

Introduction of Bach Library in Max/Msp

-- Introduction of a library for the Max/Msp environment named bach, by which the two elements — computer-aided composition and real-time environment can be combined. The usage and practical examples of the bach library will also be discussed.

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What is bach library?

THE BACH FAMILY



bach is the forefather of the family. It contains all the basic modules to deal with computer-aided composition in Max. It's the first and library you should download, since all the other members of the family won't even start working without *bach*.

cage contains ready-to-use modules to deal with many standard 20th- and 21st-century compositional techniques. It's a library designed for musicians: you will only deal with musically meaningful parameters, without even worrying about lower-level implementation. Because of this, cage is easier to deal with than *bach*; if visual programming with *bach* makes you nervous, you should definitely consider installing *cage* and give it a try.

dada is the newest member of the *bach* family: it contains non-standard graphical user interface for music generation and processing. *dada* is by design an open box: it is to *bach* what a laboratory is to a library. All of its components embrace a graphic, ludic, explorative approach to music; most of its components also refer to the worlds of plane geometry, physical modeling or recreational mathematics.

WHAT YOU CAN DO WITH BACH



COMPOSITION

Compose your music using *bach*: write, generate or modify your scores intuitively and interactively.

► Where to start: *cage* tutorials; "Through The Looking Glass" and "The Minimal Way" *bach* tutorials
► Related projects [here](#)



LIVE NOTATION

Create and display music on the fly for your performers, or for any other usage.

► Where to start: "Real Time Stories" *bach* tutorial
► Related projects [here](#)



EDUCATION

Build intuitive and interactive tools for music education. Tailor the amount of allowed interaction to your specific needs, have your students play with your patch and then automatically evaluate their results.

► Where to start: *bach* tutorials, "preventedit" attribute
► Related projects [here](#)



AUGMENTED SEQUENCERS

Use *bach.roll* and *bach.score* as symbolic sequencers, triggering soundfiles or DSP processes; since each note carries flexible meta-information, organized in slots, you can control and customize any meaningful sequencing.



SYNTHESIS

Use *bach.roll* and *bach.score* to control synthesis modules inside Max: put any meaningful parameter (numbers, envelopes, instructions...) inside the note slots, and retrieve them at playtime.

► Where to start: *bach* tutorials
► Related projects [here](#)



VIDEO AND LIGHTING

Sequence or generate video content in Jitter; use scores to control and automate any external Max-compatible device, such as DMX lighting scenarios or physical actuators.

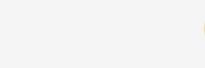
► Where to start: *bach* tutorials



CONSTRAINT PROGRAMMING

Generate data by defining the properties they should match, without writing a single line of code.

► Where to start: *bach.constraints* help file
► Related projects [here](#)



MUSIC NOTATION

bach brings music notation inside Max. You can generate, edit, script, modify and play your scores either with mouse and keyboard or through patching. Any Max audio module can be easily driven.



REACTIVE PARADIGM

bach is a true citizen of Max, perfectly incarnating its real-time paradigm. Interact with scores in a reactive way, as you would with sounds or images! From simple recording to complex processing, a new world of symbolic treatments is at the end of your fingertips.



A FAMILY OF TOOLS

bach is the head of a family of libraries which share their core philosophy and basic working principles. Each library in the growing *bach* family focuses on some particular aspects of reactive symbolic composition: *cage* and *dada* are already available.

Easily process score parameters

How to convert sound to musical score with *bach.library*?

How to quickly generate music or music score from simple ideas?

How to make music and music score in real time?



ANALYSIS

Segment and analyze scores in real-time or off-line. Organize your scores in a database, and display it.

► Where to start: *dada.segment* and *dada.catart* help files
► Related projects [here](#)



METASCORES

Build scores where each note is a complex process in itself; display process information dynamically and render audio or symbolic result properly (both at playtime and off-line).

► Where to start: *cage.meta.engine* help file
► Related projects [here](#)

How to process score parameters in Bach Library?

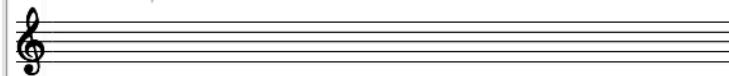
Max /Msp bach library

Adding a chord in bach.roll

You can add musical content directly via mouse and keyboard.

The simplest way to introduce a chord in bach.roll is to Cmd+click (mac) or Ctrl+click (win)

The created chord will contain a single note, positioned on the click point,



You can change a note's pitch by clicking on it and dragging up or down.

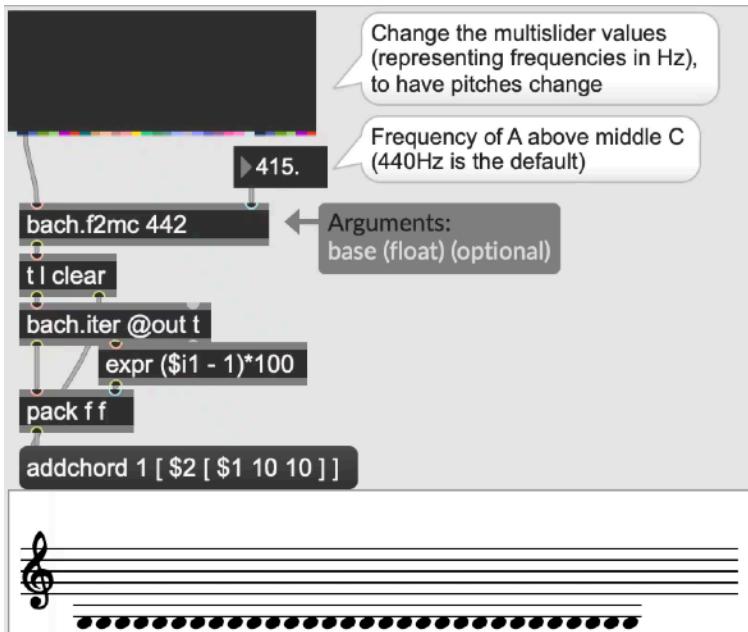
You can modify the chord onset by clicking on a notehead and dragging left or right.

Keep shift pressed if you want to either move vertically or move horizontally

Once you've added a note, you can build a chord out of it by duplicating it vertically.

Shift+Alt+click on the notehead and drag up or down, to create a new note in the same chord

Or simply Alt+click on the notehead and drag it to copy it elsewhere, in a new chord



Adding a chord in bach.roll

The "addchord" message is probably the most important message in order to create content inside a bach.roll. It adds a single chord, whose gathered syntax has to be given as argument.

`addchord [1000 [6100 1000 50]]`

Add a chord having onset 1000 and a single note (pitch 6100 midicents, duration 1000 ms, velocity 50)

`addchord 2 [1000 [6100 1000 50]]`

Optional argument before the chord gathered syntax is the voice number. Here we add the same chord at the second voice.

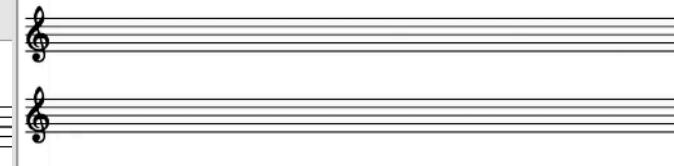
`addchord 1 [300 [6000 500 120] [7000 500 120]]`

Add a chord with two notes

`addchords [[217, [7185, 492, 100], [971, [6057, 492, 100], [1665, [7157, 492, 100]]]]]`

click on the chord to check elements (pitch 6100 midicents, duration 1000 ms, velocity 50)

You can give all the chords gathered syntaxes as argument. The list will essentially result as the gathered syntax received or output by bach.roll's first inlet or outlet



Bach.f2mc

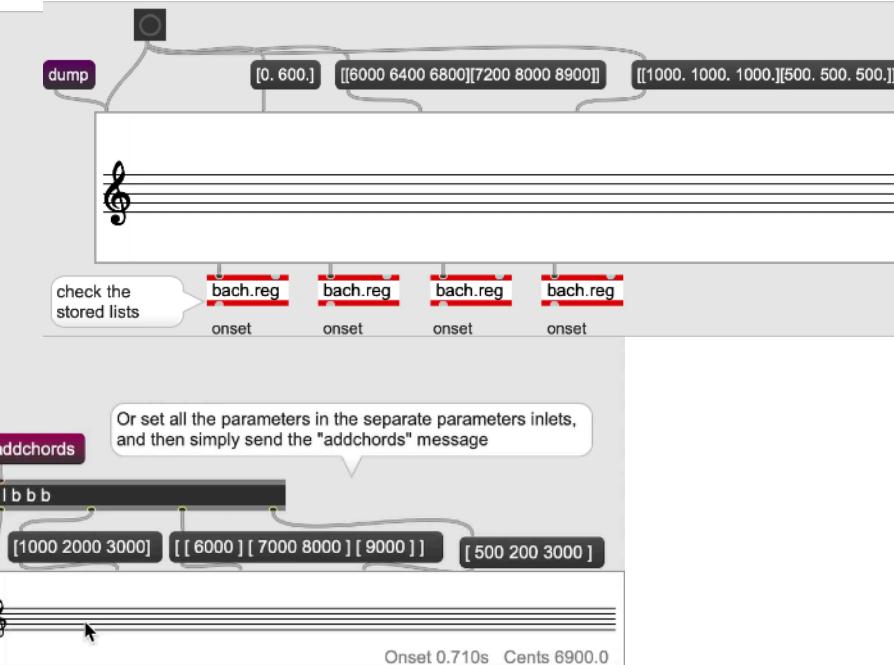
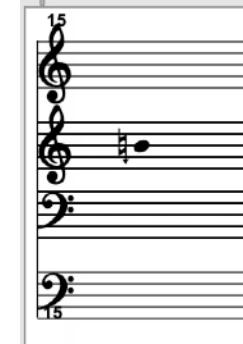
Convert frequency to midicent

488.

Drag the number box to see the pitch of the note change

`bach.f2mc @out t`

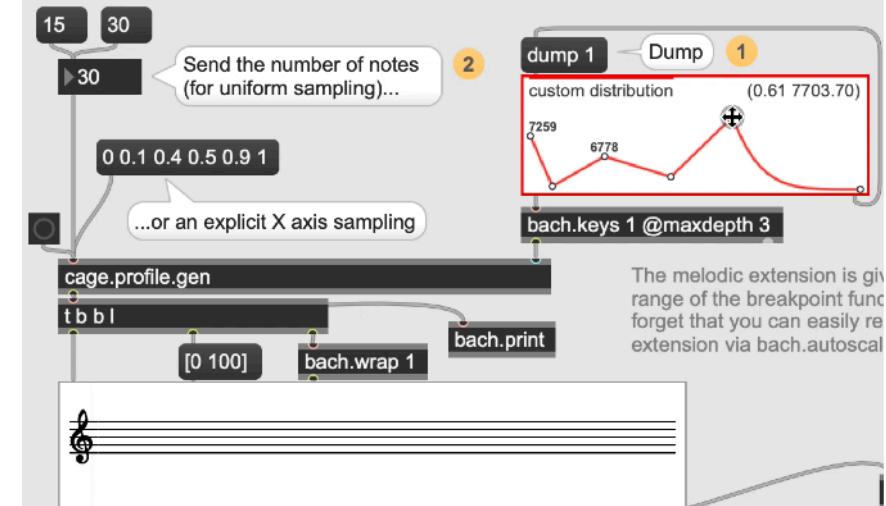
`clear, addchord 1 [0 [$1 10 10]]`

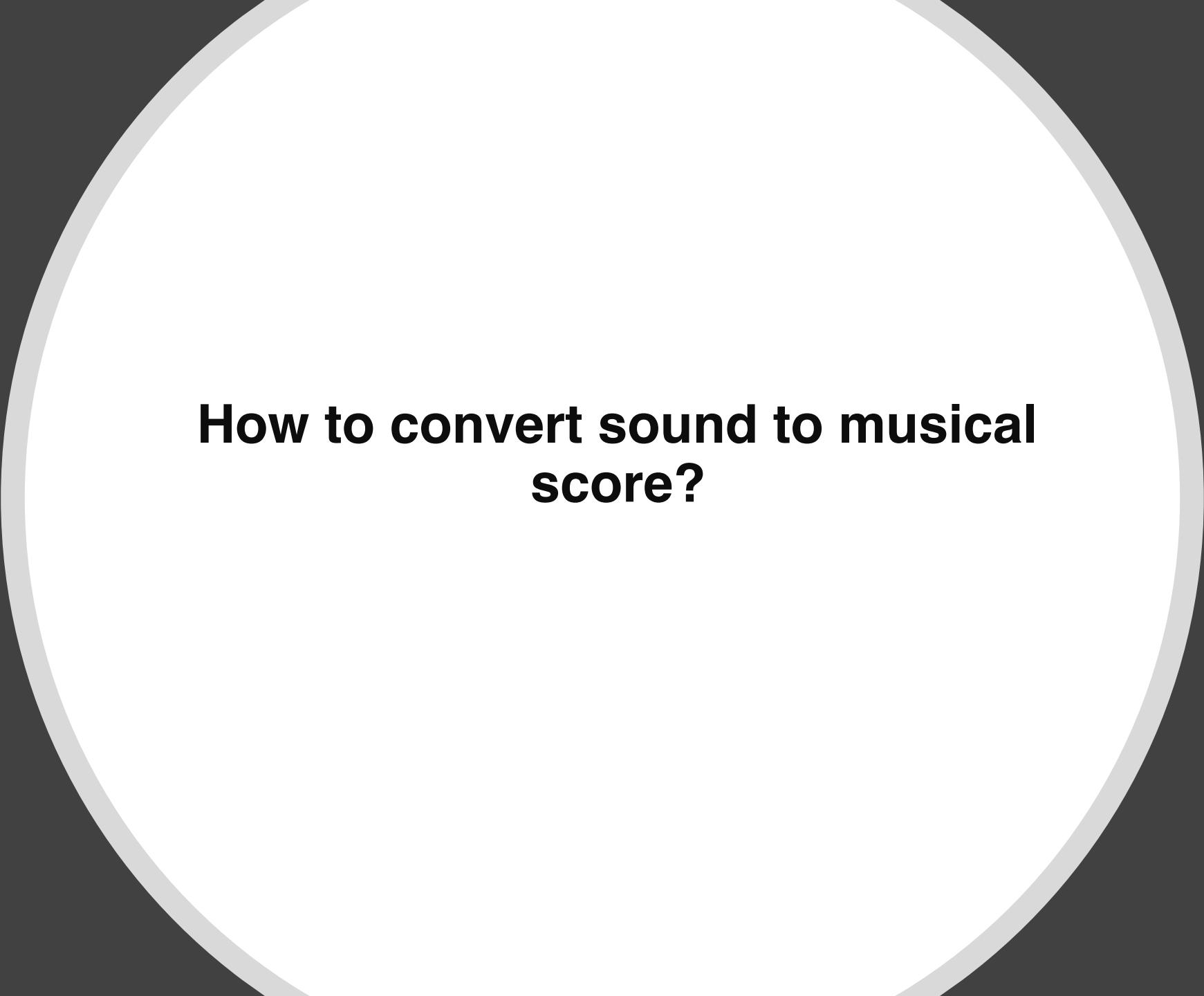


cage.profile.gen

Generate pitch profiles

Generate a melodic profile starting from a pitch breakpoint function.





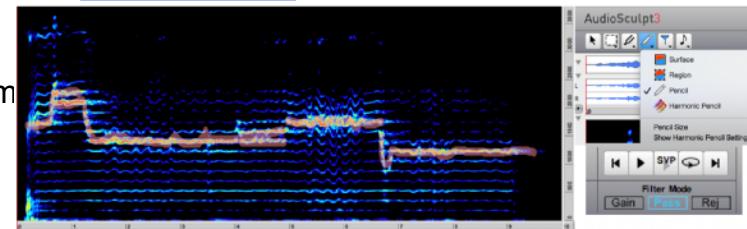
**How to convert sound to musical
score?**

Introduction about partial tracking analysis

<http://support.ircam.fr/docs/AudioSculpt/3.0/co/Partial%20Tracking%20Analysis.html>

The partial tracking analysis is a technology that allows to detect and visualize the partials of a sound. The analysis can apply either to harmonic sounds – whose partials frequencies are the produce of a common fundamental frequency with an integer – or to inharmonic sounds. This technique can be used in software such as AudioSculpt and OpenMusic .

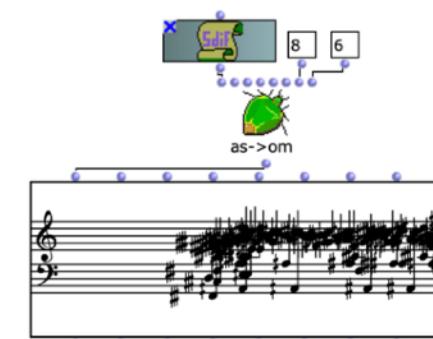
AudioSculpt



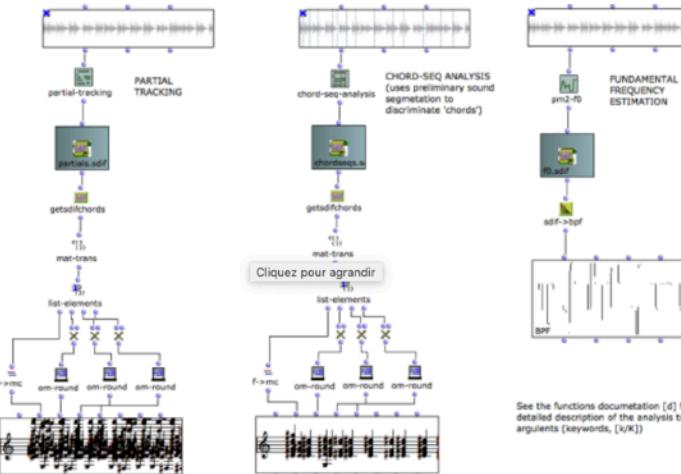
In the AudioSculpt, a group of partials can be easily selected or filtered with a pencil. The pink part is the selected partials.

It can be analyzed by the tracking analysis function, and can be saved in SDIF format files. It can then be imported and converted into music scores.

OpenMusic



OM-pm2 library



<http://support.ircam.fr/docs/om-libraries/main/co/OM-pm2.html>

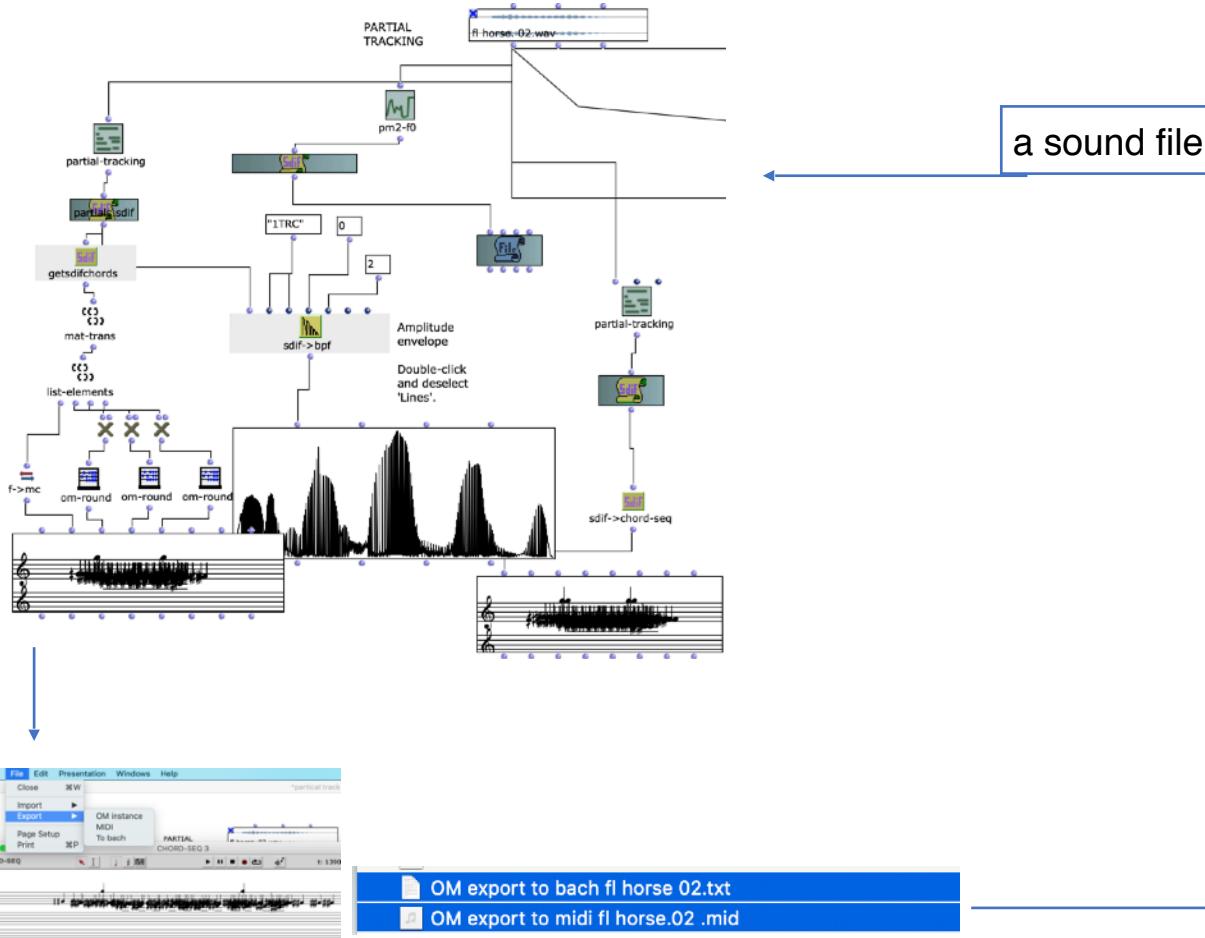
The newly developed OM-pm2 and OM-superVP libraries in OpenMusic also allows to perform additive analysis and extract the partials from audio files using the pm2 sound processing kernel.

It can also performs the "chord-seq" analysis, which extracts the main partial as chords with given time intervals.

**How to convert sound to musical
score with bach. library?**

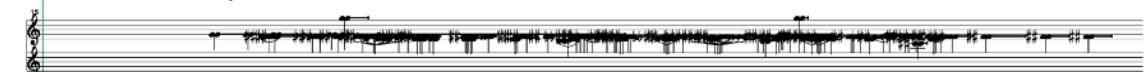
Openmusic

We can use partial tracking analysis function in OpenMusic to convert sound files to music score and save them as text files or midi files

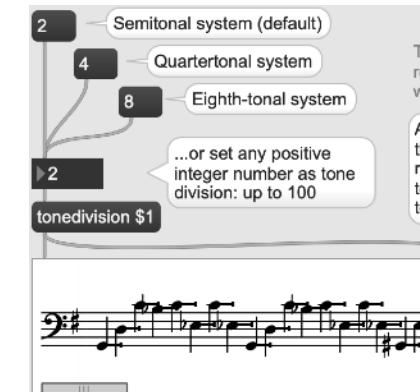
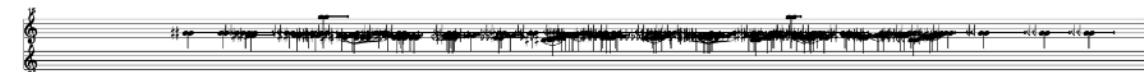


Max /Msp Bach library

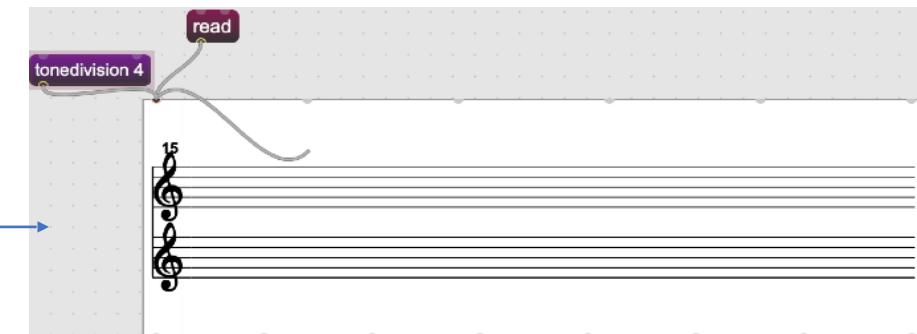
Midi file import



Text file import



MIDI files can be read by `bach.roll` (but not by `bach.score`: see `#midi+quantize` to know how to handle this case) by simply opening them with the "read" message.



Modify Score Parameters

Onset

step1 press here
read @markmeasures 1
score size
step2 dump

Pitch

2.5
bach.mapelem @maxdepth 2
bach.print
bach.wrap 1
bach.mapelem @maxdepth -2
bach.print
bach.flat 1
bach.length -2
bach.length
bach.length

Duration

Read here !!!
Remove the same elements from each group
bach.mapelem @maxdepth 2
bach.flat 1
bach.thin
bach.wrap 1
bach.mapelem @maxdepth -2
bach.flat 1
bach.length -2
bach.length
bach.length

ORIGINAL SCORE

NEW SCORE

Press quantize

所有数字 \times n = 所有音的 duration \times n

所有数字 \times n = 所有音的 onset \times n

所有数字 \times n = 所有音的 pitch \times n

所有数字 \times n = 所有音的 velocity \times n

Pitch List

Duration List

Velocity List

Each group has 2 same values, or 2 sets of same values

Pitch Control

Perform operations on each element
Remove the same elements from each group
 bach.mapelem @maxdepth 2
 bach.flat 1 @out t
 bach.thin @out t
 bach.wrap 1 @out t
 check max window

Remove the same elements from each group
 Reduce each pair of parentheses
 bach.print: a b c a b c b
 bach.print: 900 900
 bach.print: 567 567 567

Default, bach.flat erases all levels of parenthesis.
We can narrow the scope of bach.flat by using the "maxdepth" and "minlevels" attributes.
 bach.flat从列表中删除重复元素
 bach.thin将列表的深度增加到0
 bach.wrap将列表的深度增加到2倍
 bach.wrap
 bach.collect
 1
 bach.flat 1
 bach.length
 85.

Duration Control step 2

Different method to multiply the list by a number, in order to adjust the entire list
 bach.iter @out t
 * 1.
 2.5
 1
 bach.collect
 bach.flat 1
 bach.length
 85.

The bach.collect is always connected with bach.iter. to perform iterative operations on lists.

Retures the length of the list (the number of elements in the list), it is a very important concept

Modify Score Parameters

Onsets

Pitches

Duration

step1 press here
read @markmeasures 1
score size
step2 dump

Onset

1. step3 Adjust onset
p
bach.wrap 1
p dump onset
bach.length ►85.

Pitch

Remove the same elements from each group
bach.mapelem @maxdepth 2
bach.print
bach.mapelem @maxdepth -2
bach.print
bach.flat 1
bach.thin
bach.wrap 1
bach.flat 1
bach.length -2
bach.length
bach.length ►85.

Duration

Read here !!!
p read the description
Remove the same elements from each group
bach.mapelem @maxdepth 2
bach.flat 1
bach.thin
bach.wrap 1
bach.mapelem @maxdepth -2
bach.flat 1
bach.length -2
bach.length
bach.length ►85.

所有数字 x n = 所有音的 duration x n

1. step3 Adjust duration
Multiply the list by a number, to adjusted the entire list
bach.flat 1
bach.length
bach.wrap 1
p dura control
bach.flat 1
bach.length
bach.length
bach.length
bach.length ►85.

step4

ORIGINAL SCORE

Onset 0.526s Cents 5250.0

NEW SCORE

Press quantize

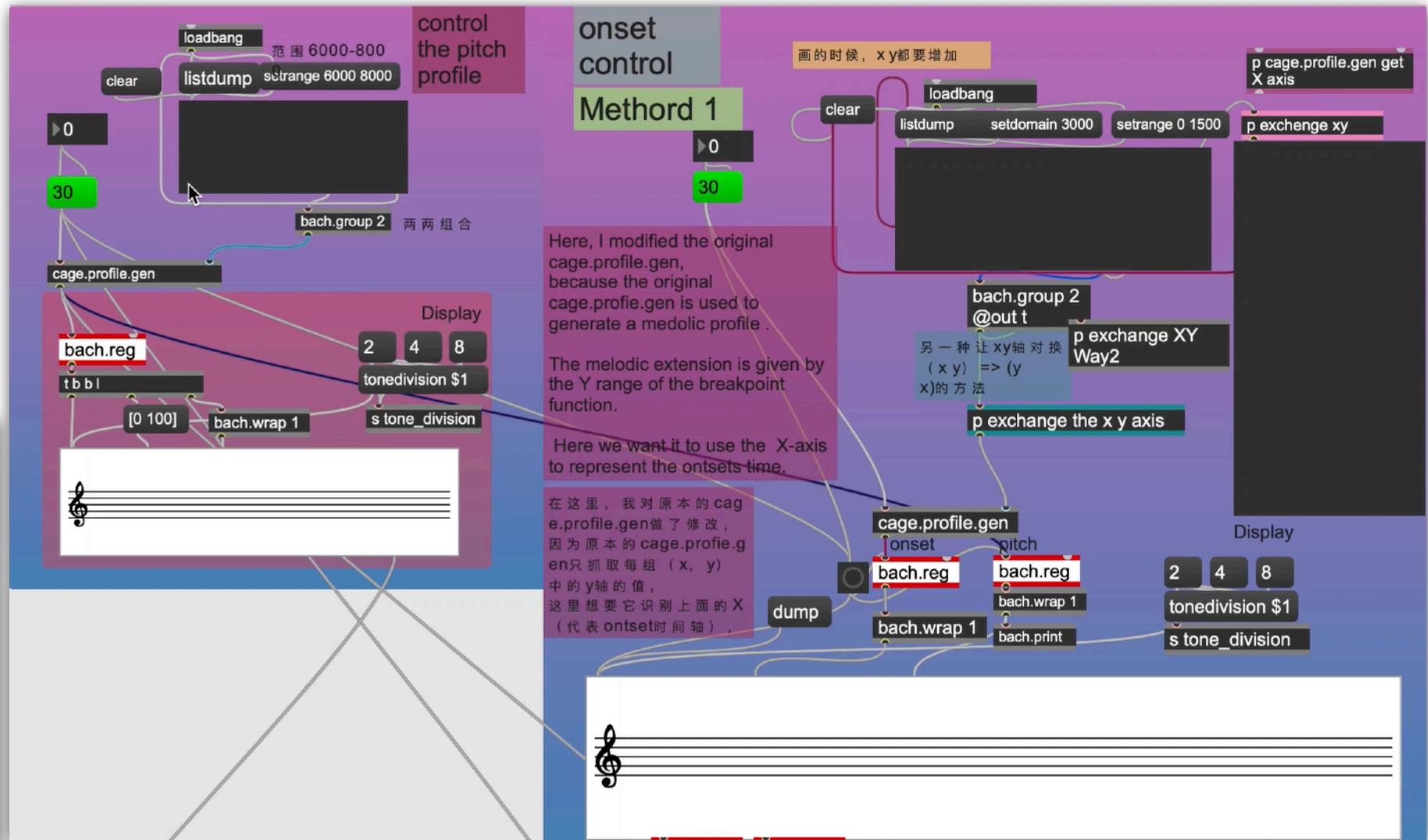
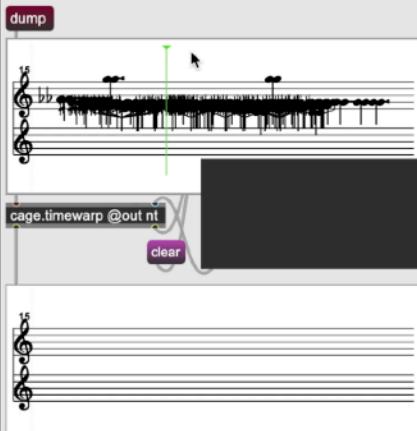
**Try some other methods to control
parameters in Bach Library**

Time control

cage.timewarp

Perform temporal distortion

cage.timewarp can perform a temporal distortion of a roll based upon a function (through a lambda loop) or a set of markers.



Method 2

onset control

Automatically generate a new onset based on the distance ratio between input points

1

step1

Enter a few points, then entire onsets will be adjusted automatically according to the proportion of the distance between the input points

Use it to split the whole music score into several sections, or to control the profile of the onsets

输入几个点，之后，整组 onset 会按照输入的点之间的距离比例自动进行调整

step 3

Press!!!



3

clear

6

第一歩：整体音乐分段

6

Up to 6 sections

bach.length

30

Original onset list

原来的、密密麻麻的 onset list
30.228758 130.228758 230.228758 330.228758 430.228758
530.228758 630.228758 730.228758 830.228758 930.228758
1030.228758 1130.228758 1230.228758 1330.228758
1430.228758 1530.228758 1630.228758 1730.228758
1830.228758 1930.228758 2030.228758 2130.228758
2230.228758 2330.228758 2430.228758 2530.228758
2630.228758 2730.228758 2830.228758 2930.228758

bach.flat

0.

bach.reg

0

bach.wrap 1

0.

可以在这里调整整体 onset 的长短比例

Multiply the list by a number, to adjusted the entire list

1.54 655.54

843.98 1021.33

1276.28 1409.30

1497.97 1642.07

1775.09 1897.02

1985.70 2930.23

original score

got first onset control from 1

You only need to draw an idea,

1

step1

第一步：整体音乐分段

Enter a few points, then entire onsets will be adjusted automatically according to the proportion of the distance between the input points

clear

Press!!!



Up to 6 sections

4

step2

0.

可以在*这里*调整整体 onset 的长短比例

Multiply the list by a number, to adjusted the entire list

original score

got first onset control from 1

I have only set up to 6 sections, of course there can be more sections

New onset range for each section

28.12	1297.79
1582.82	1738.29
2049.23	2567.46
2671.11	2930.23

各组 onset 的新的范围

1

step1

第一步：整体音乐分段

Enter a few points,
then entire onsets will be adjusted automatically
according to the proportion of the distance
between the input points

clear

Press!!!



Multiply the list by a number,
to adjusted the entire list

Up to 6
sections

4

step2

2.

New onset range for
each section

各组 onset 的新的范围

0.00	1062.07
2073.80	2662.02
3814.92	4497.25
5673.69	6214.85

original score

Onset 0.897s Cents 7150.0

got first onset control from 1

3

Get the final
resultLast
Press!!

quantize
Click here to
quantize!

= 60

15 2 3 4 5 6 7 8 9 10 11 12

2

Adjust onsets of each group

第二步：每组音 onset控制

Group1

step1

Enter a few points here,
number of points is unlimited

6

clear

step 3



Group2

3

step1

clear

step 3



Group 3

4

step1

clear

step 3:



Group 4

3

step1

clear

step 3:



Group 5

0

step1

clear

step 3:



Group 6

0

step1

clear

step 3:



3

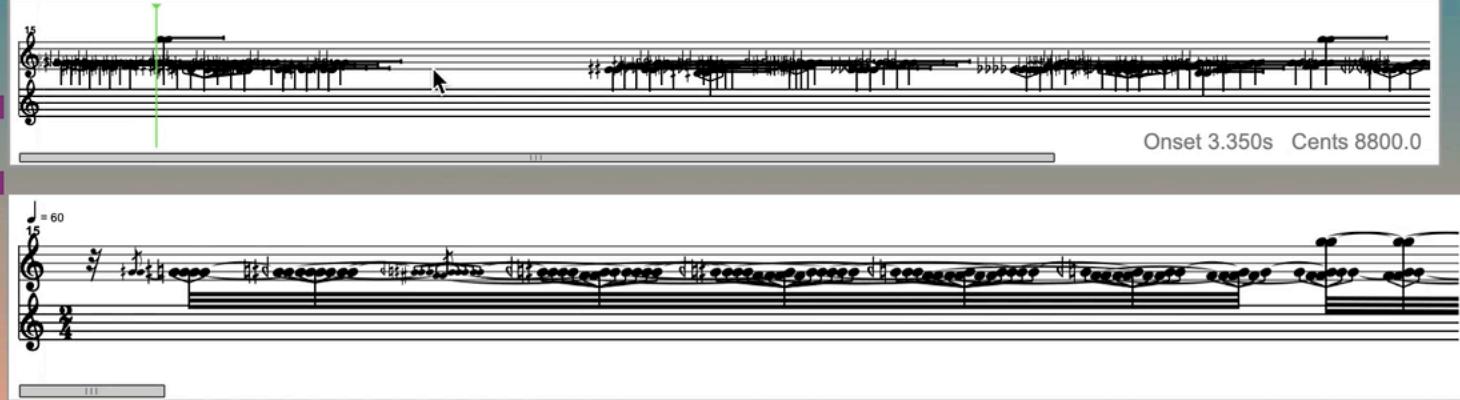
Get the final result

Last Press!!



quantize

Click here to quantize!



1

Onset Multiply

1.



Adjust duration here! !

Duration Multiply 0.01

2

3

Open here to adjust the quantize elements

then press quantize !!

p quantize

p merge

Group 6

step1

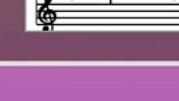
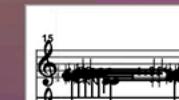
clear

2

step2

0.

step 3:



a sound file



score image.png

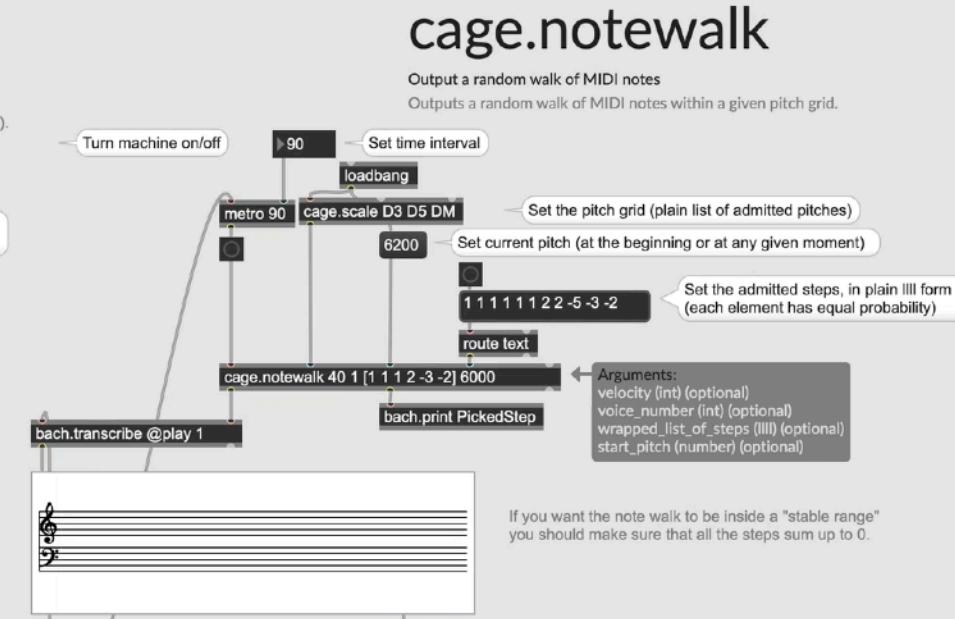
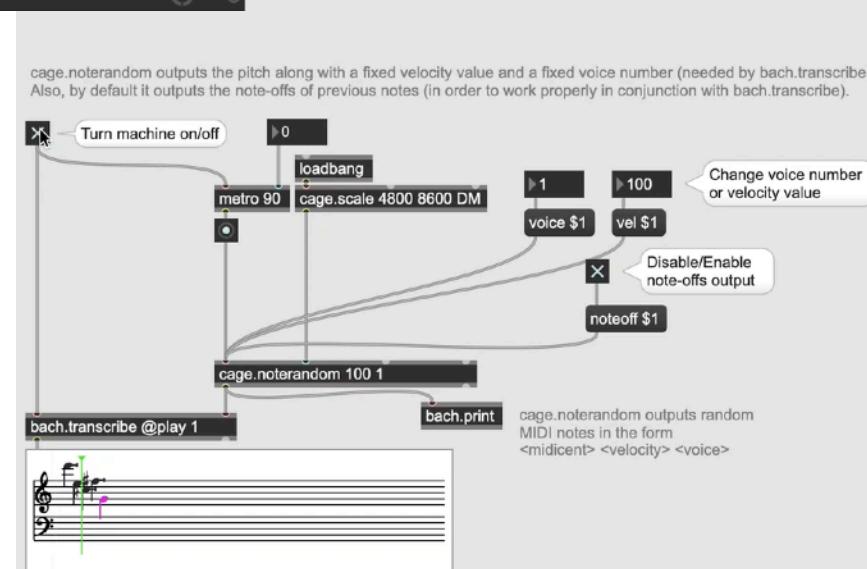
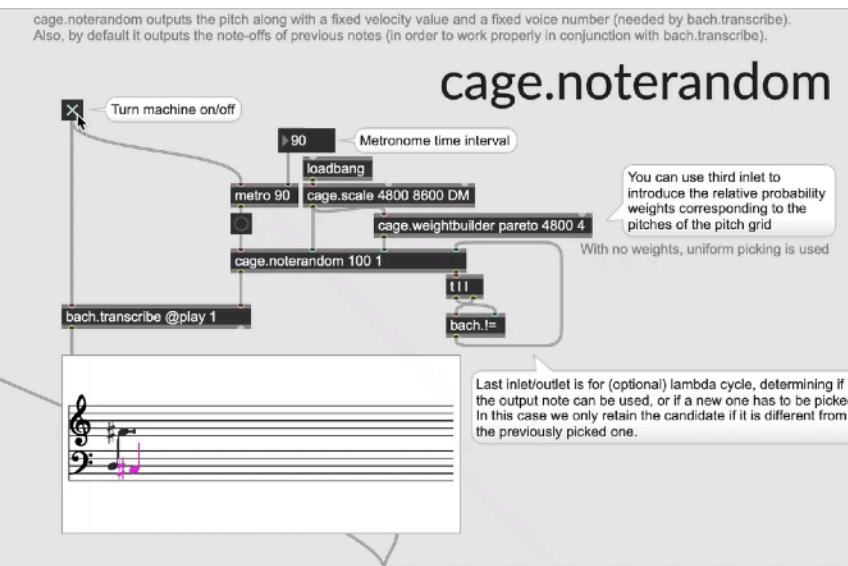
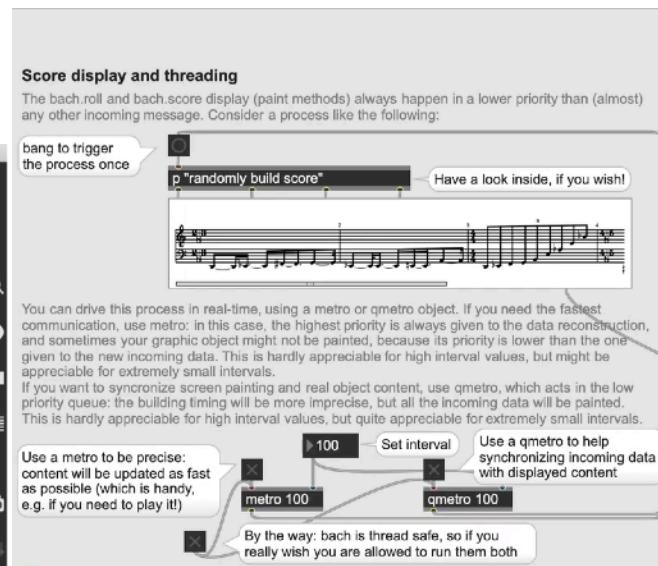
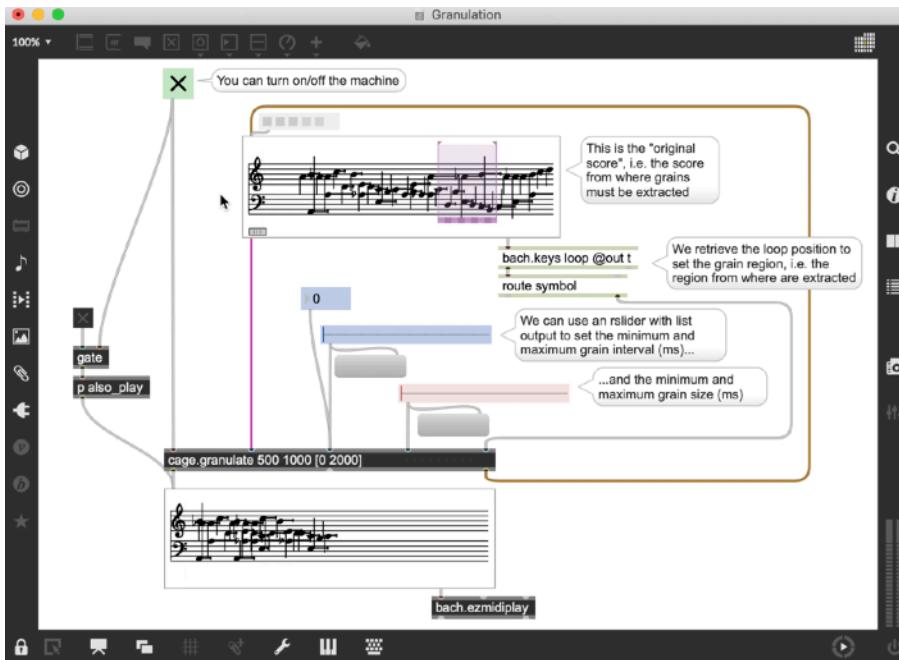
15 60

15 6 7 8 9

15 10 11 12 13 14

15 15 16 17

Various methods for real time composition in Bach Library



Thank you!!!
Jie Man