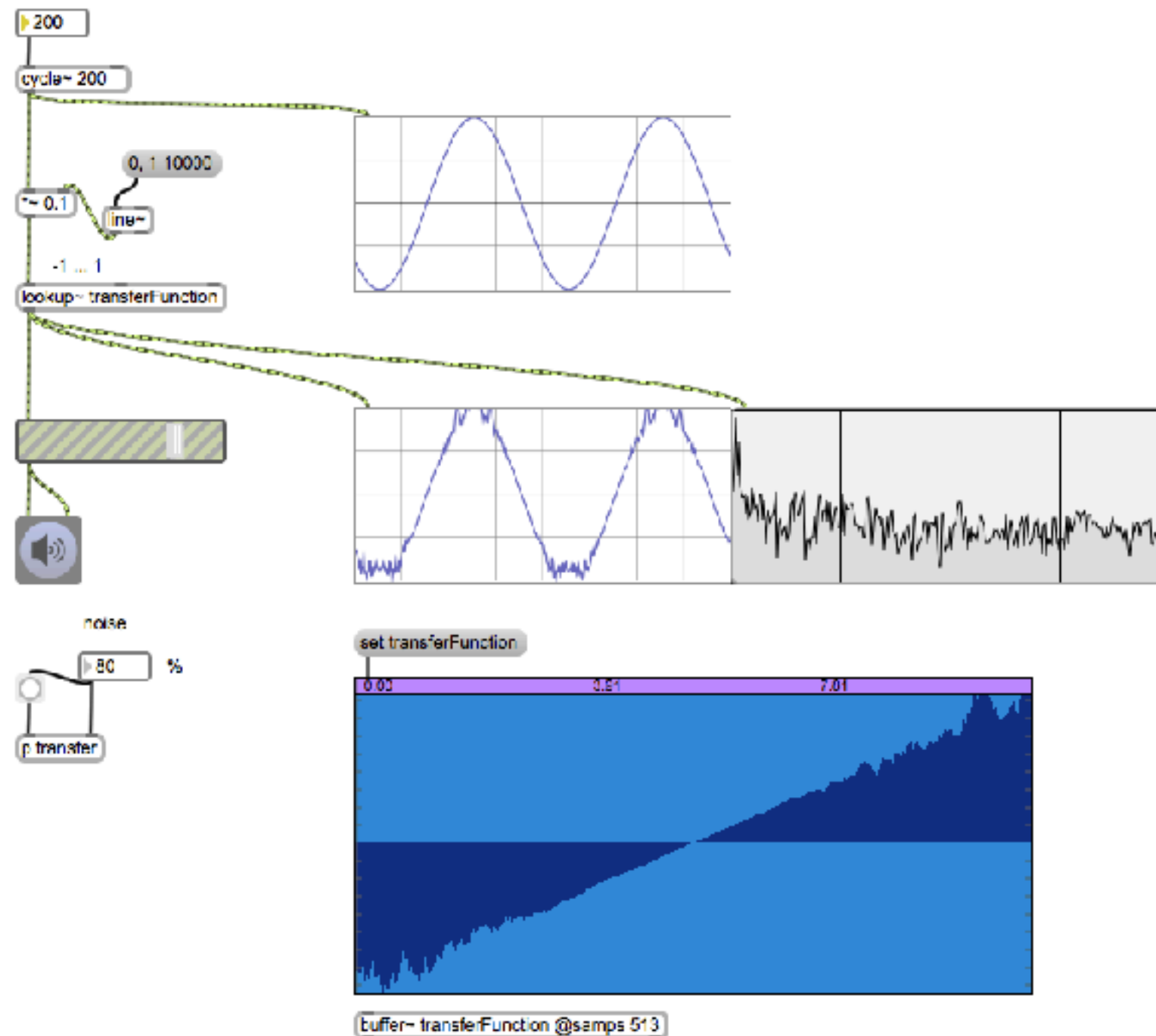
Die Zufälligkeit ist auch abhängig von der Amplitude

Zwei Vorschläge

2. Another possibility is to link the amount of randomness in the waveshaping function to the duration of the tone or another parameter of the event
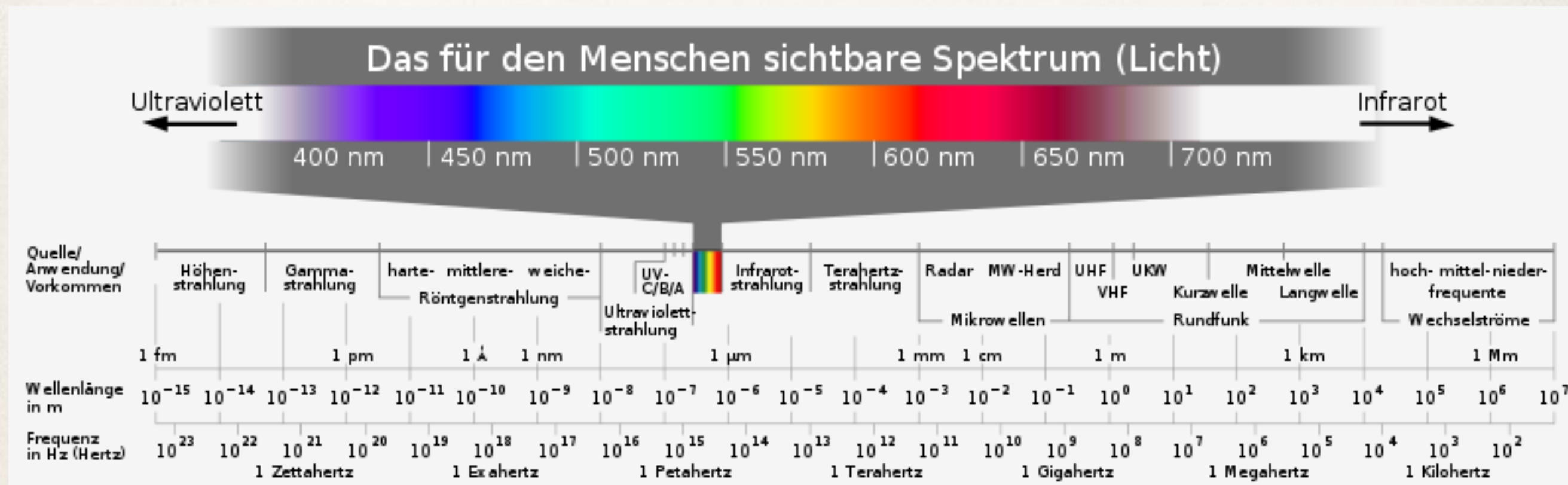
Experiment mit Max

Hörübungen

Farbe (Licht)

Frequenz

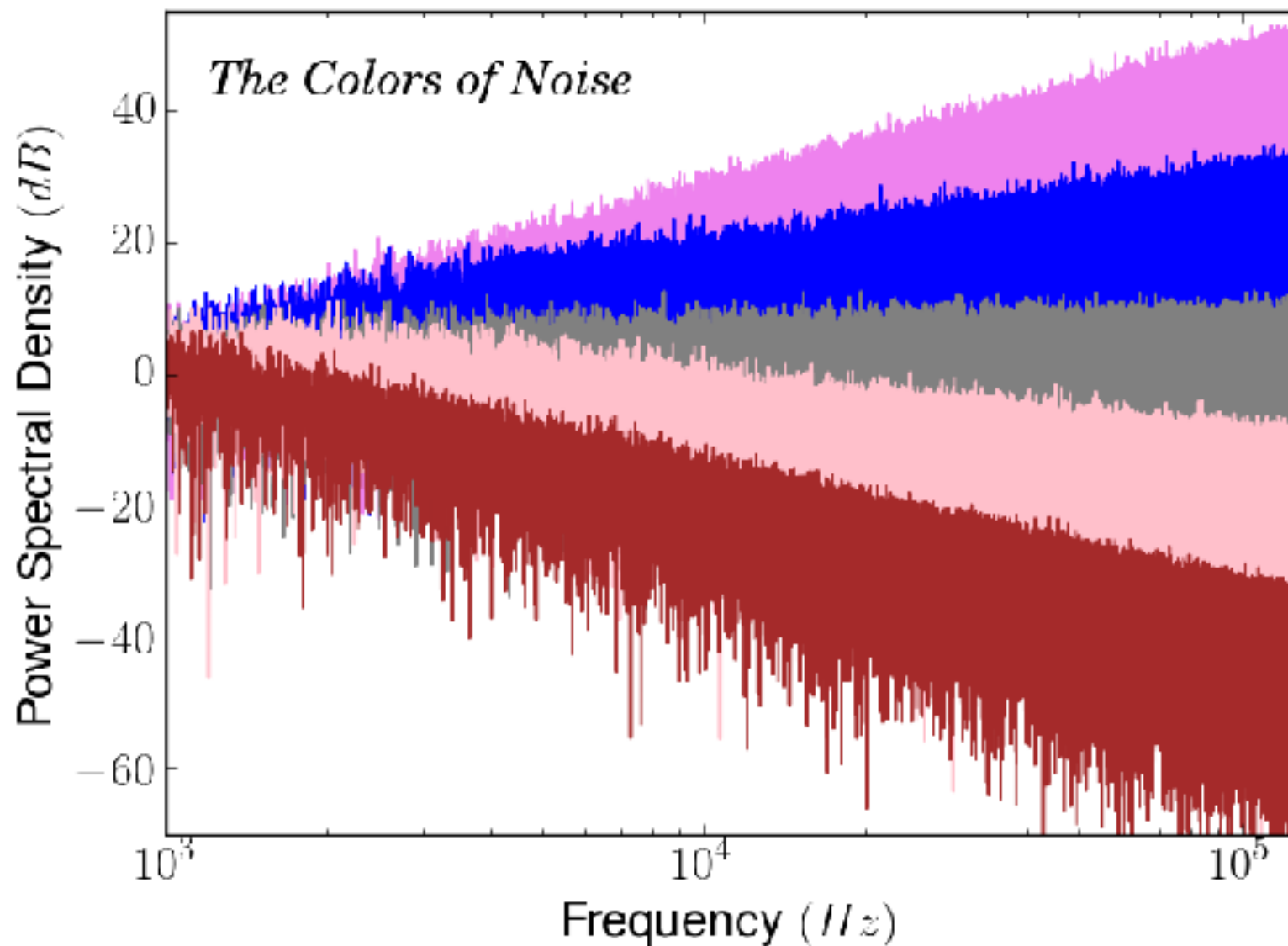Hoch   Tief

Das für den Menschen sichtbare Spektrum (Licht)

Farbe (Licht)

Hoch

Frequenz

Tief

Color	Wavelength	Frequency	Photon energy
violet	380–450 nm	668–789 THz	2.75–3.26 eV
blue	450–495 nm	606–668 THz	2.50–2.75 eV
green	495–570 nm	526–606 THz	2.17–2.50 eV
yellow	570–590 nm	508–526 THz	2.10–2.17 eV
orange	590–620 nm	484–508 THz	2.00–2.10 eV
red	620–750 nm	400–484 THz	1.65–2.00 eV

Hörübungen

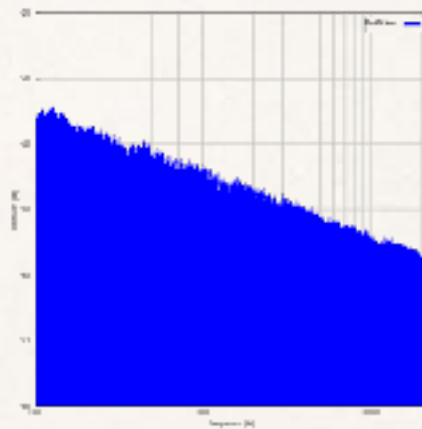
Violet

Blau

Pink

Red
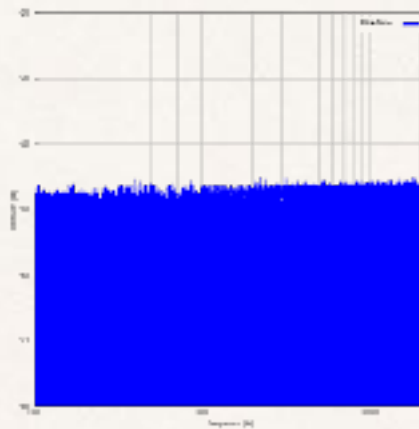(Brownian)

Farben des Rauschens

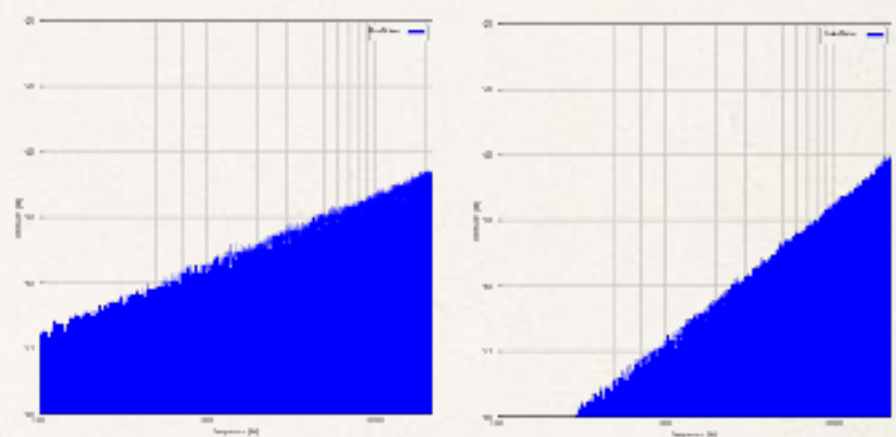-6dB/Oct   -3dB/Oct   +3dB/Oct   +6dB/Oct
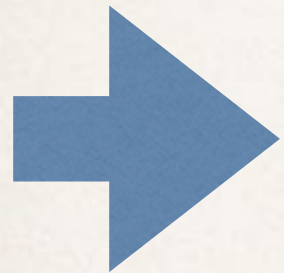

Red
(Brownian)
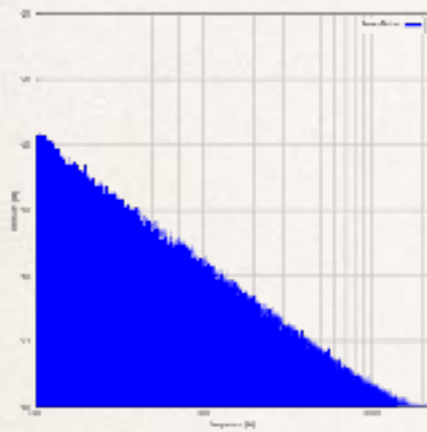
Pink

White

Blue

Violet

Pink Noise

✤ Was ist die Eigenschaft von des Pink Noise?

✤ Warum ist Pink Noise wichtig?

Pink Noise

✤ Was ist die Eigenschaft von des Pink Noise?

➡ In der Akustik wird pink noise als ein Geräusch empfunden, bei dem ein durchschnittlicher Mensch alle Frequenzbereiche des hörbaren Schallspektrums etwa als gleich laut empfindet.

Stochastic Waveform Synthesis

Stochastic Waveform Synthesis
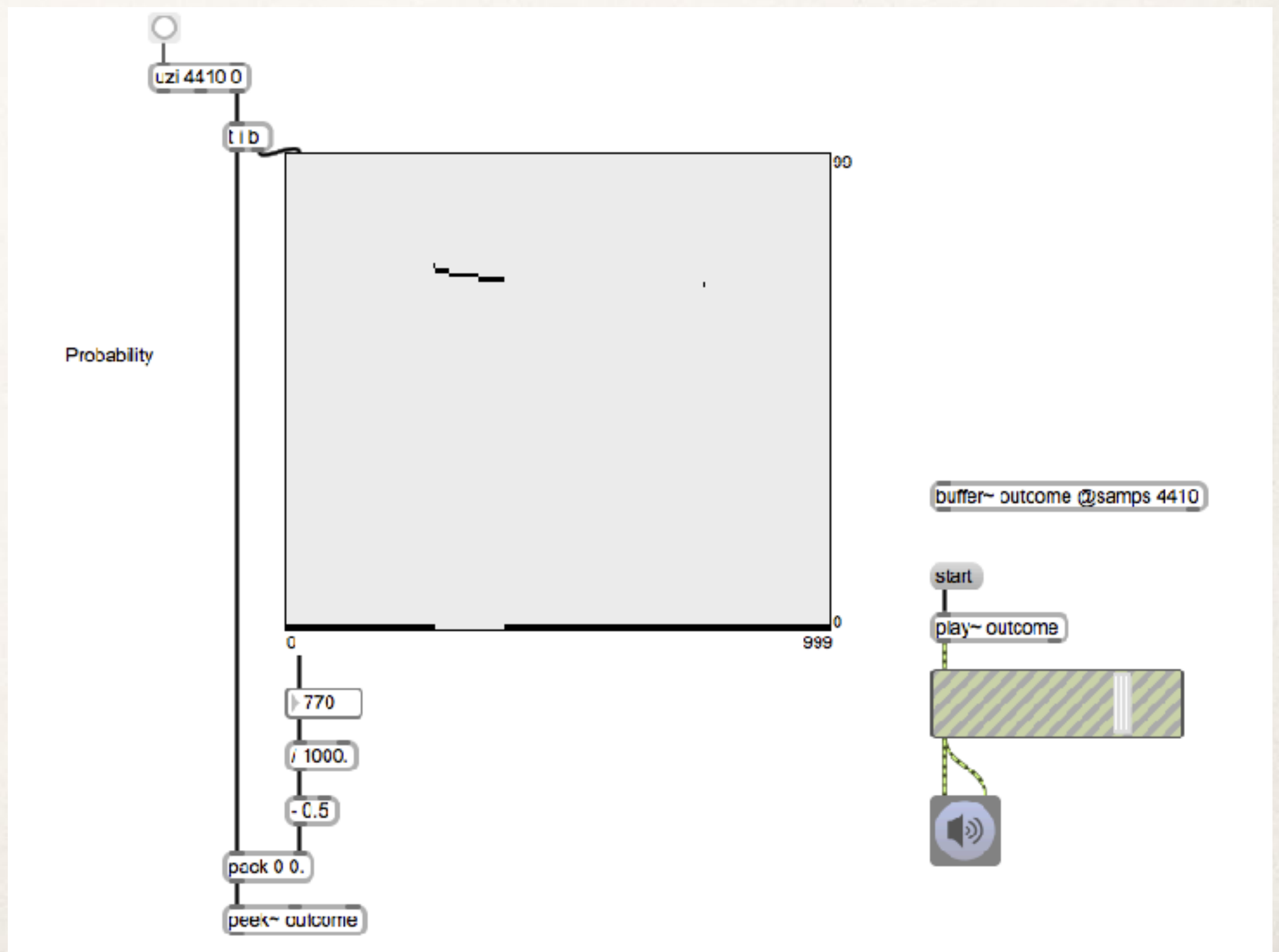
✤ Definition?

Stochastic Waveform Synthesis

✤ Definition?

Stochastic waveform synthesis generates sound samples by comparing the value of a pseudorandom number against a probability distribution.
A probability distribution is a curve that indicates the numerical probability of a range of possible outcomes.

Experiment mit Max

Dynamic Stochastic Synthesis
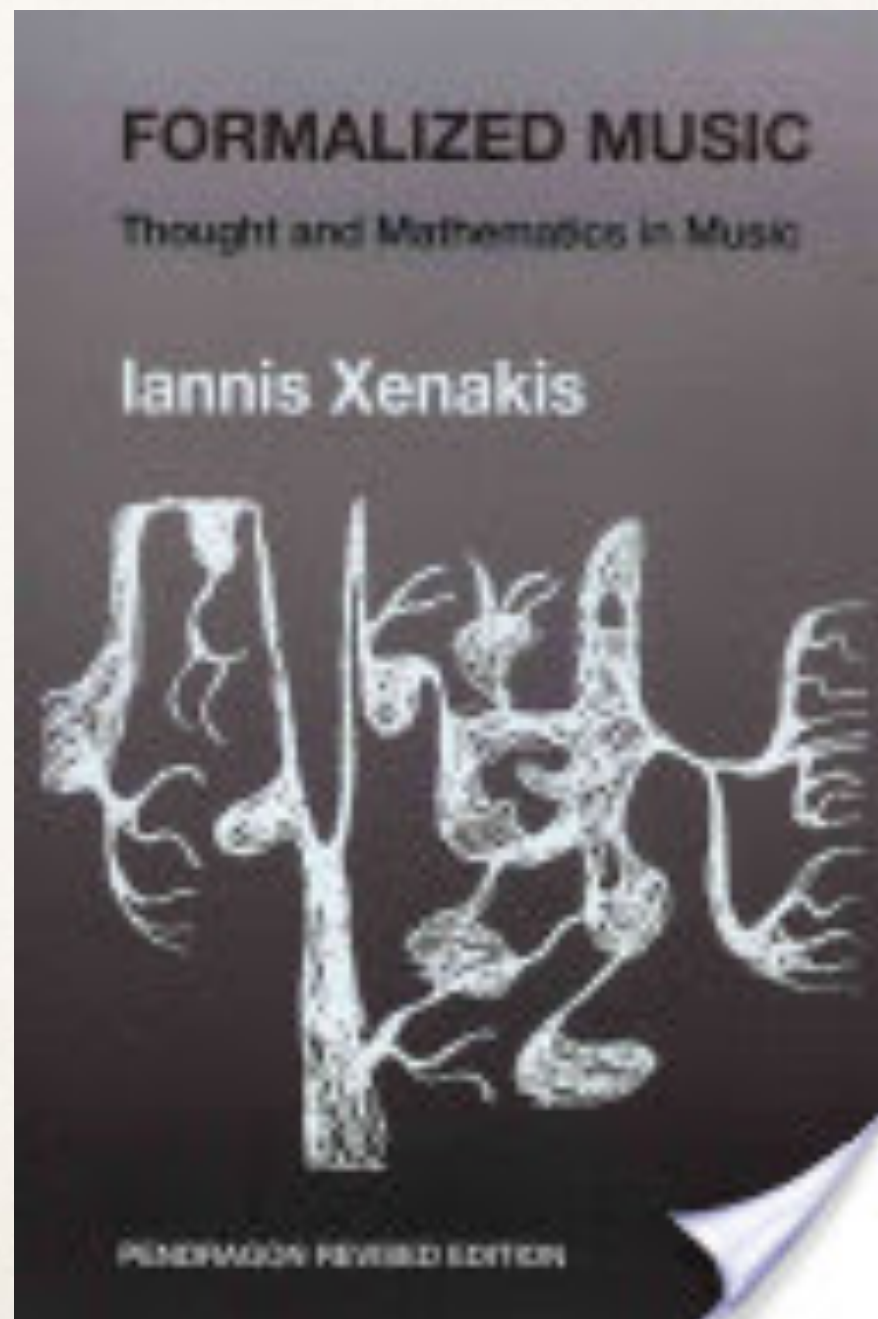
Gendy3

Gendy makes sound by repeating an initial waveform and then distorting that waveform in time and amplitude. Thus the synthesis algorithm computes each new waveform by applying stochastic variations to the previous waveform.

Gendy3: Algorithmus

In the program, the waveform is represented as a polygon
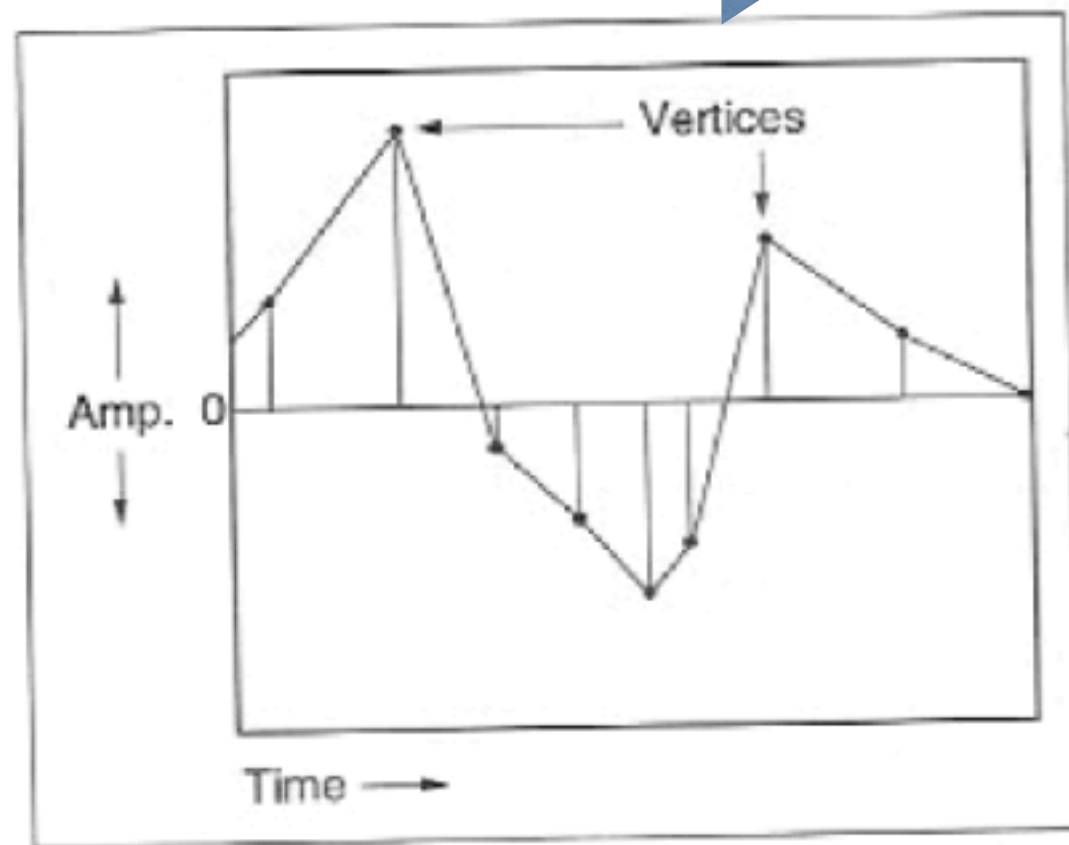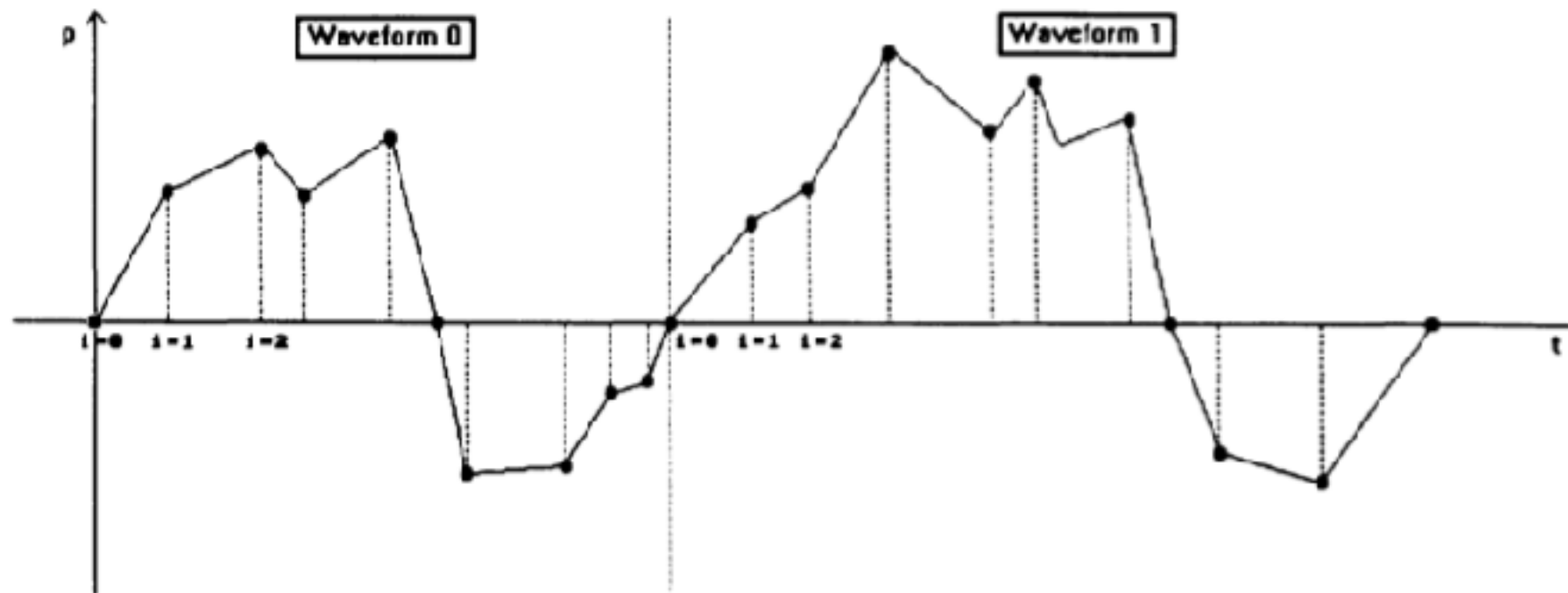
( ) synthese

Figure 8.14 Waveform structure in GENDY. The waveform is a collection of polygons formed by drawing straight line segments between vertices on the time-frequency plane. Note the unequal time intervals between vertices.

Gendy3: Algorithmus

EXAMPLE 2: TWO SUCCESSIVE POLYGONIZED WAVEFORMS
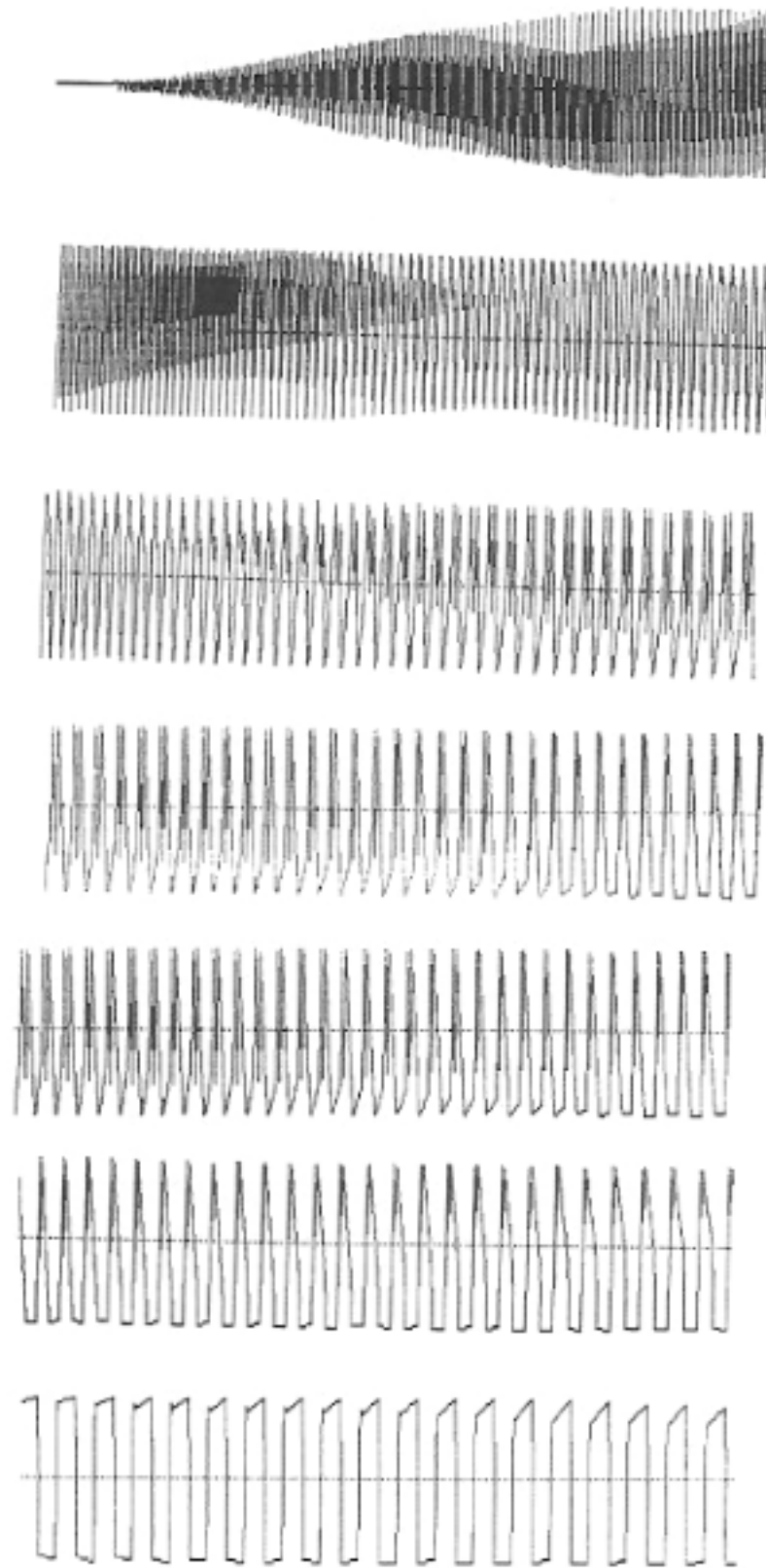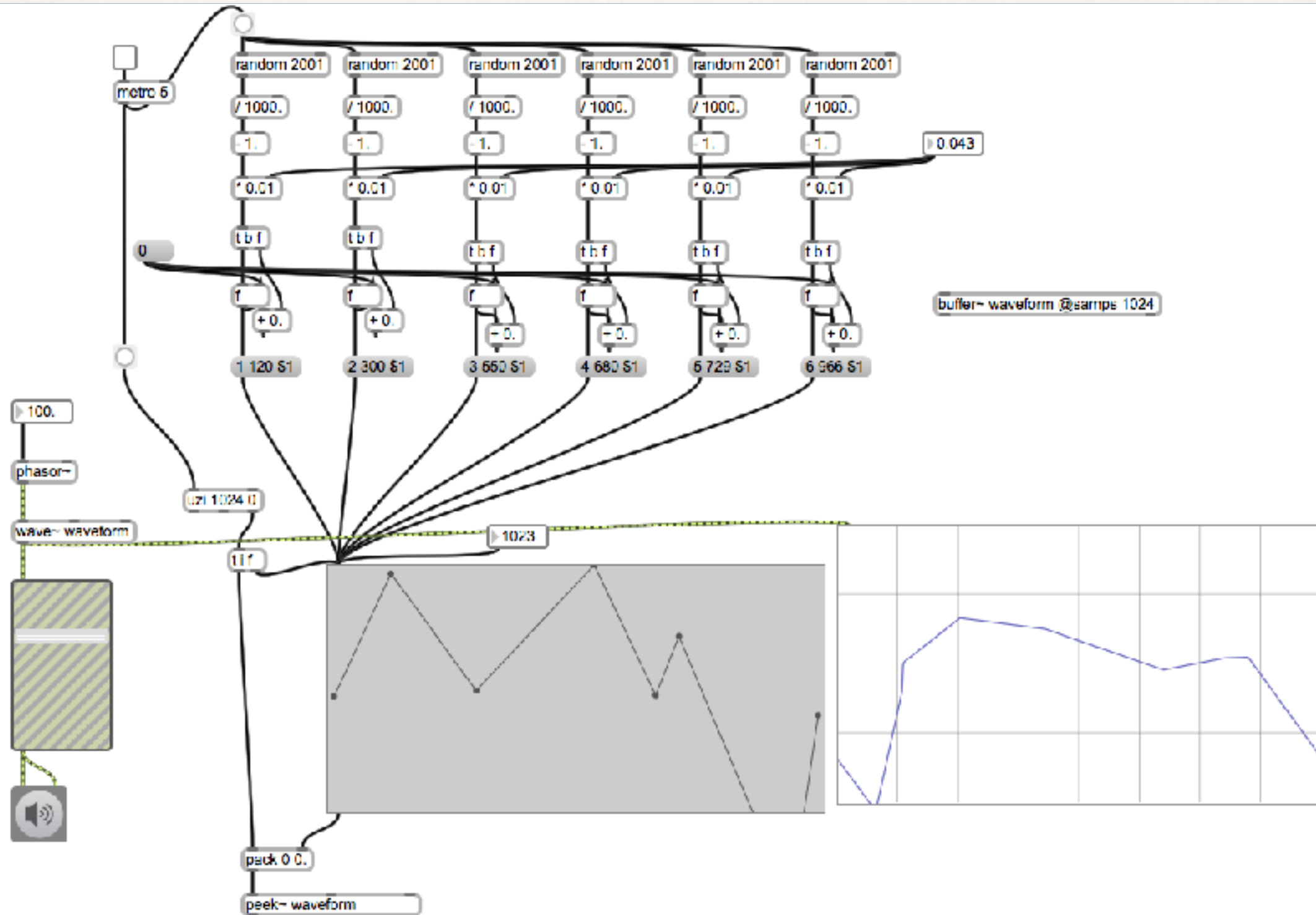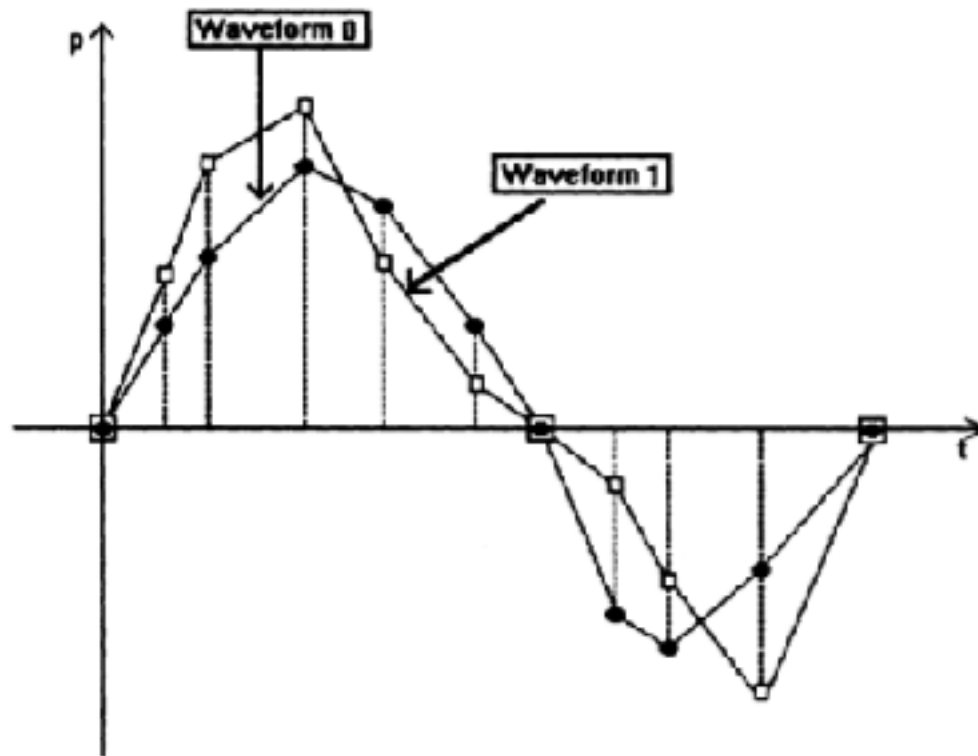WITH TEN SEGMENTS

Figure 8.16 Waveform evolution generated by the GENDY program. The progression starts at the top and proceeds to the bottom, plotting time to the right on each line.
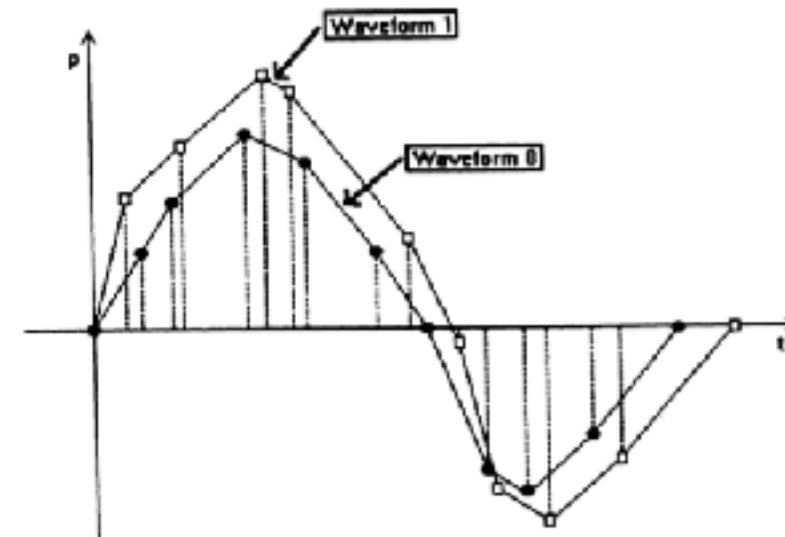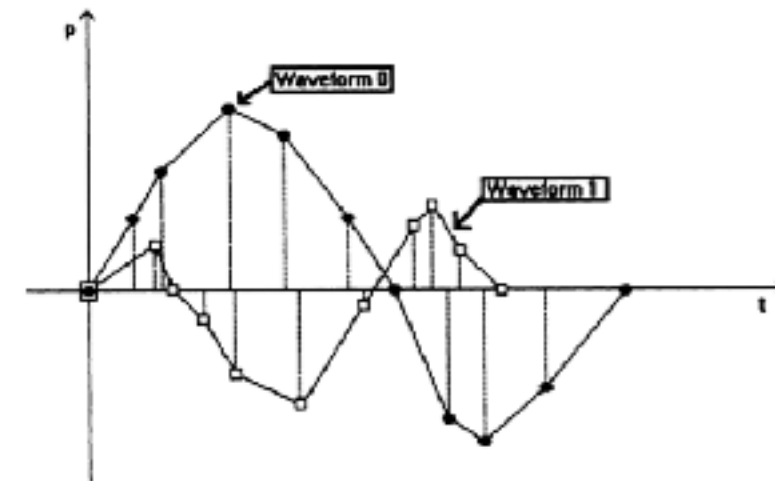
Ergebnis

Experiment mit Max

Gendy3: Algorithmus

EXAMPLE 3: NONLINEAR AMPLITUDE DISTORTION
OF A POLYGONIZED WAVEFORM

EXAMPLE 4: AMPLITUDE AND TIME DISTORTION
OF A WAVEFORM
(THE TOTAL DURATION OF THE WAVEFORM INCREASES)

EXAMPLE 5: AMPLITUDE AND TIME DISTORTION
OF A WAVEFORM
(THE TOTAL DURATION OF THE WAVEFORM DECREASES)

Gendy 1 - 3 in SuperCollider

SuperCollider CLASSES
UGens>Generators>Stochastic

Gendy3

Dynamic stochastic synthesis generator.

Source: /Applications/SuperCollider/SuperCollider.app/Contents/Resources/SCClassLibrary/Common/Audio/Gendyn.sc
Inherits from: UGen : AbstractFunction : Object

See also: Gendy1, Gendy2

Description

See Gendy1 help file for background. This variant of GENDYN normalises the durations in each period to force oscillation at the desired pitch. The breakpoints still get perturbed as in Gendy1 .

There is some glitching in the oscillator caused by the stochastic effects - control points as they vary cause big local jumps of amplitude. Put ampscale and durscalelow to minimise the rate of this.

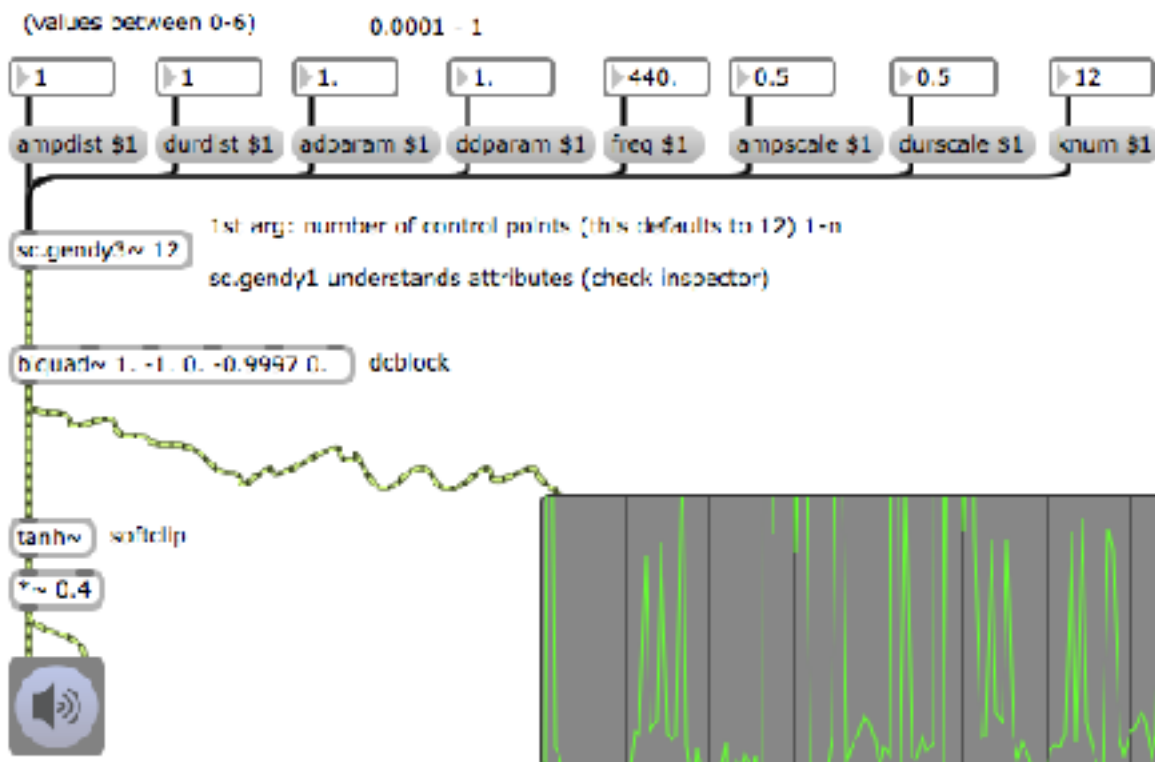SuperCollider implementation by Nick Collins

Experiment mix Max

Iannis Xenakis

Gendy3 for Fixed-media (1991)