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Y

for oud and live electronics  
for Yasamin Shahhosseini

2022

Comissioned by MusikFabrik Köln  
First performance 10 January 2022  
Duration ca. 10'

This piece has been written for and in close collaboration with Yasamin Shahhosseini. So it is really a co-composition, and it leaves a lot of freedom for both, the oud and the live electronics. This score tries to reflect this in a combination of drawings, descriptions, musical notation and technical specifications.

Thanks go also to Zabi Tajik for the recordings of the *Zahak* parts of Ferdowsi's *Shahname*.

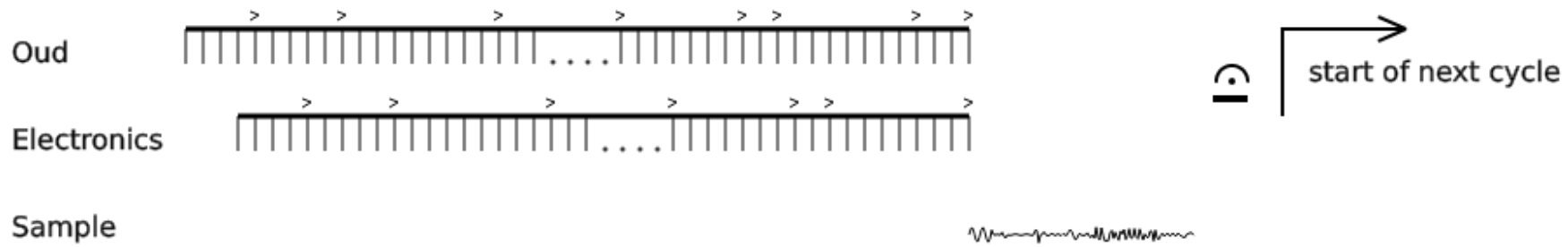
Material and recordings can be accessed via [joachimheintz.net/y.html](http://joachimheintz.net/y.html)

## Content

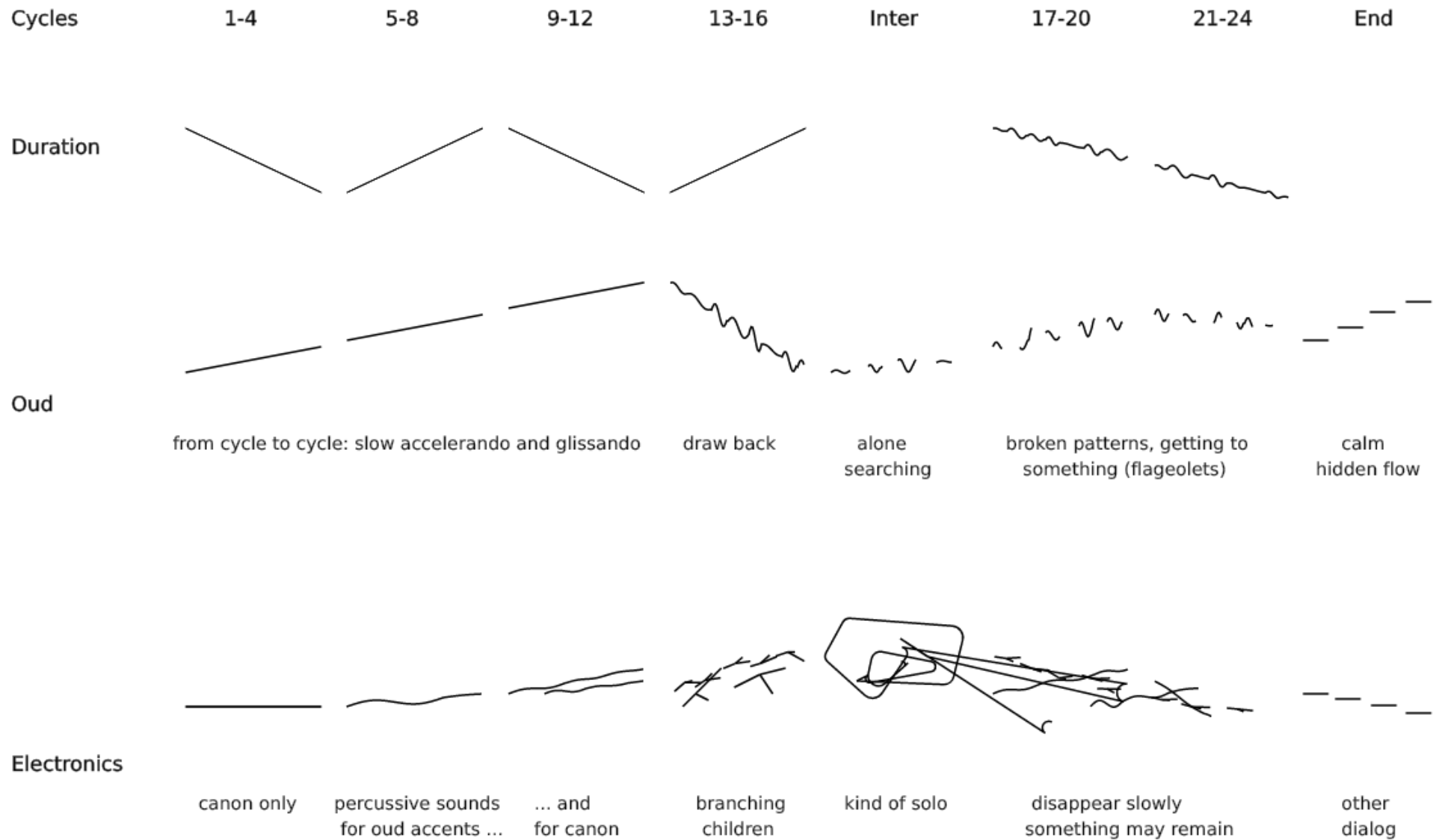
Basic model: Cycle	p. 2	Electronics: Software	
Overview / Form	p. 3	Needed	p. 11
Oud		Directory tree	p. 11
Tuning	p. 4	Start the software	p. 12
Cycle duration	p. 4	Adjust the parameters for onset detection	p. 13
Pitches	p. 5	Other important settings	p. 13
Electronics: Devices etc		Electronics: How to play	
Needed	p. 6	General remarks	p. 15
Connections	p. 7	Cycles 1-8	p. 15
Positioning	p. 8	Cycles 9-16	p. 16
MIDI setup	p. 9	Inter	p. 17
ASCII keys	p. 10	Cycles 17-24	p. 18
		End	p. 18
		Electronics overview	p. 19

# Basic model: Cycle

Oud is playing repetitions on a damped string, with irregular accents. Electronics is repeating the live input after some notes, as canon. If an accent occurs both in oud and in the canon, the canon stops and a sample is played back. The oud stops as well, and continues after the sample (and a rest) with the next cycle.



# Overview / Form



# Oud

## Tuning

Strings I and V are one semitone lower than usual.

In addition, the two single strings for I - V are slightly mistuned for beatings:

String:            VI            V            IV            III            II            I

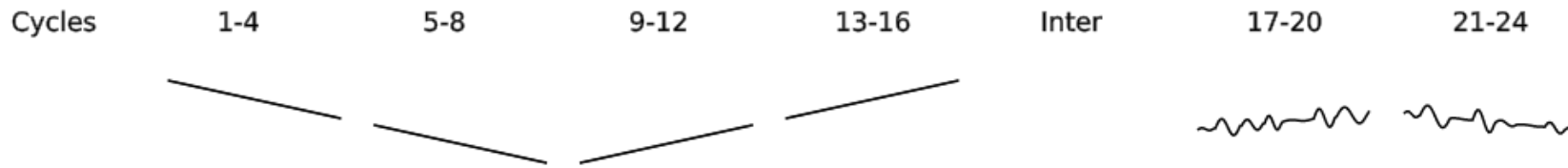
Beatings in MM = 72:            1            2            3            4            5

## Cycle duration

In general, the cycle duration depends on the oud. If the oud avoids a clash, or in other words, an accent together with the canon, or in other words, an accent now together with an accent of the past — then the cycle will continue. If a clash occurs, the cycle is finished. See the *Duration* line in *Overview / Form* above for the suggested development of the duration.

Note that in cycles 9-16 the canon plays back the oud of cycles 1-8. The possibility of clashes is suspended for this time. This means that cycle nine has at least the duration of cycle one, cycle ten has at least the duration of cycle two, and so on.

Another important decision in this context is the duration of the rest, before starting the next cycle. It is suggested to have a line like this for the rest durations:



## Pitches

1. For the repetitions in cycles 1-16, only use string VI. Start with and end approximately with .
2. For cycles 17-24, these flageolets can be used:

String	II VI V VI	VI VI V I	VI I V V	I V VI V	V VI VI IV	I VI V VI	V VI VI III	V VI II VI
Oud								
Elctr.								
Cycle	17	18	19	20	21	22	23	24

3. For the end, use these, in contact with the electronics, and repeat the last three ad libitum:

String	III	VI	IV	VI	III	VI	V	I	VI	IV	V	II	III	VI
Partial	2	5	3	6	3	7	5	2	8	5	6	3	4	9

# Electronics: Devices etc.

## Needed

1. Six medium sized loud speakers, e.g. Genelec 8040 (speaker 1-3) and 8050 (speaker 4-6). If possible, put on the floor.
2. A mixer for controlling the output volume (6 in, 6 out).
3. Microphone Neuman KM 184 or similar for the oud (= *Cond* in input channel 2 for the Csound program).
4. AKG C411PP or similar as pickup. This pickup is only used for onset detection, so it can be put on the edge of the oud:



5. MIDI keyboard with foot pedal (sustain) input. Two octaves for keys are sufficient. In addition to the pedal and the keys, the Csound program is using 14 knobs and one ribbon controller. (The ribbon controller is not essential and can be replaced by a knob or slider.)
6. Audio interface with 2 mic in and 6 line outs.
7. Computer with Csound (6.16 or higher) and CsoundQt. (The Csound files can be downloaded from [joachimheintz.net/y.html](http://joachimheintz.net/y.html). The samples are provided by request.)

# Connections

1. The foot pedal is on the stage and will be pressed by the oud player to start a cycle. It is connected via XLR extension with the MIDI keyboard (which itself is connected with the computer):



2. Interface:

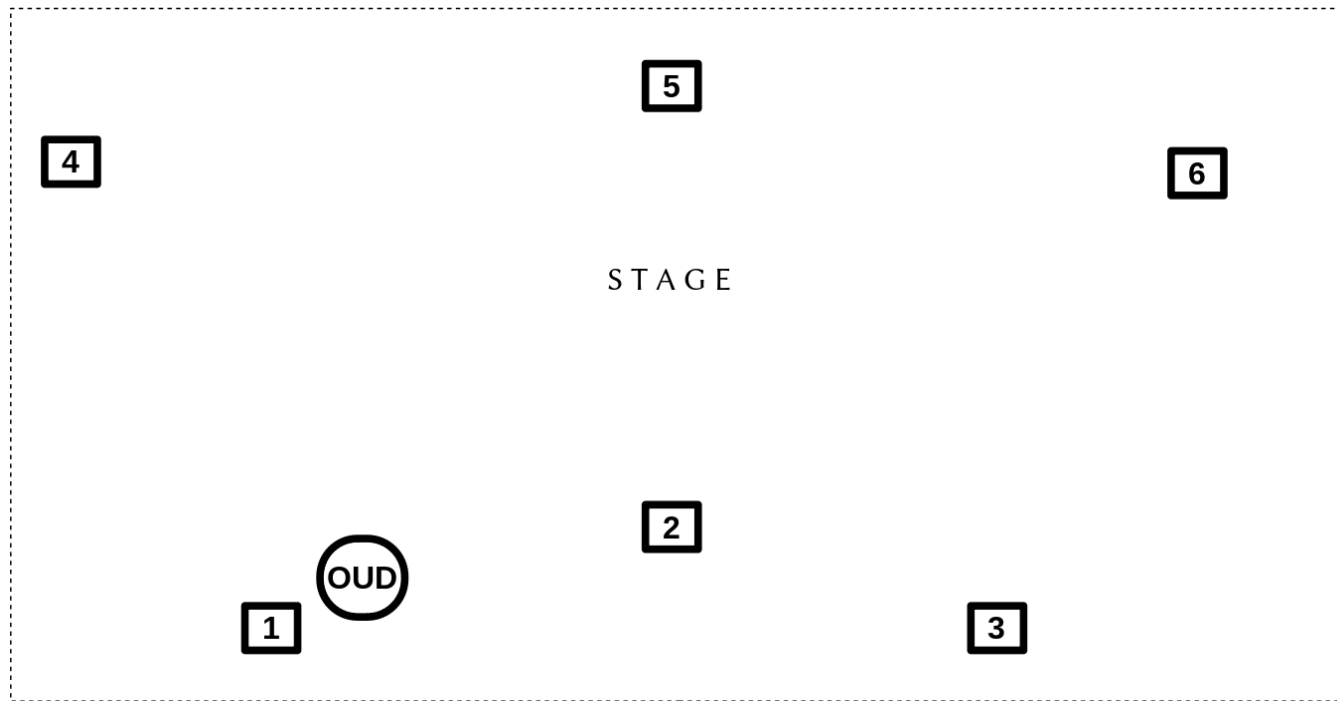
- In 1 = pickup
- In 2 = condenser
- Out 1-6 = to mixer

3. Mixer:

- In 1-6 = from interface
- Out 1-6 = to speakers



# Positioning



Distance 1-2 and 2-3 is approximately 2 meters.

Speaker 4, 5 and 6 form a second row and should be put to rear to get a remote sound (quasi background).

Speaker 1 is used for amplification of the oud.

Speaker 2 is used for the interrupting samples (Zahak etc), and later for some of the flageolets.

Speaker 3 is used for the canon.

Speaker 4-6 are used for various other sounds.

## MIDI setup

In general, the MIDI setup is flexible and can be changed in the CsoundQt GUI (for the cc numbers) or in the code (for the note-on numbers, see instruments *Midi* and *FlageEnd* in line 440 and 916). This is an overview about what is being used in the first performance with an Arturia MiniLab.

CC	Range	Software channel	Initial value	Meaning
2	-40 .. 12	perc_oud_db	-40	volume of the additional percussive sounds for oud accents
3	-40 .. 12	perc_canon_db	-40	volume of the additional percussive sounds for canon accents
4	-20 .. 12	vol_flage_db	~ 0	volume of the flageolet sounds
5	0 .. 1	perc_probablility	0	probability that an accent gets an additional percussive sound
6	0 .. 1	perc_child_prob	0	probability that a percussive sound has children
7	0 .. 20	perc_machine_freq	0	frequency of the machine which produces percussive sounds
8	-30 .. 10	vol_perc_child_db	-30	volume of the percussive child sounds
10	-30 .. 12	vol_out_1_db	~ 0	volume of speaker 1 (= oud amplification)
11	-30 .. 12	vol_out_2_db	~ 0	volume of speaker 2 (= sample playback)
12	-30 .. 12	vol_out_3_db	~ 0	volume of speaker 3 (= canon)
13	-30 .. 12	vol_out_456_db	~ 0	volume of speaker 4-6 (= remote)
14	-30 .. 12	vol_canon_echo_db	-30	volume of repeated parts of the canon
15	0 .. 1	perc_child_probab_DN	-30	probablity of demo/news snippets for percussive children
16	-40 .. 0	vol_amplification_db	~ -10	volume of live amplification for oud
17	-2 .. 2	child_axis	0	ribbon controller: transposition range of the <i>PercChild</i> instrument
64	0 or 127	pedal	-	foot pedal: pushed by the oud player to start a new cycle
Key	dB range	Meaning		
55, 57, 59	-30 .. 0	play a short snippet from any Zahak sample		
67, 69, 71	-30 .. 0	play a short snippet only from the Zahak samples which were used already		
48, 50, 52, 53 60, 62, 64, 65	-30 .. 0	play a part of a previous canon		
54	-30 .. 0	proceed one step in the line of flageolets (downwards)		
61	-30 .. 0	stay on this step in the line of flageolets		
66	-30 .. 0	go back one step in the line of flageolets (upwards)		

## ASCII keys

The computer keyboard is used for these keys:

Key	ASCII	Meaning
+	43	Increase cycle count
-	45	Decrease cycle count
z	122	Force clash / sample / interruption
o	111	Remove clash prohibition (cycles 9-16)
␣	32	Start next cycle instead of pedal

# Electronics: Software

## Needed

1. Csound 6.16 or higher. For download and install, see the instructions at [csound.com](http://csound.com).
2. CsoundQt 0.98 or higher. For download and install, see [csoundqt.github.io](http://csoundqt.github.io).
3. For running the code, two files are needed. Both are provided at [joachimheintz.net/y.html](http://joachimheintz.net/y.html):
  - a) [https://joachimheintz.de/stuecke/code/y\\_220110.csd](https://joachimheintz.de/stuecke/code/y_220110.csd) contains the main code.
  - b) [https://joachimheintz.de/stuecke/code/y\\_udos.inc](https://joachimheintz.de/stuecke/code/y_udos.inc) contains the functions (UDOs) which are #included in the main code.

Both files must be in the same directory.

4. The sound files which are being played whenever a clash occurs consist of
  - a) parts of the *Zahak* story in Ferdowsi's *Shahname* (recorded by Zabi Tajik)
  - b) prerecorded oud flageolets (played by Yasamin Shahhosseini)
  - c) some percussive sounds
  - d) sounds from demonstrations
  - e) montage of news as done in my piece *nach\_richten* (2020)

These sound files are provided by request.

## Directory tree

```
csd
├── y_220110.csd
├── y_udos.inc
samples
├── demo
│   ├── demo.wav
├── flage
│   ├── flage_01.wav
│   └── ...
├── nachrichten
│   └── nachrichten.wav
├── perc
│   └── casta_mix.wav
```

```

├─ ...
├─ zahak
├─ Zahak01.wav
├─ ...

```

## Start the software

1. Open the y\_220110.csd file in CsoundQt. Make sure the file y\_udos.inc is in the same folder.
2. When you click on View > Widgets, you should see this GUI:

The GUI is titled "Widgets" and contains the following sections:

- Input:** Includes sliders for Pickup (gain -44, channel 1) and Cond. (gain -45, channel 2). A "Mix for amplification and canon" knob is set to 0.86. A "Mix" slider is at -46.
- Control:** A large control panel with a "clash prohibited" checkbox. It features a grid of volume and probability controls for various instruments:
 

	Vol Perc Oud	Vol Perc Canon	Vol Flage	Probab Perc	Probab Perc Child	Perc Machine Freq	Vol Perc Child
center pitch for perc childs (ribbon control)	-13.0	-40.0	-10.2	0.00	0.00	0.00	-12.7
	2	3	4	5	6	7	8
	Vol 1 Oud	Vol 2 Zahak	Vol 3 Canon	Vol 4-6 Backgrnd	Vol CanEcho	Probab Perc DN	Vol Amplif
	-0.9	-1.6	-1.2	-2.9	0.4	0.00	-8.8
	10	11	12	13	14	15	16
- Output:** A list of 6 output channels: Oud, Zahak, Canon, Back L, Back M, Back R, each with a corresponding level indicator.
- START PROGRAM HERE!:** A large central button.
- Amplification On / Off:** A toggle button.
- Midi Pedal:** A button.
- cycle count:** A large display showing "0" and a "next cycle" display showing "1".
- onset detection:** Controls for db diff (5), db thresh (-36), min time (s) (0.10), del tim (ms) (5), and rms freq (hz) (25). Includes a "TEST!" button.
- accent detection:** Controls for db thresh (-25), del tim (ms) (10), and a "TEST!" button.
- clash detection:** Controls for max time difference (s) (0.50).
- clash live / accent canon:** Two indicator lights.
- Clash Display:** A large "CLASH!" indicator.
- ONSET test display:** A label for the onset detection section.
- ACCENT test display:** A label for the accent detection section.
- CHECK BEFORE START:** A list of instructions:
  1. Arturia = Scene 2
  2. Adjust all knobs on Arturia, and ribbon cc
  3. Input chnls for both mics, output routing
  4. Mix for amplification
  5. Turn off Wifi
  6. Uncomment record if desired
- AFTER START:** A list of instructions:
  7. Amplification button ON
  8. If necessary, check onsets and accents
- KEYS:** A list of keyboard shortcuts:
  - Z -----> Force Zahak / Interruption
  - 0 -----> Remove Clash prohibition
  - + -----> Increase Next Count
  - -----> Decrease Next Count
  - [space] --> Start Next Cycle (= Pedal)
- NORMAL PARAMS FOR AKG C411:**

```

ONSET: db_diff = 5, db_thresh = -30, min_time = 0.1, del_tim = 5, rms_freq = 25
ACCENT: db_thresh = -20, del_tim = 10
CLASH: max_tim_diff = 0.5

```

- 3.. Start the program by clicking on the big white button on top. (This is important for having the mouse focus in the widget panel, so that the computer keyboard can be read as input, not as edit.)
4. If you want to amplify the oud click on the "Amplification On/Off" button. The amount of amplification can be controlled via cc 16 "Vol Amplif". The amplified sound will go out of speaker 1.

## Adjust the parameters for onset detection

Technically, the whole piece is based on detecting

- a) the single oud notes (repetitions), and
- b) distinguishing the accents from the normal notes.

This detection is done by a function called *OnDtct* in the instrument *AnalyzeLiveInput*. The parameters of this function can be adjusted in the middle section of the GUI, as "onset detection", "accent detection" and "clash", like this:

1. The oud plays continuous damped repetitions like in the beginning of the piece. Make sure that you have a good signal level for the pickup microphone.
2. Press the TEST! button in the "onset detection" section. You should hear a click for each note. If not, change the *db thresh* value. If this is not successful, adjust the other parameters. (This requires some deeper understanding of the function — see <https://github.com/csudo/csudo/blob/master/misc/OnDtct.csd>.)
3. If this works in a reliable way, press the TEST! button in the "accent detection" section. You should now hear a plopp sound for each accent.
4. The box in the "clash detection" section sets the maximal time difference between a live accent and an accent in the canon, which is still considered as a clash. Half a second (0.5) should be fine. Smaller values will produce fewer clashes; larger values will produce more clashes.

## Other important settings

1. In the "Input" section top left, set a "Mix for amplification and canon". This does not affect the onset detection (which is done by the pickup microphone only). You will hear this mix for the canon (speaker 3) and for the live amplification of the oud (if this feature is used).

2. In the *Collect* instrument you see this in line 1034 of the code:

```
;fout GenDate(), 18, gaInPickup, gaInCondenser, gaInMix, a1, a2, a3, a4, a5, a6
```

If you remove the semicolon, each run of this instrument will write a 9-channel soundfile with the internally recorded audio signals for input and output on disk.

3. Other input channels than 1 for the pickup and 2 for the condenser can be set in the GUI, in the "Input" section.

Other output channels than the default 1-6 can be set in line 28-33 of the code. For instance, if you want to use hardware channels 9-14 instead, change to

```
giOutChnOud   = 9    ;= audio_chn_1  
giOutChnZahak = 10   ;= audio_chn_2  
giOutChnCanon = 11   ;= audio_chn_3  
giOutChnBackL = 12   ;= audio_chn_4  
giOutChnBackM = 13   ;= audio_chn_5  
giOutChnBackR = 14   ;= audio_chn_6
```

(Make sure in this case to set `nchnls=16` in the orchestra header.)

# Electronics: How to play

## General remarks

In the following sections, and in the electronic overview, processes are described mostly in a linear way, like "increase volume" or "decrease density". But this is only meant on the long run, and should be contrasted by sudden changes in any direction. In other words: As the overall form of this piece is very simple, it accepts and needs many deviations. All should be done from perceiving the present situation and having a good connection with the oud.

## Cycle 1-8

### What happens

The oud player presses the pedal at the beginning of each cycle.

The electronics repeats the oud input in speaker 3 after these number of repetitions:

<b>Cycle</b>	1	2	3	4	5	6	7	8
<b>Distance</b>	2	3	5	8	8	5	3	2

This is done automatically.

Each cycle stops when a clash of a live accent and an accent in the canon occurs, as described above.

The samples here are from the Zahak story. They are chosen automatically according to some settings.

### To play

*Zahak Echo*. Some additional parts of the Zahak samples can be played by pressing either

- a) MIDI keys 55, 57, 59 or
- b) MIDI keys 67, 69, 71



The b) option will only play parts of the samples which have been used already. The a) option will play from anywhere, from Zahak samples which may come later as a whole, or will never be used at all.

The samples are being played as long as the key is pressed, but only until the end of the sound file (no loop).

*Perc Oud.* In cycles 5-8, adding percussive sounds to oud accents can be started carefully. This is done by increasing the probability (cc 6) and the volume for percussive accents in the oud (cc 2).

## Cycle 9-16

### What happens

When the oud player starts a new cycle by pressing the pedal, the electronics repeats what has been played in cycles 1-8. The interrupting samples after a clash are following now a sequence of Demo and News.

### To play

*Perc Oud.* In cycles 9-12, reach the maximum. Go back in 13-16.

*Perc Canon.* Increase the volume of the additional percussive accents in the canon (cc 3) in 9-12. Stay in 13-16.

*Canon Echo.* Playback of parts of previous cycles, activated by MIDI Keys C D E F. Playback is active as long as key is pressed. Volume is controlled with cc 14. Increasing intensity in these cycles.

*Perc Child.* The probability that from one percussive accent one, two or three other percussive sounds derive. They will form a chain of downwards transposition. The probability is adjusted with cc 6; the volume of the child sounds with cc 8. Starting with few, the density and intensity increases in these cycles.

*Perc Machine.* This machine produces one to five percussive events of type *Perc Child*. The frequency is controlled via cc 7. The pitch median of the first note is controlled via cc 17 (ribbon controller). Start carefully in cycles 13-16 and increase.

*Clash allow.* In these cycles previous cycles are played back by the canon voice. Any clash is prohibited as long as the previous canon is not finished. For instance, if cycle 1 was 30 seconds until the clash occurred, in cycle 9 there will be no clash for 30 seconds. If the electronic player wants to make an earlier clash possible, press the "o" key. The red light top left in the "Control" section of the GUI will disappear then, and any clash is immediately possible.

*Perc DN*. This means that a percussive sound of type *Perc Child* is accompanied by a snippet from the Demo or News samples. This is controlled by a probability between 0 (= never) and 1 (= always). Start this features slowly at the very end of this part. The probability is controlled via cc 15.

## Inter

### What happens

No cycles any more. Oud draws back. Quasi solo for electronics. Oud comes back at the end, after a longer silence.

### To play

*Perc Machine*. This is now the main instrument. Gets calmer to the end of this part.

*Perc DN* also has its peak here, but it is also possible to keep it until the end.

*Canon Echo*. Still intense, but slowly decreasing.

## Cycle 17-24

### What happens

Oud comes in again and starts cycle 17 with pedal press.

The canon is now preforized and transposed.

Clash / interruption can happen either in the usual way, or by decision of the electronic player. But the sample is now a flageolet (instead of Zahak, Demo or News).

### To play

*Z/F Trigger*. The "z" key of the computer keyboard can be used in cycles 1-16 to stop a cycle by will of the electronic player.

This will usually not be used at all. But here, the same key can be used freely. A series of flageolets will be triggered, as shown in the overview on page XX. Adjust the volume via cc 4.

*Canon Echo.* Come to an end during this part, if it has not been ended before.

*Perc Machine.* Should be reduced more and more.

*Perc DN.* Will probably disappear.

## End

### What happens

Oud has come to calmness and plays the series of flageolets (see page 5). Electronics plays a mirrored series which can reach its end or not. Both partners act between progressing, staying and going back in a free way.

### To play

*Flageolets.* The MIDI keys are 54 for progress (= going down), 66 for regress (= going up) and 61 for stay. Note that the latter will add pitch deviation to the normal pitch. The sequence will start with tone 11 and then go down to 10, 9 etc.



A musical staff in treble clef showing a sequence of 11 notes. The notes are: 1 (F4), 2 (G4), 3 (A4), 4 (B4), 5 (C5), 6 (B4), 7 (A4), 8 (G4), 9 (F4), 10 (E4), 11 (D4). The notes are marked with diamond symbols and stems. A long arrow points from the right towards the 6th note (B4).

Note number	1	2	3	4	5	6	7	8	9	10	11
Pitch	F4	G4	A4	B4	C5	B4	A4	G4	F4	E4	D4

# Electronics overview

