



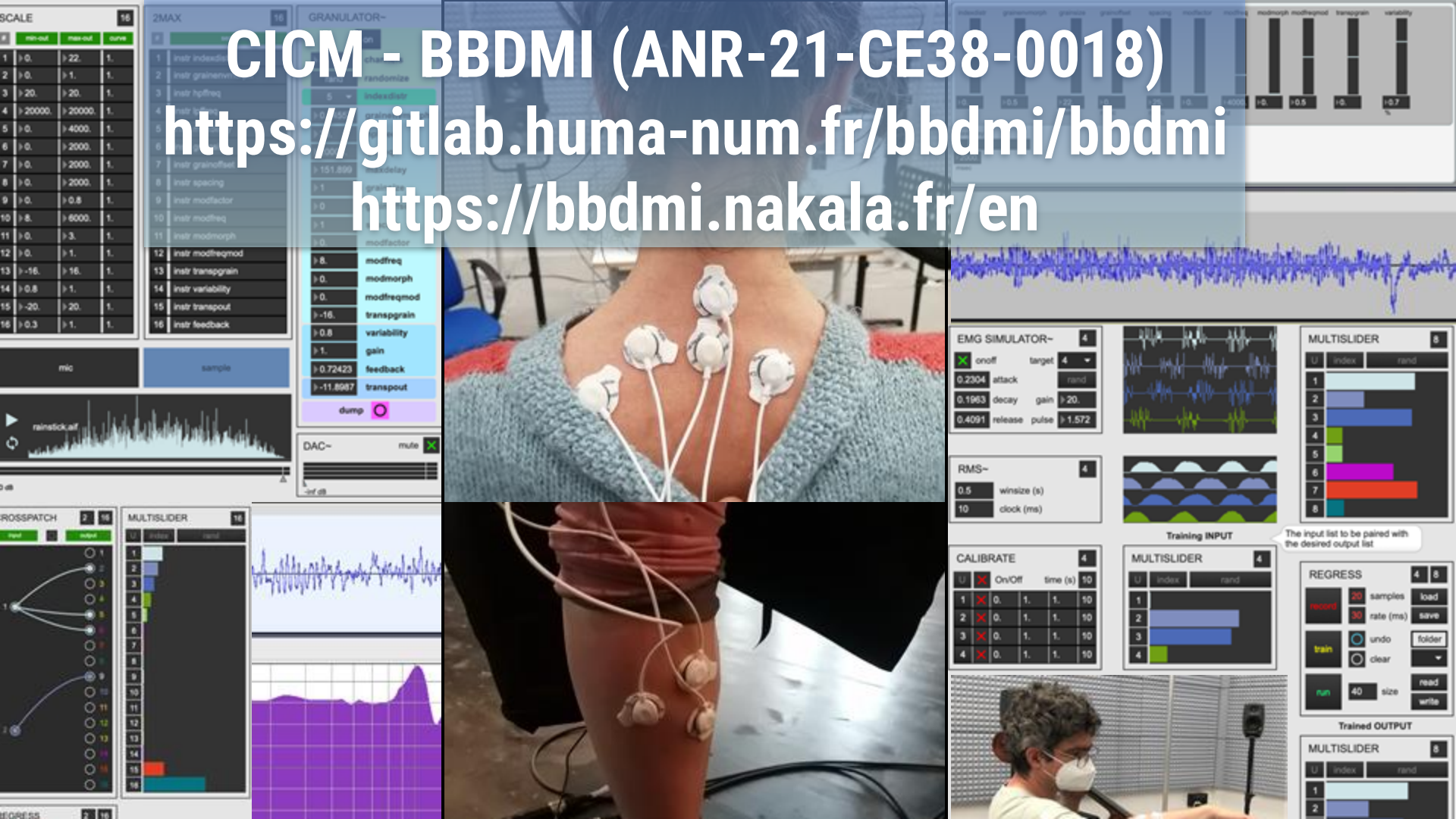
FUNCTIONAL AMBISONIC GRANULATOR

David Fierro - Alain Bonardi
CICM - BBDMI (ANR-21-CE38-0018)
<https://gitlab.huma-num.fr/bbdmi/bbdmi>
<https://bbdmi.nakala.fr/en>

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<https://bbdmi.nakala.fr/en>



SCALE	min-out	max-out	curve
1	>0.	>22.	1.
2	>0.	>1.	1.
3	>20.	>20.	1.
4	>20000.	>20000.	1.
5	>0.	>4000.	1.
6	>0.	>2000.	1.
7	>0.	>2000.	1.
8	>0.	>2000.	1.
9	>0.	>0.8	1.
10	>8.	>6000.	1.
11	>0.	>3.	1.
12	>0.	>1.	1.
13	>-16.	>16.	1.
14	>0.8	>1.	1.
15	>-20.	>20.	1.
16	>0.3	>1.	1.

2MAX	instr indelay	instr grainenv	instr hpfreq	instr grainofflow	instr spacing	instr modfactor	instr modfreq	instr modmorph	instr modfreqmod	instr transgrain	instr variability	instr transpout	instr feedback
1	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.
2	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.
3	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.
4	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.
5	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.
6	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.
7	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.
8	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.
9	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.
10	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.
11	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.
12	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.
13	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.
14	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.
15	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.
16	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.

GRANULATOR-	modfreq	modmorph	modfreqmod	transgrain	variability	gain	feedback	transpout
1	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.
2	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.
3	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.
4	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.
5	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.
6	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.
7	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.
8	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.
9	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.
10	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.
11	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.
12	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.
13	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.
14	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.
15	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.
16	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.

EMG SIMULATOR-	onoff	target	attack	decay	release	pulse
1	>0.	>0.	>0.	>0.	>0.	>0.
2	>0.	>0.	>0.	>0.	>0.	>0.
3	>0.	>0.	>0.	>0.	>0.	>0.
4	>0.	>0.	>0.	>0.	>0.	>0.
5	>0.	>0.	>0.	>0.	>0.	>0.
6	>0.	>0.	>0.	>0.	>0.	>0.
7	>0.	>0.	>0.	>0.	>0.	>0.
8	>0.	>0.	>0.	>0.	>0.	>0.
9	>0.	>0.	>0.	>0.	>0.	>0.
10	>0.	>0.	>0.	>0.	>0.	>0.
11	>0.	>0.	>0.	>0.	>0.	>0.
12	>0.	>0.	>0.	>0.	>0.	>0.
13	>0.	>0.	>0.	>0.	>0.	>0.
14	>0.	>0.	>0.	>0.	>0.	>0.
15	>0.	>0.	>0.	>0.	>0.	>0.
16	>0.	>0.	>0.	>0.	>0.	>0.

RMS-	winsize (s)	clock (ms)
1	>0.	>0.
2	>0.	>0.
3	>0.	>0.
4	>0.	>0.
5	>0.	>0.
6	>0.	>0.
7	>0.	>0.
8	>0.	>0.
9	>0.	>0.
10	>0.	>0.
11	>0.	>0.
12	>0.	>0.
13	>0.	>0.
14	>0.	>0.
15	>0.	>0.
16	>0.	>0.

CALIBRATE	On/Off	time (s)
1	>0.	>0.
2	>0.	>0.
3	>0.	>0.
4	>0.	>0.
5	>0.	>0.
6	>0.	>0.
7	>0.	>0.
8	>0.	>0.
9	>0.	>0.
10	>0.	>0.
11	>0.	>0.
12	>0.	>0.
13	>0.	>0.
14	>0.	>0.
15	>0.	>0.
16	>0.	>0.

REGRESS	samples	load	rate (ms)	save	undo	folder	clear	read	write
1	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.
2	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.
3	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.
4	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.
5	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.
6	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.
7	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.
8	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.
9	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.
10	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.
11	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.
12	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.
13	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.
14	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.
15	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.
16	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.	>0.

Trained OUTPUT	index	read
1	>0.	>0.
2	>0.	>0.
3	>0.	>0.
4	>0.	>0.
5	>0.	>0.
6	>0.	>0.
7	>0.	>0.
8	>0.	>0.
9	>0.	>0.
10	>0.	>0.
11	>0.	>0.
12	>0.	>0.
13	>0.	>0.
14	>0.	>0.
15	>0.	>0.
16	>0.	>0.

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Architecture / GUI's

02

Spectral Processing

03

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Macro controls

A vertical list of parameters and their values, displayed in a software interface. The list is as follows:

- on
- ▶ 4 channels
- rand randomize
- 1 indexdistr
- ▶ 0.5 grainenvmorph
- ▶ 20. hpffreq
- ▶ 20000. lpffreq
- ▶ 2000. maxdelay
- ▶ 40 grainsize
- ▶ 40 grainoffset
- ▶ 80 spacing
- ▶ 0. modfactor
- ▶ 500. modfreq
- ▶ 0. modmorph
- ▶ 0.5 modfreqmod
- ▶ 0. transpgrain
- ▶ 0.3 variability
- ▶ 1. gain
- ▶ 0.2 feedback
- ▶ 0. transpout
- dump

GUI'S

Multi Granulator

granulator

Grain

GrainEnvelope

Indextistr gainmorph grainsize grainoffset spacing modfactor modfreq modmorph modfreqmod transpgrain variability

maxdelay

loop

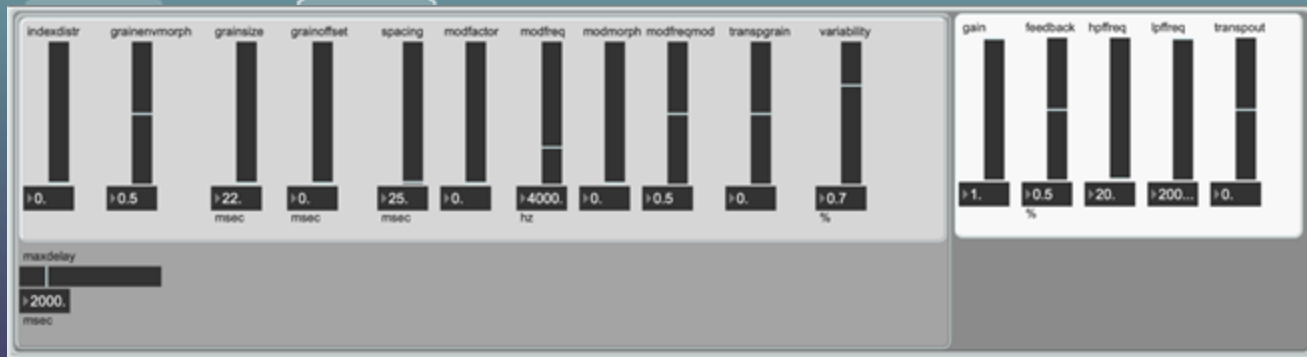
gain feedback hpffreq lpffreq transpout



indextistr gainmorph grainsize grainoffset spacing modfactor modfreq modmorph modfreqmod transpgrain variability

maxdelay

gain feedback hpffreq lpffreq transpout



on

4 channels

rand randomize

1 indexdistr

0.5 grainenvmorph

20. hpffreq

20000. lpffreq

2000. maxdelay

40 grainsize

40 grainoffset

80 spacing

0. modfactor

500. modfreq

0. modmorph

0.5 modfreqmod

0. transpgrain

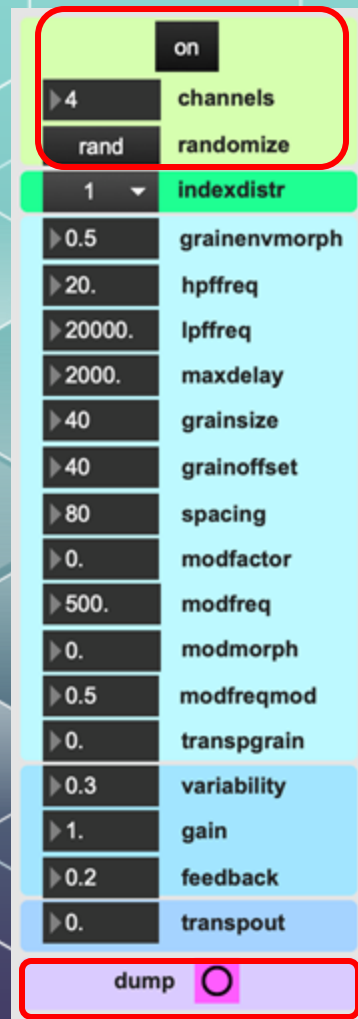
0.3 variability

1. gain

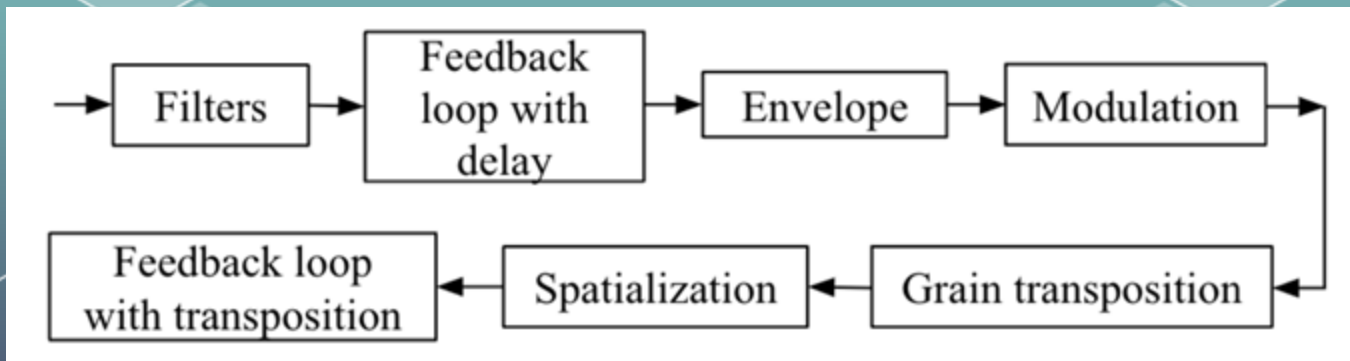
0.2 feedback

0. transpout

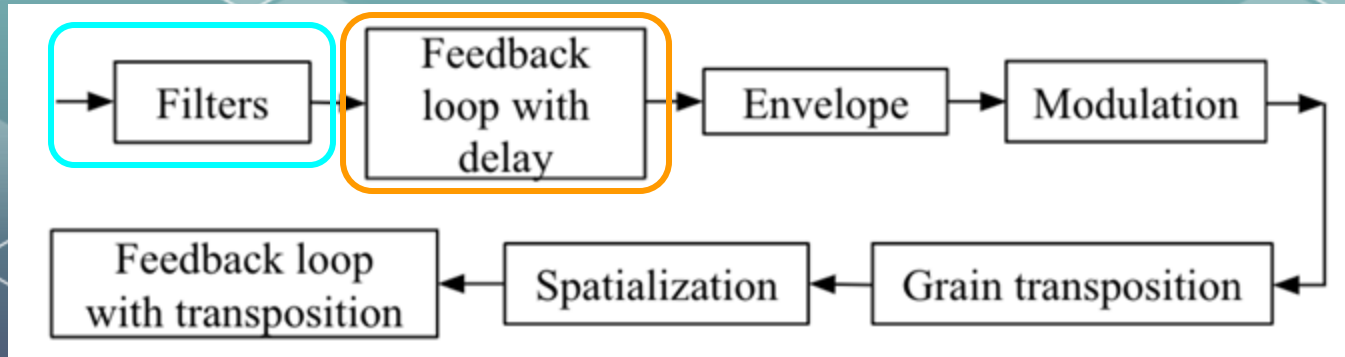
dump



Simplified diagram



Filters

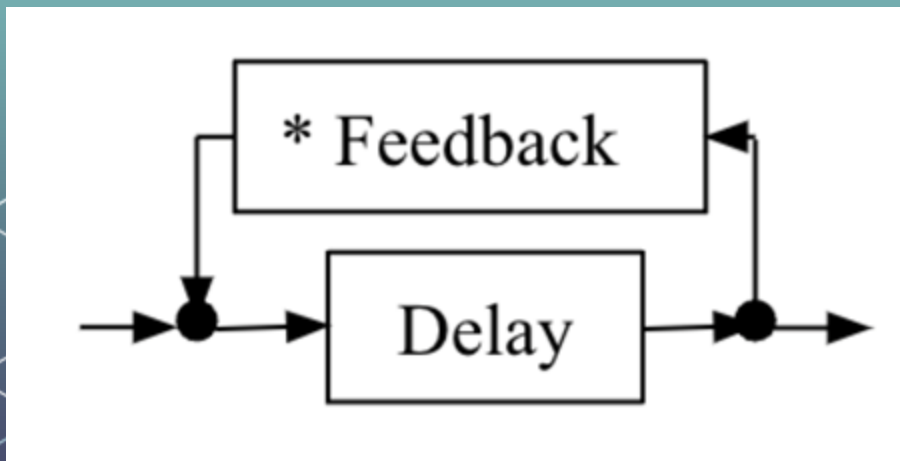


on

- ▶ 4 channels
- rand randomize
- 1 indexdistr
- ▶ 0.5 grainenvmorph
- ▶ 20. hpfreq
- ▶ 20000. lpffreq
- ▶ 2000. maxdelay
- ▶ 40 grainsize
- ▶ 40 grainoffset
- ▶ 80 spacing
- ▶ 0. modfactor
- ▶ 500. modfreq
- ▶ 0. modmorph
- ▶ 0.5 modfreqmod
- ▶ 0. transpgrain
- ▶ 0.3 variability
- ▶ 1. gain
- ▶ 0.2 feedback
- ▶ 0. transput

dump

Input delayed feedback loop

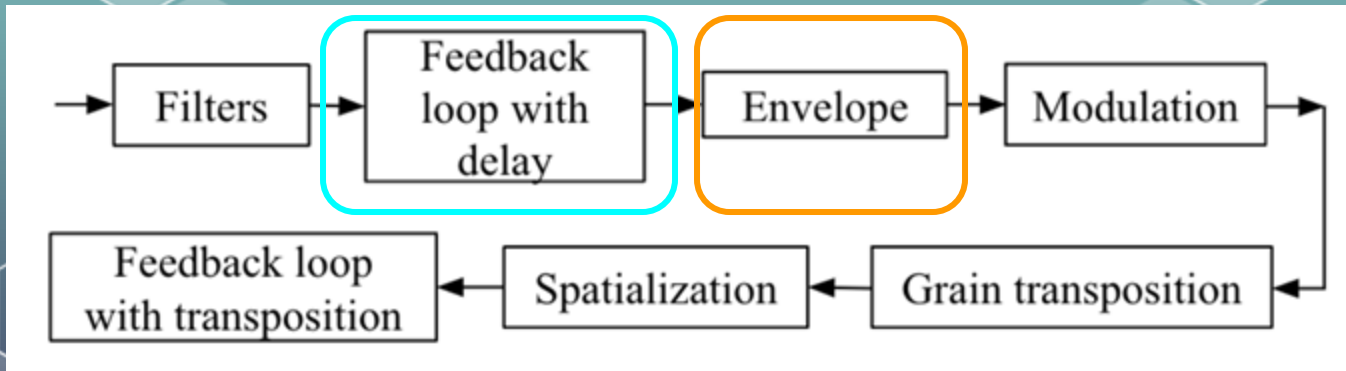


on

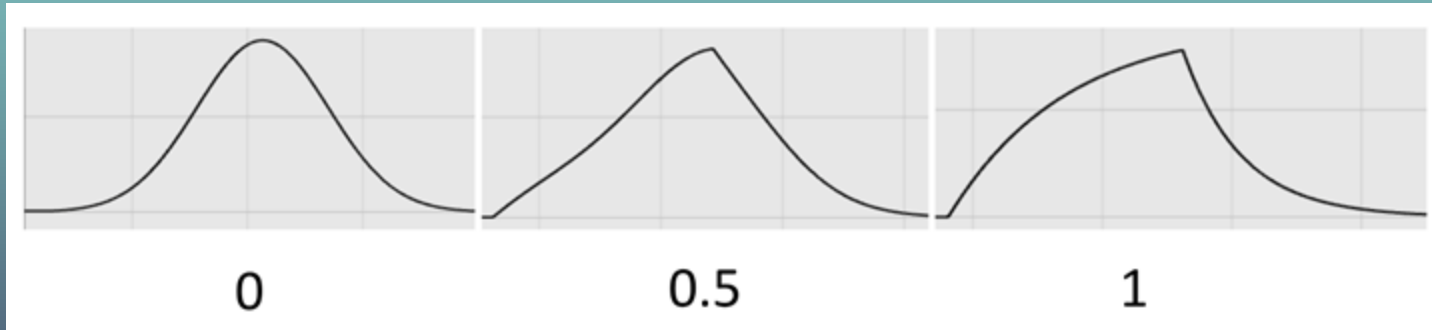
▶ 4	channels
rand	randomize
1	indexdistr
▶ 0.5	grainenvmorph
▶ 20.	hpffreq
▶ 20000.	lpffreq
▶ 2000.	maxdelay
▶ 40	grainsize
▶ 40	grainoffset
▶ 80	spacing
▶ 0.	modfactor
▶ 500.	modfreq
▶ 0.	modmorph
▶ 0.5	modfreqmod
▶ 0.	transpgrain
▶ 0.3	variability
▶ 1.	gain
▶ 0.2	feedback
▶ 0.	transput

dump

Simplified diagram



Envelope design

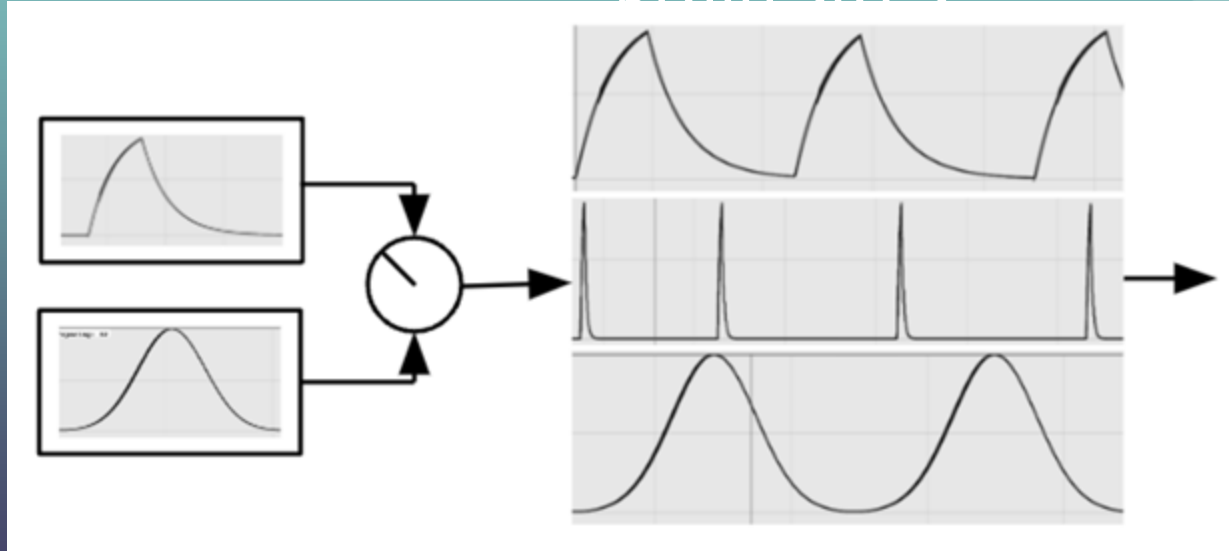


on

- ▶ 4 channels
- rand randomize
- 1 indexdistr
- ▶ 0.5 grainenvmorph
- ▶ 20. hpffreq
- ▶ 20000. lpffreq
- ▶ 2000. maxdelay
- ▶ 40 grainsize
- ▶ 40 grainoffset
- ▶ 80 spacing
- ▶ 0. modfactor
- ▶ 500. modfreq
- ▶ 0. modmorph
- ▶ 0.5 modfreqmod
- ▶ 0. transpgrain
- ▶ 0.3 variability
- ▶ 1. gain
- ▶ 0.2 feedback
- ▶ 0. transpout

dump

Morphing between envelopes and different grain sizes

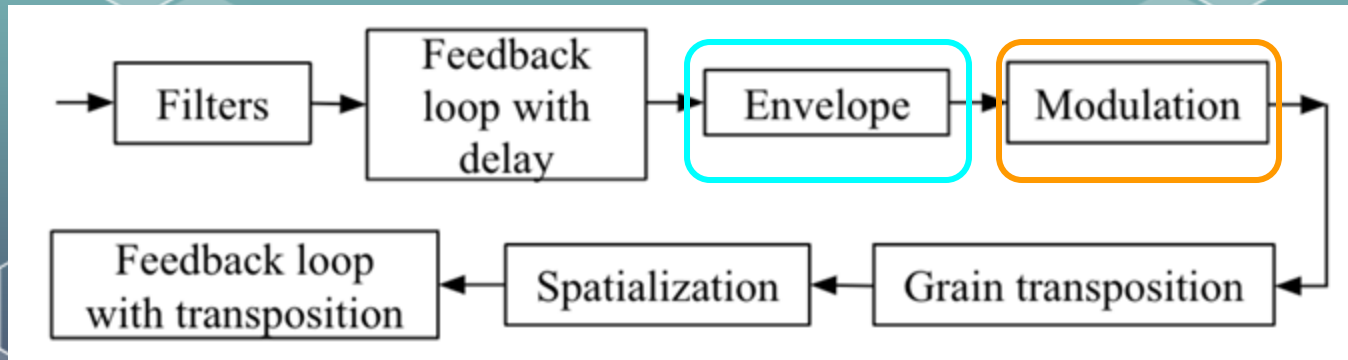


on

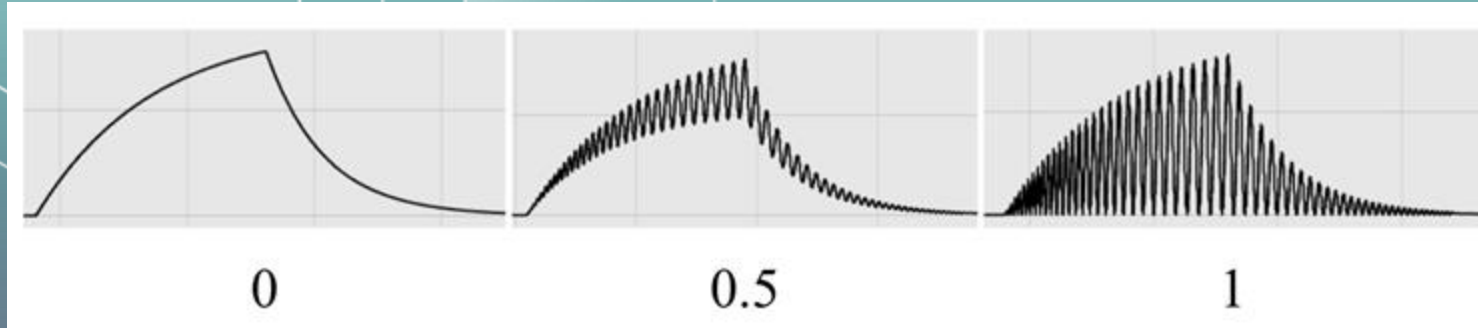
▶ 4	channels
rand	randomize
1	indexdistr
▶ 0.5	grainenvmorph
▶ 20.	hpffreq
▶ 20000.	lpffreq
▶ 2000.	maxdelay
▶ 40	grainsize
▶ 40	grainoffset
▶ 80	spacing
▶ 0.	modfactor
▶ 500.	modfreq
▶ 0.	modmorph
▶ 0.5	modfreqmod
▶ 0.	transpgrain
▶ 0.3	variability
▶ 1.	gain
▶ 0.2	feedback
▶ 0.	transput

dump

Simplified diagram



Envelope amplitude modulation

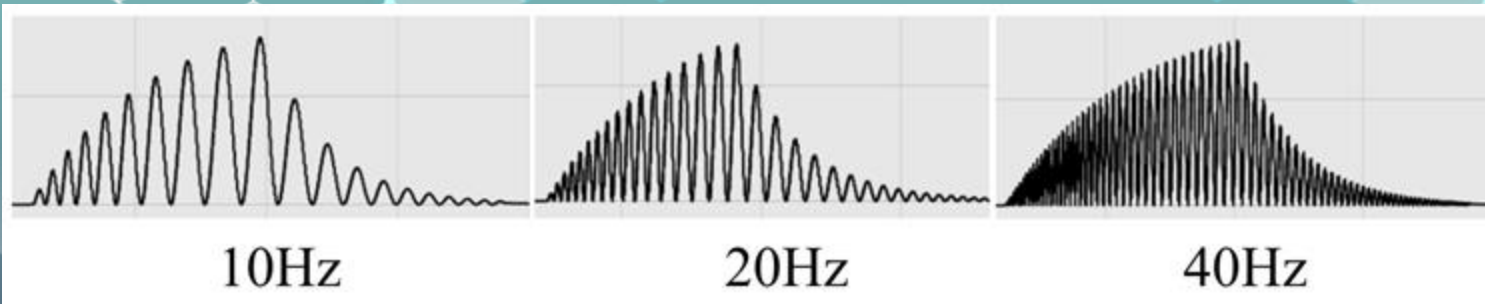


on

- ▶ 4 channels
- ▶ rand randomize
- ▶ 1 indexdistr
- ▶ 0.5 grainenvmorph
- ▶ 20. hpfreq
- ▶ 20000. lpfreq
- ▶ 2000. maxdelay
- ▶ 40 grainsize
- ▶ 40 grainoffset
- ▶ 80 spacing
- ▶ 0. modfactor
- ▶ 500. modfreq
- ▶ 0. modmorph
- ▶ 0.5 modfreqmod
- ▶ 0. transpgrain
- ▶ 0.3 variability
- ▶ 1. gain
- ▶ 0.2 feedback
- ▶ 0. transput

dump

Variable “modfreq”

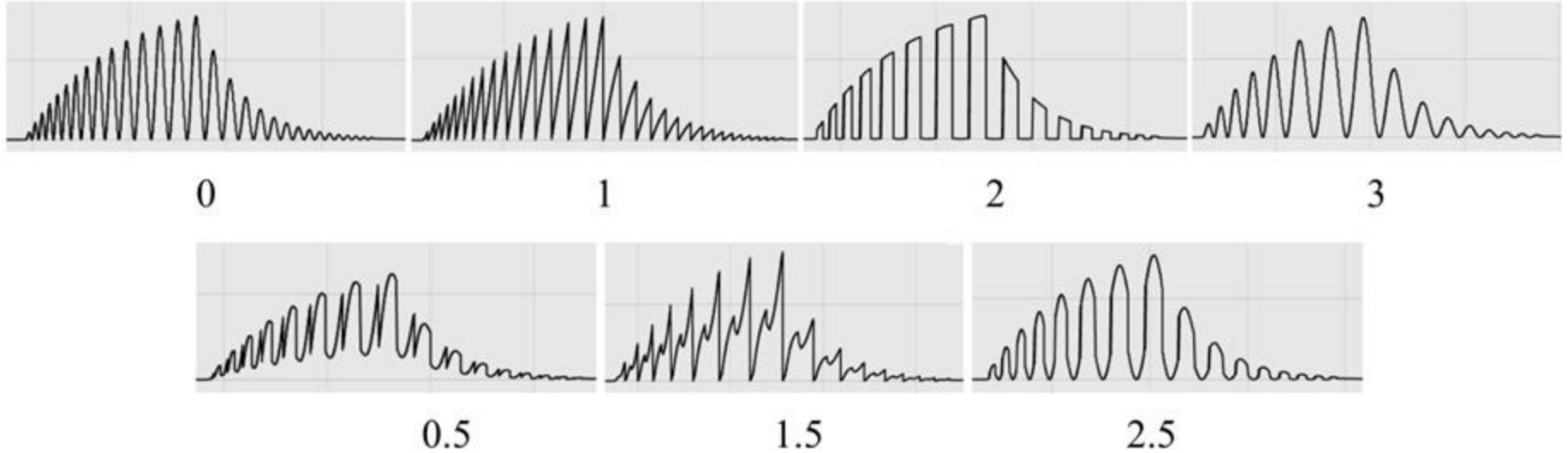


on

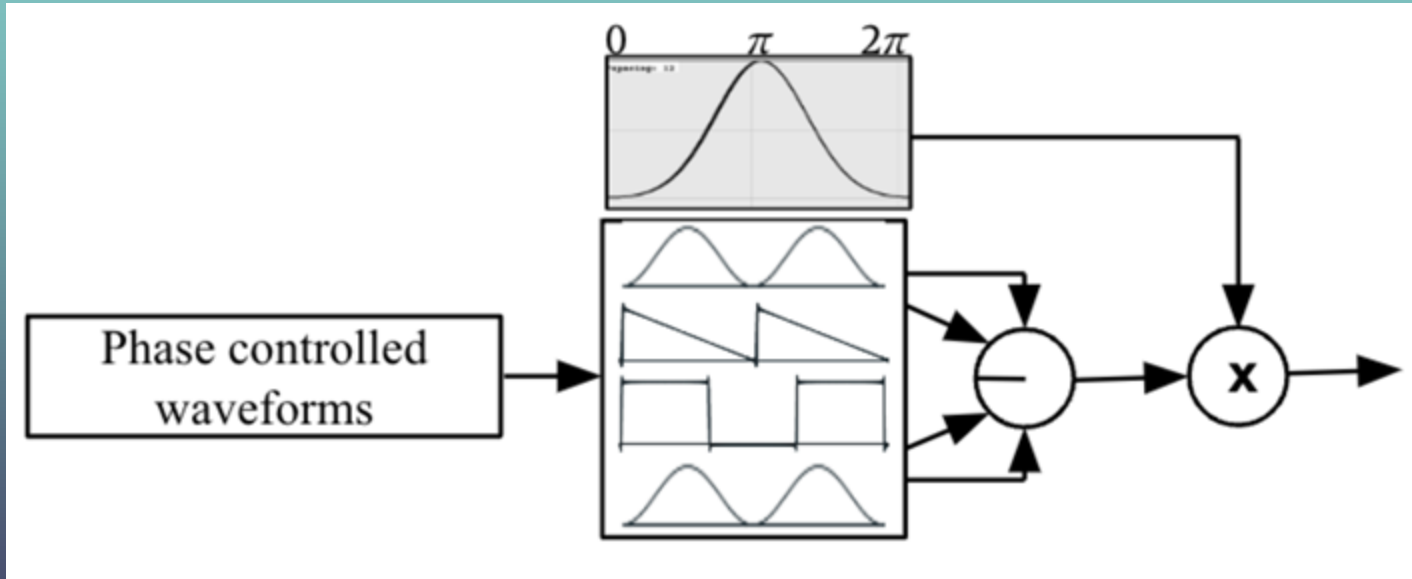
- ▶ 4 channels
- ▶ rand randomize
- ▶ 1 indexdistr
- ▶ 0.5 grainenvmorph
- ▶ 20. hpfreq
- ▶ 20000. lpffreq
- ▶ 2000. maxdelay
- ▶ 40 grainsize
- ▶ 40 grainoffset
- ▶ 80 spacing
- ▶ 0. modfactor
- ▶ 500. modfreq
- ▶ 0. modmorph
- ▶ 0.5 modfreqmod
- ▶ 0. transpgrain
- ▶ 0.3 variability
- ▶ 1. gain
- ▶ 0.2 feedback
- ▶ 0. transpout

dump ○

Modulating signal morphing from sine to square



Mix of different modulating signals

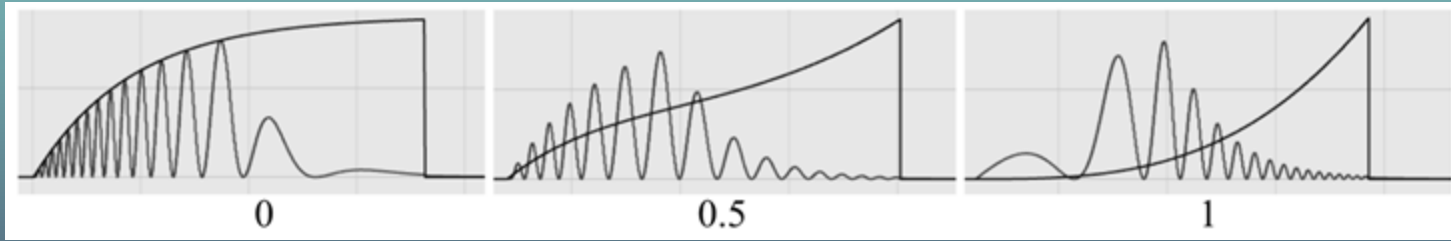


on

- ▶ 4 channels
- ▶ rand randomize
- ▶ 1 indexdistr
- ▶ 0.5 grainenvmorph
- ▶ 20. hpffreq
- ▶ 20000. lpffreq
- ▶ 2000. maxdelay
- ▶ 40 grainsize
- ▶ 40 grainoffset
- ▶ 80 spacing
- ▶ 0. modfactor
- ▶ 500. modfreq
- ▶ 0. modmorph
- ▶ 0.5 modfreqmod
- ▶ 0. transpgrain
- ▶ 0.3 variability
- ▶ 1. gain
- ▶ 0.2 feedback
- ▶ 0. transput

dump

Frequency modulation of the amplitude modulating signal

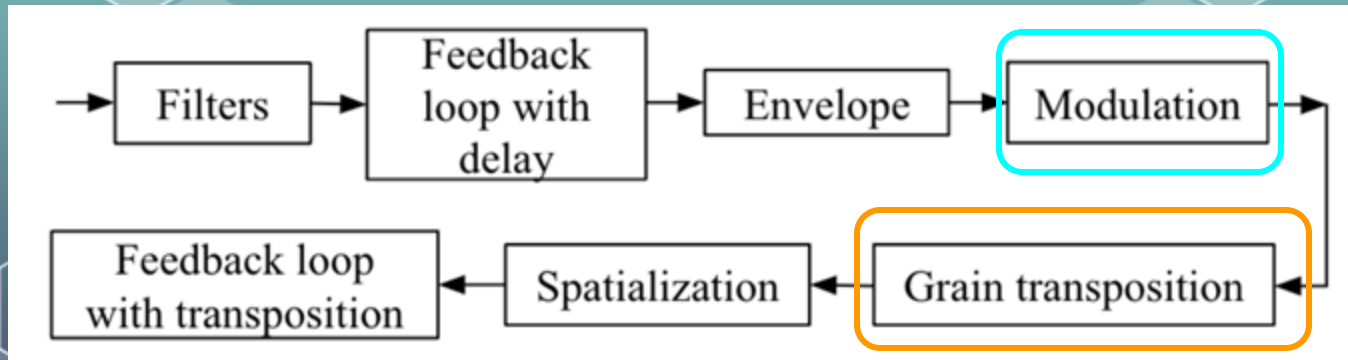


on

- ▶ 4 channels
- ▶ rand randomize
- ▶ 1 indexdistr
- ▶ 0.5 grainenvmorph
- ▶ 20. hpffreq
- ▶ 20000. lpffreq
- ▶ 2000. maxdelay
- ▶ 40 grainsize
- ▶ 40 grainoffset
- ▶ 80 spacing
- ▶ 0. modfactor
- ▶ 500. modfreq
- ▶ 0. modmorph
- ▶ 0.5 modfreqmod
- ▶ 0. transpgrain
- ▶ 0.3 variability
- ▶ 1. gain
- ▶ 0.2 feedback
- ▶ 0. transput

dump

Simplified diagram

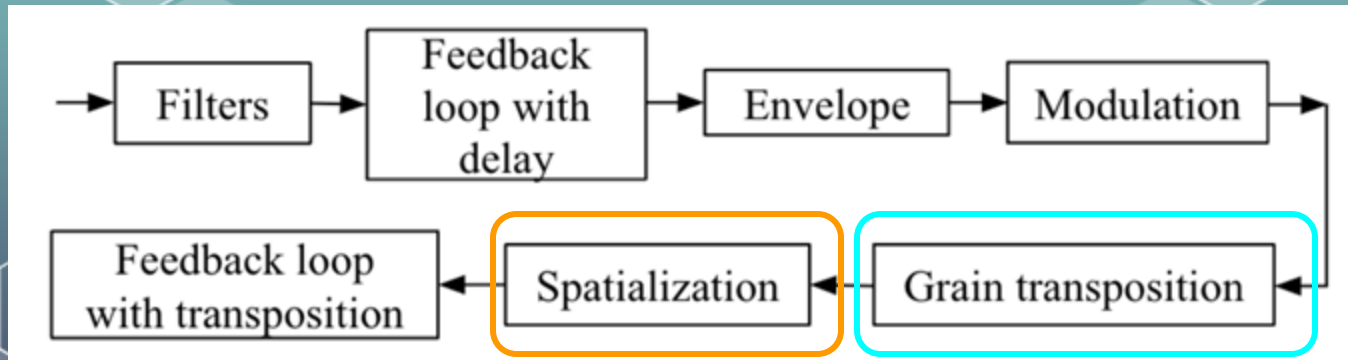


Grains Transposition

Grains are transposed within a range of -24 to +24 semitones

on	
▶ 4	channels
rand	randomize
1 ▼	indexdistr
▶ 0.5	grainenvmorph
▶ 20.	hpffreq
▶ 20000.	lpffreq
▶ 2000.	maxdelay
▶ 40	grainsize
▶ 40	grainoffset
▶ 80	spacing
▶ 0.	modfactor
▶ 500.	modfreq
▶ 0.	modmorph
▶ 0.5	modfreqmod
▶ 0.	transpgrain
▶ 0.3	variability
▶ 1.	gain
▶ 0.2	feedback
▶ 0.	transput
dump	<input type="radio"/>

Simplified diagram



Spatialisation

Spatial Sound Transformation

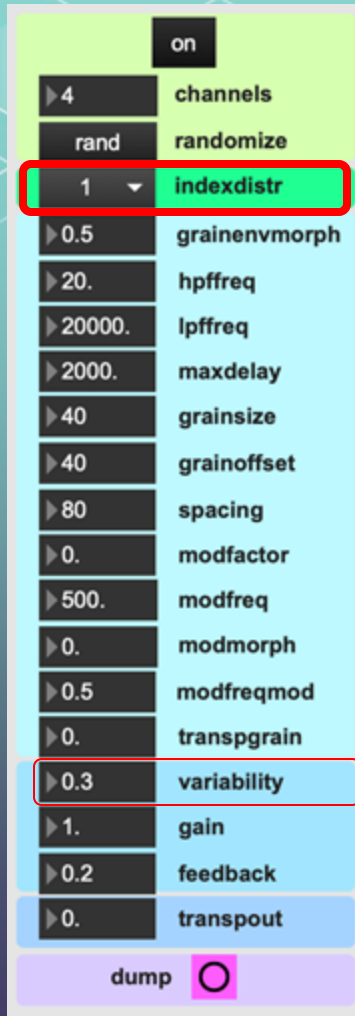
Between ambisonic encoding and decoding

Independent manipulation of ambisonic harmonic channels.



From Point Source to Diffuse Field

Ambisonic spatialization
Precisely localized initial sound
to diffuse fields through
feedback loops.



Ambisonic Distribution

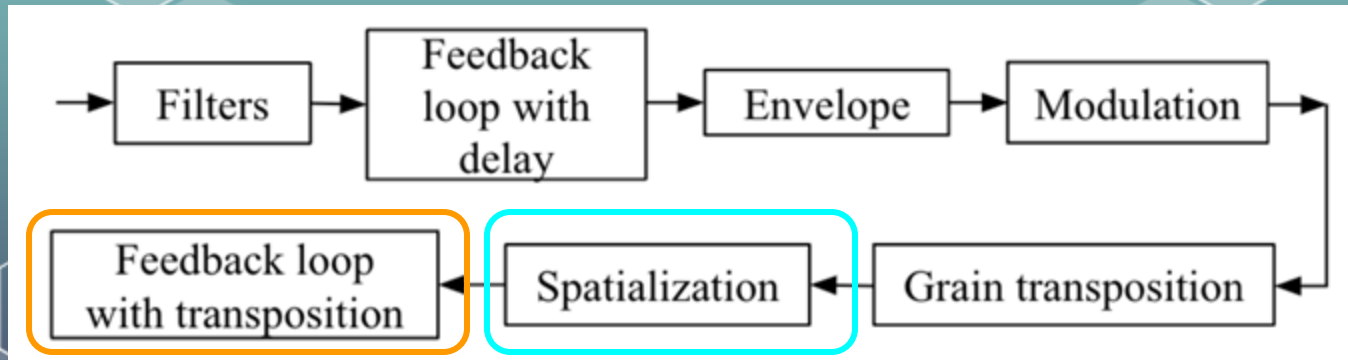
x		
x^2	composite1	x^5
sin	x^3	1-(1-x)^5
log(1+x)	1-(1-x)^3	composite4
sqrt(x)	composite2	2^(10(x-1))
1-cos(Pi/2*x)	x^4	composite5
(1-cos(Pi*x))/2	1-(1-x)^4	1-sqrt(1-x^2)
1-(1-x)^2	composite3	sqrt(1-(x-1)^2)

on

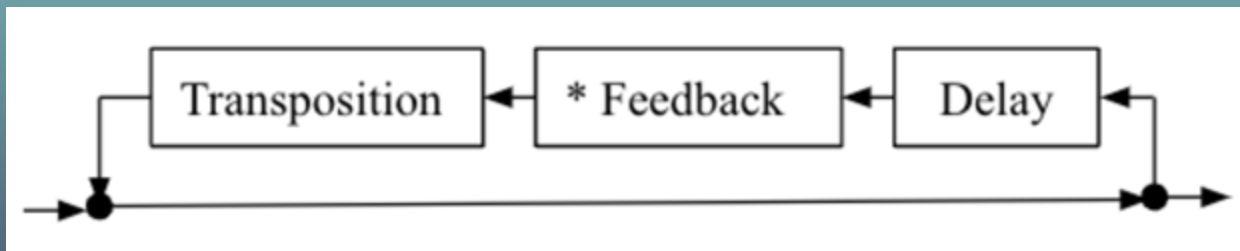
- ▶ 4 channels
- rand randomize
- 1 indexdistr
- ▶ 0.5 grainenvmorph
- ▶ 20. hpffreq
- ▶ 20000. lpffreq
- ▶ 2000. maxdelay
- ▶ 40 grainsize
- ▶ 40 grainoffset
- ▶ 80 spacing
- ▶ 0. modfactor
- ▶ 500. modfreq
- ▶ 0. modmorph
- ▶ 0.5 modfreqmod
- ▶ 0. transpgrain
- ▶ 0.3 variability
- ▶ 1. gain
- ▶ 0.2 feedback
- ▶ 0. transpout

dump

Simplified diagram



Grains Feedback Loop and Transposition



on

▶ 4	channels
rand	randomize
1	indexdistr
▶ 0.5	grainenvmorph
▶ 20.	hpffreq
▶ 20000.	lpffreq
▶ 2000.	maxdelay
▶ 40	grainsize
▶ 40	grainoffset
▶ 80	spacing
▶ 0.	modfactor
▶ 500.	modfreq
▶ 0.	modmorph
▶ 0.5	modfreqmod
▶ 0.	transpgrain
▶ 0.3	variability
▶ 1.	gain
▶ 0.2	feedback
▶ 0.	transpout

dump

MACRO CONTROLS



Regression

RapidMax



One Layer Perceptron



FAUST



FUNCTIONAL AMBISONIC GRANULATOR

David Fierro - Alain Bonardi
CICM - BBDMI (ANR-21-CE38-0018)
<https://gitlab.huma-num.fr/bbdmi/bbdmi>
<https://bbdmi.nakala.fr/en>