

The Physical Model as Metaphor for Musical Creation

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ACROE - ICA
Grenoble - FRANCE

(INPG / UJF / Ministère de la Culture)

The Physical Model as Metaphor for Musical Creation

- to compose WITH Physical Models
- 'pico..TERA' is a piece entirely made with a unique complex Physical Model of a 'virtual orchestra'

CORDIS-ANIMA and GENESIS

- a Language to model and to simulate physical objects
- a user Interface to create music with CORDIS-ANIMA

see also...

PAPER SESSION 19 - Physical Modeling 4
Chamber Music Hall (A302)
11.30-12.00
Nicolas Castagne, Claude Cadoz
GENESIS: A Friendly Musician-Oriented Environment for Mass-Interaction Physical Modeling

CORDIS-ANIMA and GENESIS

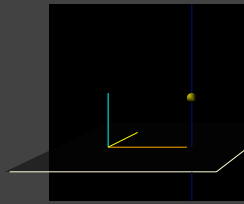
elementary objects / physical interactions

MAS			RES
SOL			FRO
CEL			REF
			BUT
			LNL
			SOX

CORDIS-ANIMA and GENESIS

elementary objects / physical interactions

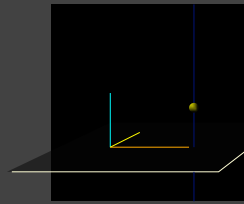
MAS



CORDIS-ANIMA and GENESIS

elementary objects / physical interactions

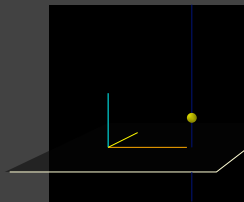
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CORDIS-ANIMA and GENESIS

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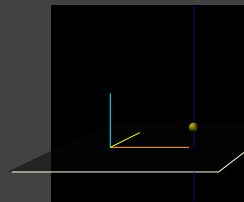
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CORDIS-ANIMA and GENESIS

elementary objects / physical interactions

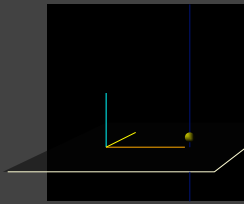
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CORDIS-ANIMA and GENESIS

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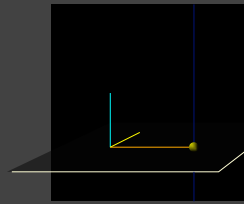
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CORDIS-ANIMA and GENESIS

elementary objects / physical interactions

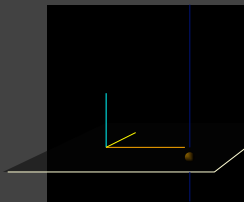
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CORDIS-ANIMA and GENESIS

elementary objects / physical interactions

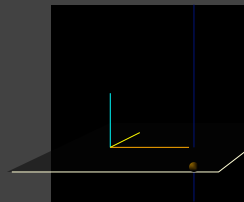
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CORDIS-ANIMA and GENESIS

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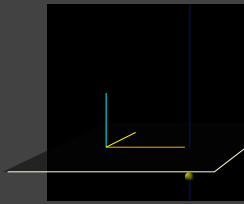
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CORDIS-ANIMA and GENESIS

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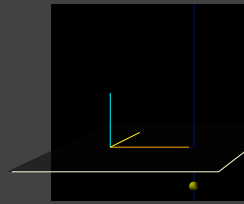
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CORDIS-ANIMA and GENESIS

elementary objects / physical interactions

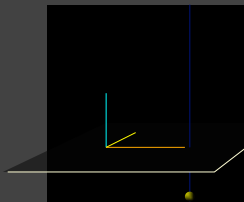
MAS



CORDIS-ANIMA and GENESIS

elementary objects / physical interactions

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CORDIS-ANIMA and GENESIS

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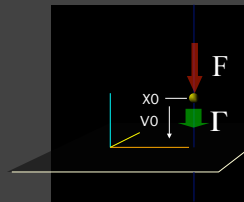


M

X0

V0

$$\Gamma = F/M$$



CORDIS-ANIMA and GENESIS

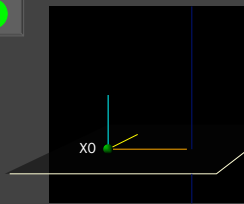
elementary objects / physical interactions

SOL



X0

Fixed Point



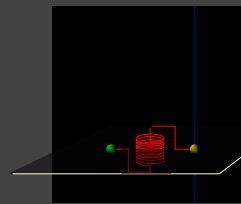
CORDIS-ANIMA and GENESIS

elementary objects / physical interactions



RES

K



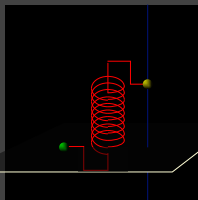
CORDIS-ANIMA and GENESIS

elementary objects / physical interactions



RES

K



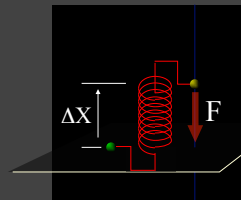
CORDIS-ANIMA and GENESIS

elementary objects / physical interactions



RES

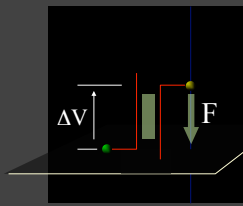
K



$$F = - K \cdot \Delta X$$

CORDIS-ANIMA and GENESIS

elementary objects / physical interactions



	FRO
	Z

$$F = - Z \cdot \Delta V$$

CORDIS-ANIMA and GENESIS

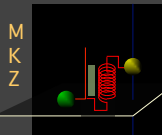
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CORDIS-ANIMA and GENESIS

elementary objects / physical interactions

CEL			REF
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CORDIS-ANIMA and GENESIS

elementary objects / physical interactions

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CORDIS-ANIMA and GENESIS

elementary objects / physical interactions

	BUT
	LNL
	SOX




Com-position / Generation...

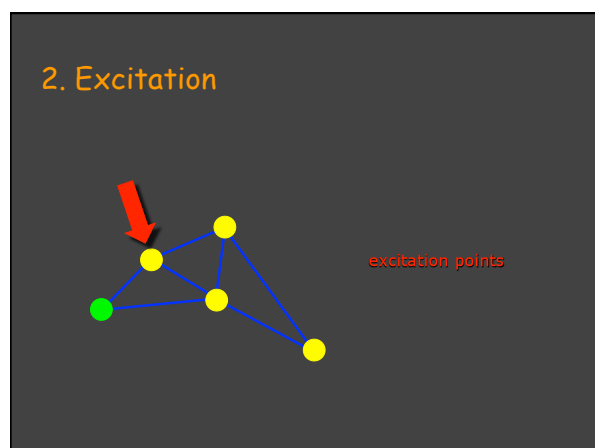
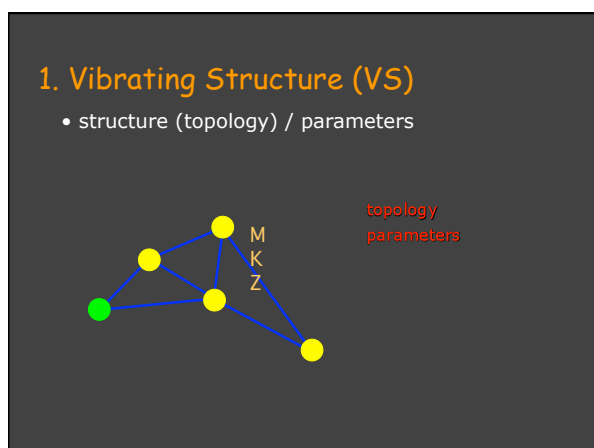
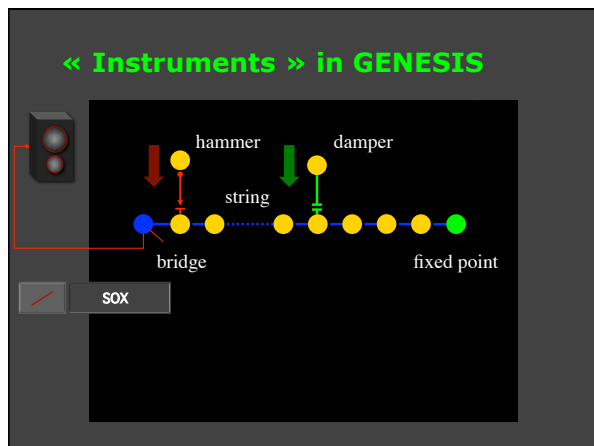
- compose
in French: *com-poser* (put together)
the link between elements can be arbitrary
- ≠ generate
the link between elements is determined
by rules or processes

Composition / Generation...

	Instruments	Events	Sounds
composition			
generation			

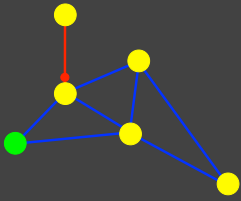
Composition / Generation...

	Instruments	Events	
composition			
generation			



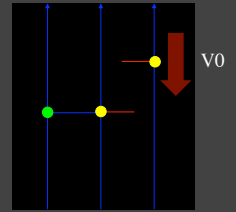
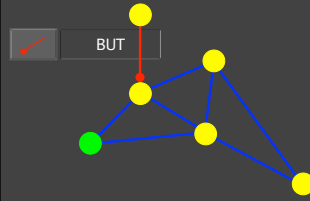
2. Excitation

- to strike



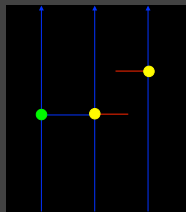
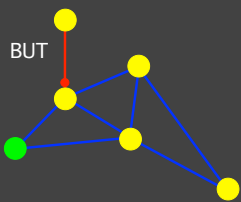
2. Excitation

- to strike (BUTée)



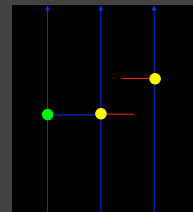
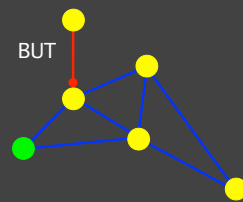
2. Excitation

- to strike (BUTée)



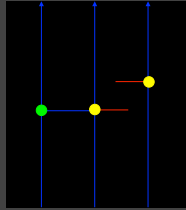
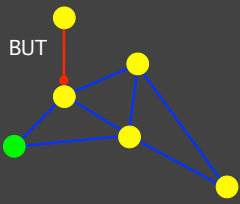
2. Excitation

- to strike (BUTée)



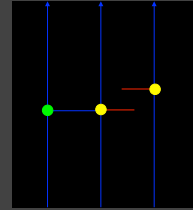
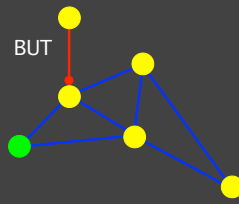
2. Excitation

- to strike (BUTée)



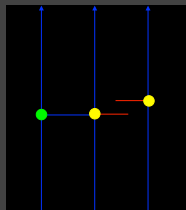
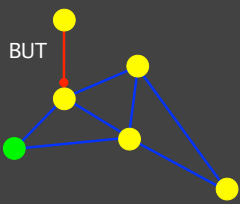
2. Excitation

- to strike (BUTée)



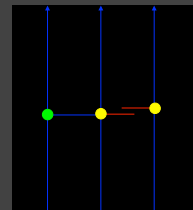
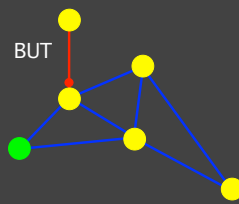
2. Excitation

- to strike (BUTée)



2. Excitation

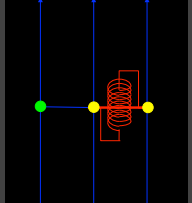
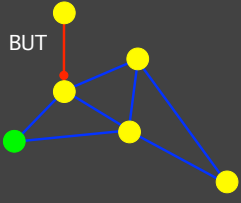
- to strike (BUTée)



2. Excitation

- to strike (BUTée)

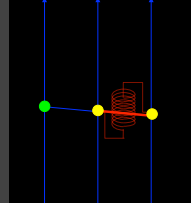
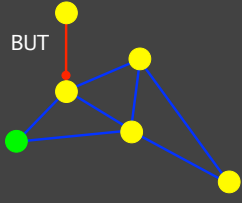
BUT



2. Excitation

- to strike (BUTée)

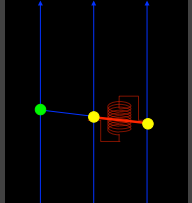
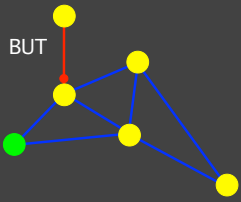
BUT



2. Excitation

- to strike (BUTée)

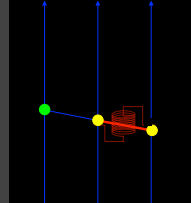
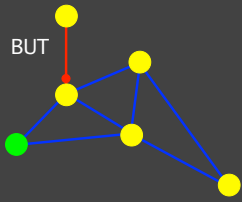
BUT



2. Excitation

- to strike (BUTée)

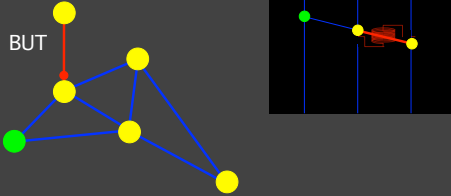
BUT



2. Excitation

- to strike (BUTée)

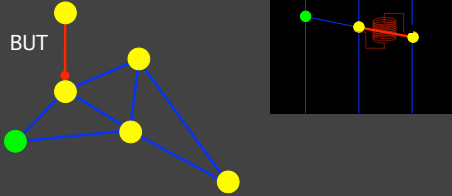
BUT



2. Excitation

- to strike (BUTée)

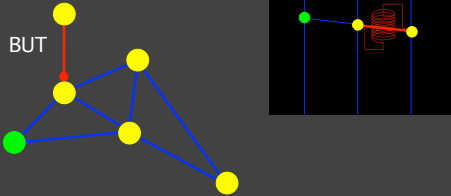
BUT



2. Excitation

- to strike (BUTée)

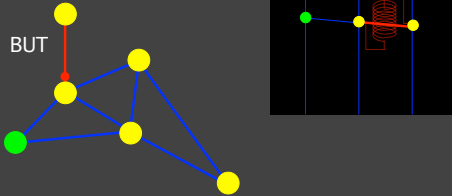
BUT



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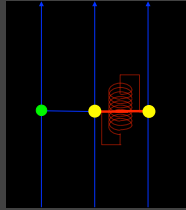
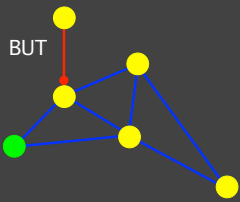
- to strike (BUTée)

BUT



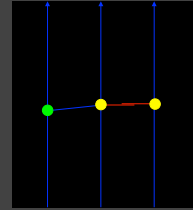
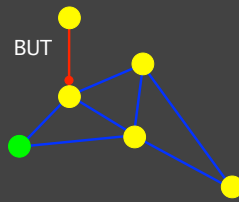
2. Excitation

- to strike (BUTée)



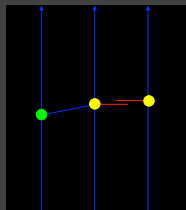
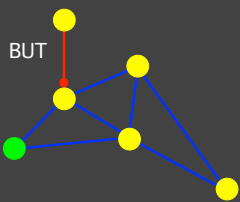
2. Excitation

- to strike (BUTée)



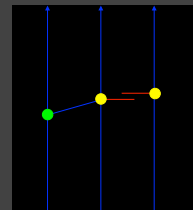
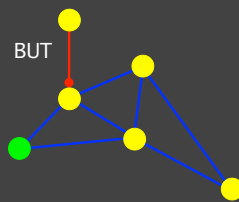
2. Excitation

- to strike (BUTée)



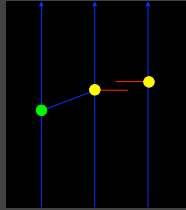
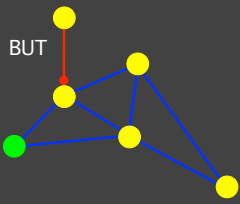
2. Excitation

- to strike (BUTée)



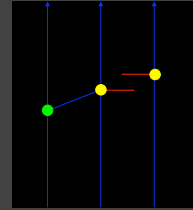
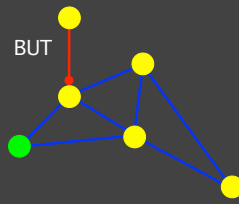
2. Excitation

- to strike (BUTée)



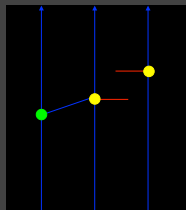
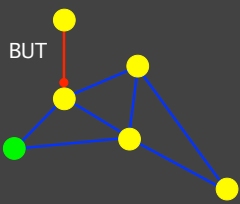
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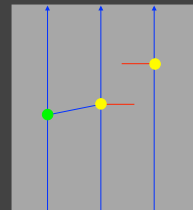
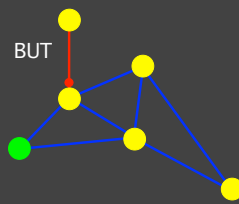
2. Excitation

- to strike (BUTée)



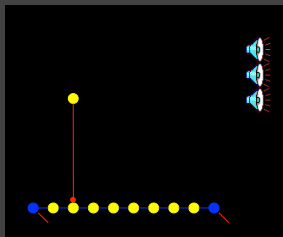
2. Excitation


- to strike (BUTée)



to strike various Vibrating Structures

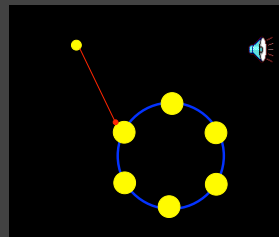
- a short string



 K=0.01
K=0.04
K=0.005

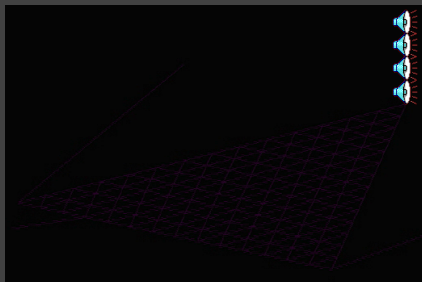
to strike various Vibrating Structures


- a ring



to strike various Vibrating Structures

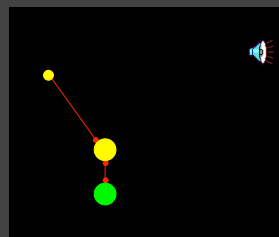
- a triangular plate



 size 1
size 2
size 3
size 4

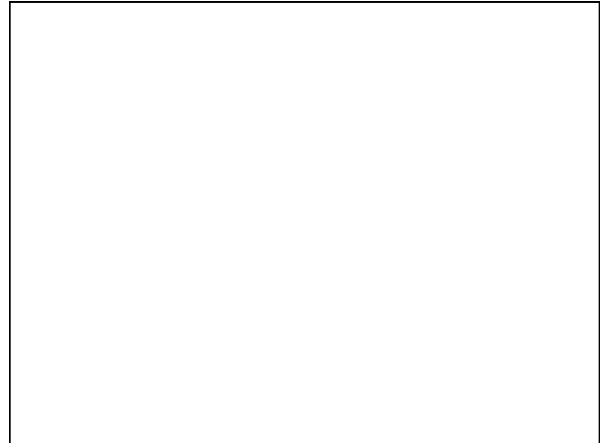
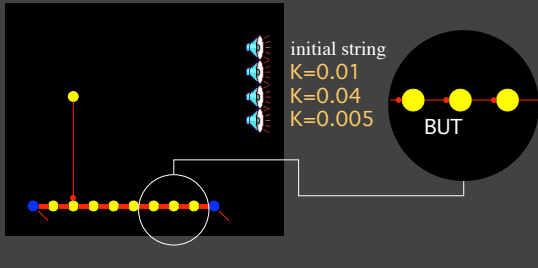
to strike various Vibrating Structures

- a water drop



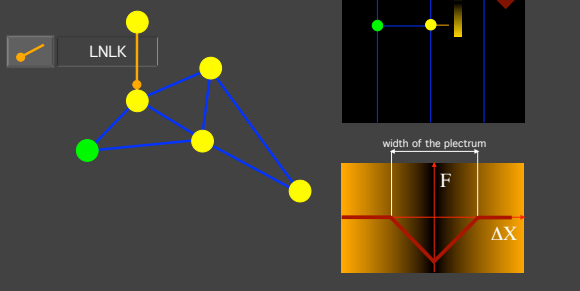
to strike various Vibrating Structures

- a set of particles in a pipe



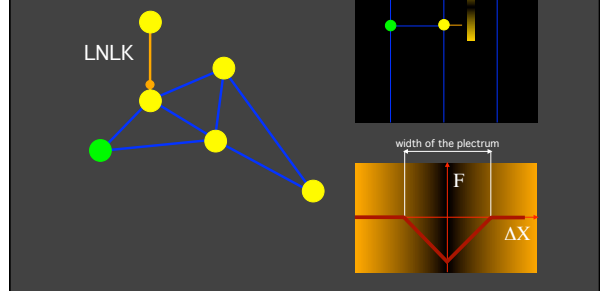
2. Excitation

- to pluck (LNLK)



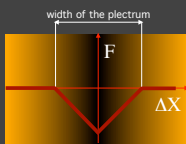
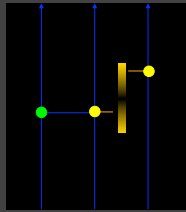
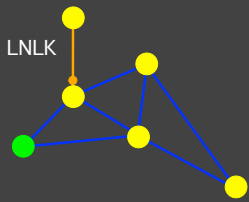
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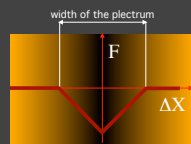
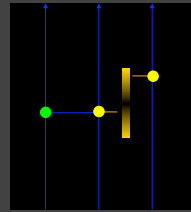
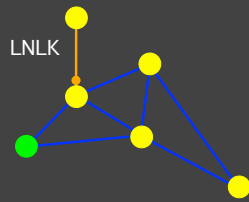
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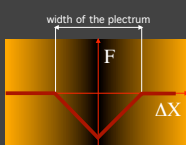
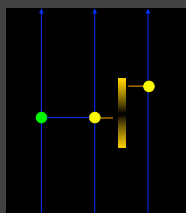
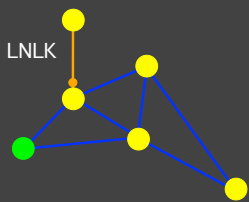
2. Excitation

- to pluck (LNLK)



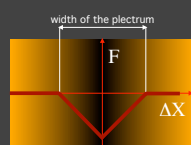
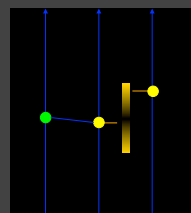
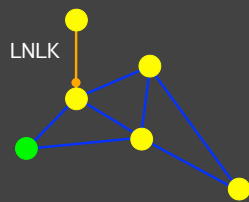
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The diagram shows a triangular lattice of nodes connected by blue lines. A green node is at the bottom left, and a yellow node is at the top left. A vertical orange line is labeled 'LNLK'. To the right, a string instrument bridge is shown with a green dot on the left and a yellow dot on the right. Below the bridge, a triangular spectrum is shown with a red line forming the base. The height of the triangle is labeled 'F' and the width of the base is labeled ' ΔX '. The text 'width of the plectrum' is written above the spectrum.

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- to pluck (LNLK)

LNLK

width of the plectrum

F

ΔX

2. Excitation

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LNLK

width of the plectrum

F

ΔX

2. Excitation

- to pluck (LNLK)

LNLK

width of the plectrum

F

ΔX

2. Excitation

- to pluck (LNLK)

LNLK

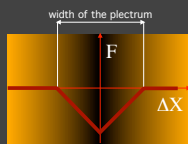
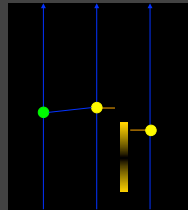
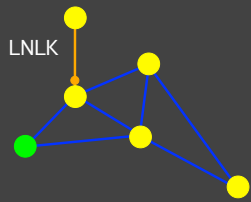
width of the plectrum

F

ΔX

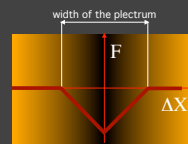
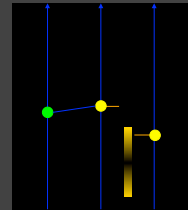
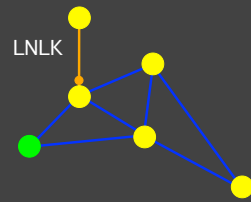
2. Excitation

- to pluck (LNLK)



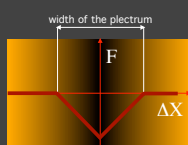
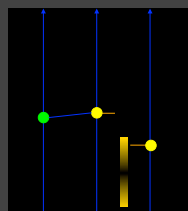
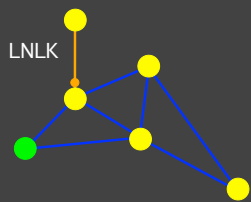
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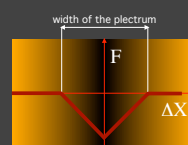
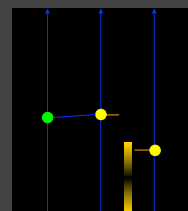
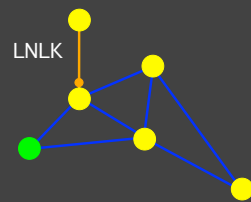
2. Excitation

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The diagram shows a network of nodes and edges. A path of nodes is highlighted in orange and labeled 'LNLZ'. A green node is also highlighted. To the right, a graph plots force F against displacement ΔV , showing a characteristic hysteresis loop with a peak and a drop. Above this graph, a vertical bar with a yellow dot and a red arrow pointing down illustrates the state of the system.

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The diagram shows a network of nodes (one green, five yellow) connected by blue lines. A vertical bar is positioned between the green node and the yellow nodes. Below the network is a graph with a horizontal axis labeled ΔV and a vertical axis labeled F . The graph shows a blue curve that starts at a negative value, crosses the zero line, reaches a positive peak, and then returns to zero.

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The diagram shows a network of nodes and edges. A green node is connected to a yellow node, which is labeled "LNLZ". This yellow node is further connected to a network of other yellow nodes. To the right, there is a graph with a vertical axis labeled "F" and a horizontal axis labeled " ΔV ". The graph shows a blue curve that starts at a negative value, crosses the zero line, reaches a positive peak, and then returns to zero. Above the graph, there is a schematic of a vertical bar with a horizontal line passing through it, and a yellow dot on the right side of the bar.

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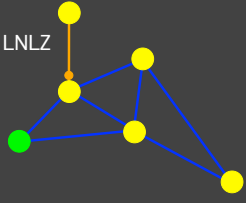
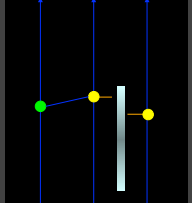
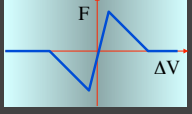
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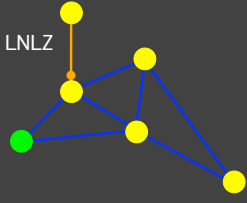
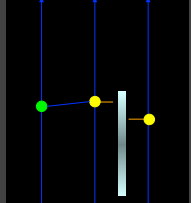
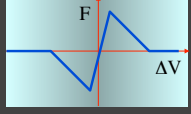
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- to bow (LNLZ)

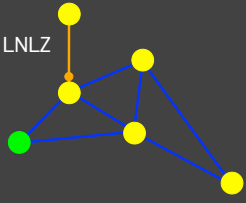
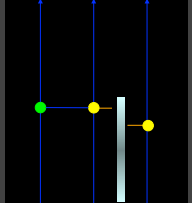
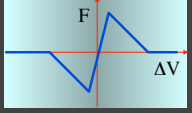
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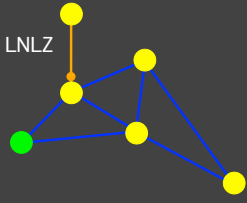
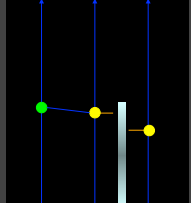
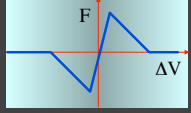
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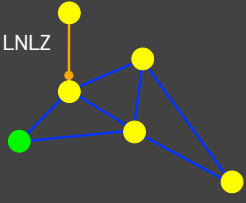
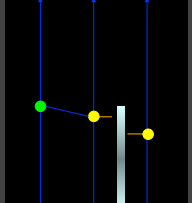
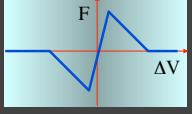
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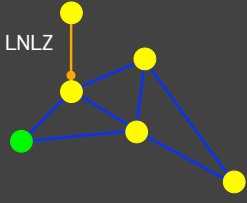
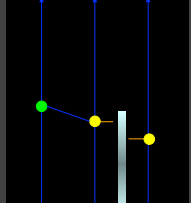
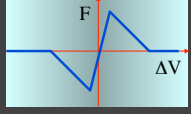
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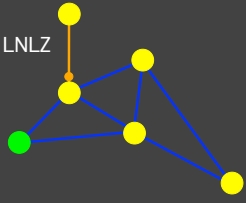
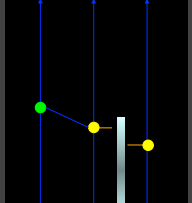
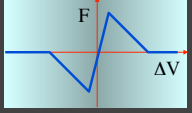
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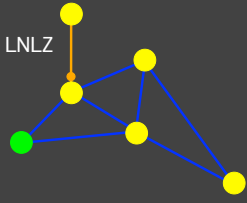
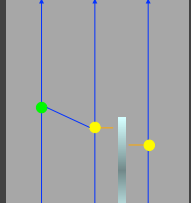
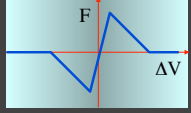
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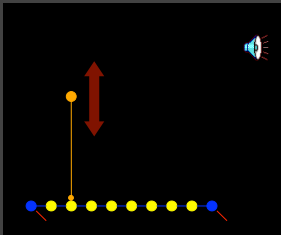
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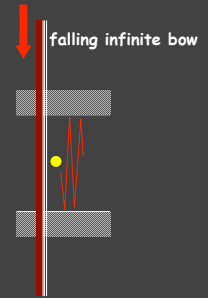
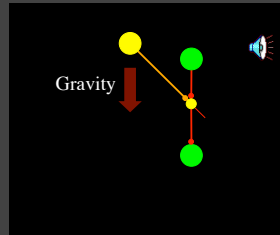
to bow various Vibrating Structures

- a string



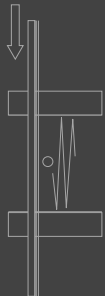
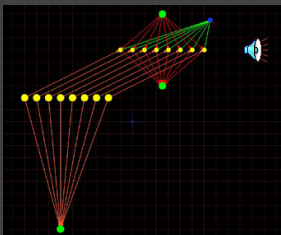
to bow various Vibrating Structures

- a strange **Zigoto**



to bow various Vibrating Structures

- a set of 8 strange **Zigoto**

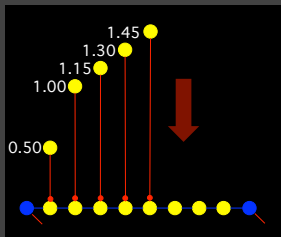


Composition / Generation...

	Instruments	Events
composition		
generation		

Composition of events / Generation...

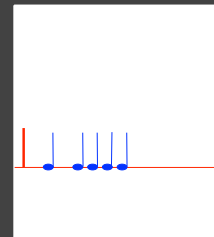
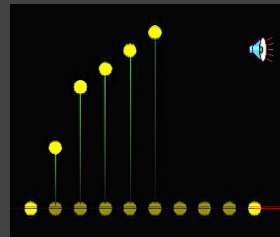
- a set of « stones » falling on a string from different altitudes



	X0	V0	T0
MAS0	0.50	-1	0.50
MAS1	1.00	-1	1.00
MAS2	1.15	-1	1.15
MAS3	1.30	-1	1.30
MAS4	1.45	-1	1.45

Composition of events / Generation...

- -> a succession of events

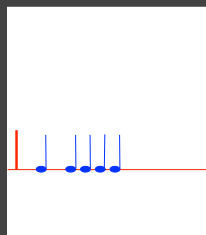


Composition of events / Generation...

- -> a succession of events

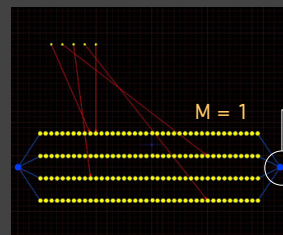
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MAS3	1.30	-1	1.30
MAS4	1.45	-1	1.45

I
N
T
E
R
F
A
C
E



3. Several VS - Bridge

- addition of vibrations



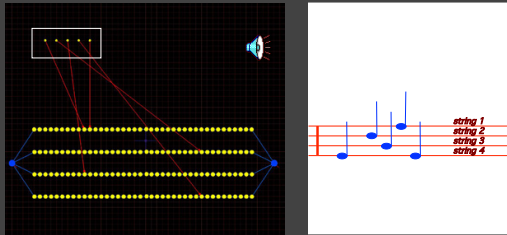
Bridge

CEL

M = 100
K = 100
Z = 100

Composition of events / Generation...

- a succession of different events (same intensity)



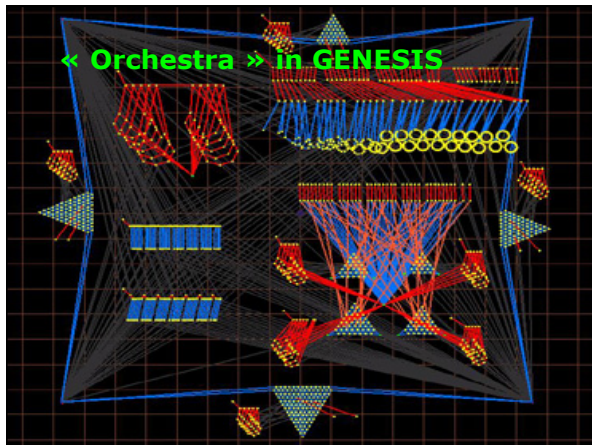
Composition of events / Generation...

- a succession of different events (var. intensities)

	X0	V0	T0
MAS0	0.50	-1	
MAS1	10.0	-0	
MAS2	11.5	-0	
MAS3	13.0	-0	
MAS4	1.45	-1	

Elementary physical event:

- kinetic energy ($1/2M.V0^2$)
- action time ($T=X0/V0$)
- selected objects

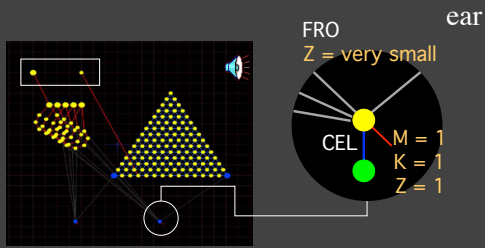


Composition / Generation...

	Instruments	Events
composition		
generation		

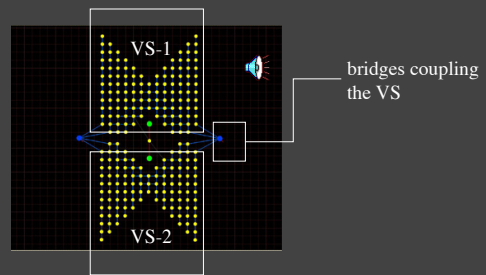
Comp. of instruments / Generation...

- several instruments in the same environment, ears of a listener



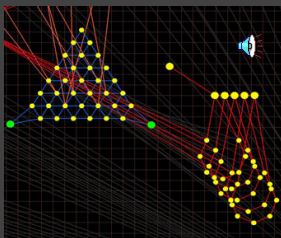
Com-position of Instruments

- instruments (or VS) interacting



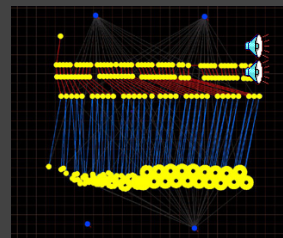
Com-position of Instruments

- instrument playing on instrument (wind blowing on a triangular plate)






Com-position of Instruments

- instrument playing on instrument (wind on small crystals) (wind on rings)



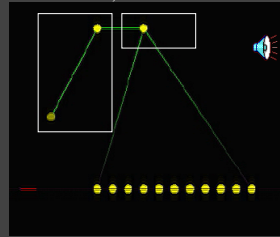
Composition / Generation...

	Instruments	Events
composition		
generation		

Comp. / Simple Generation of events

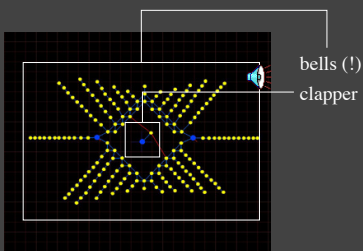
- a beater

the beater, its mallet



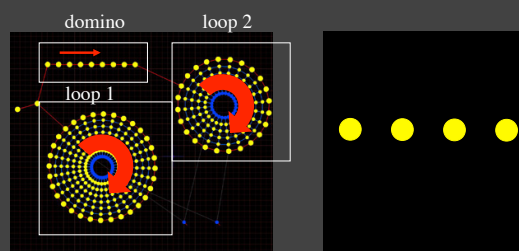
Comp. / Simple Generation of events

- bell clapper



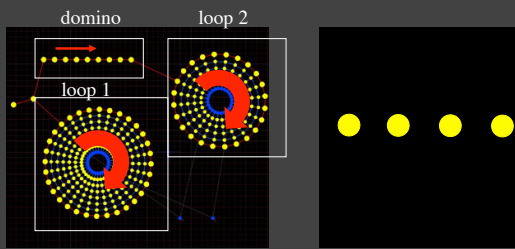
Comp. / Complex Generation of events

- dominos, loops and snakes



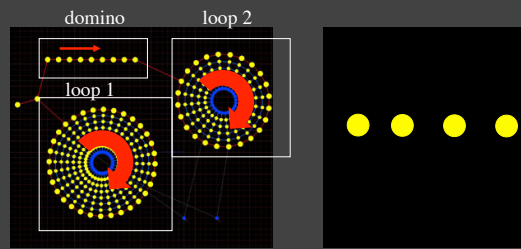
Comp. / Complex Generation of events

- dominos, loops and snakes



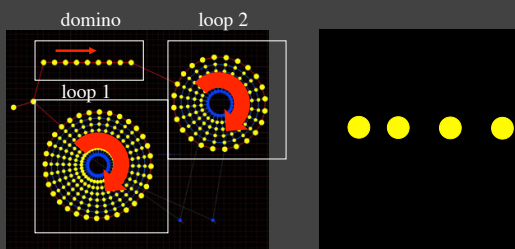
Comp. / Complex Generation of events

- dominos, loops and snakes



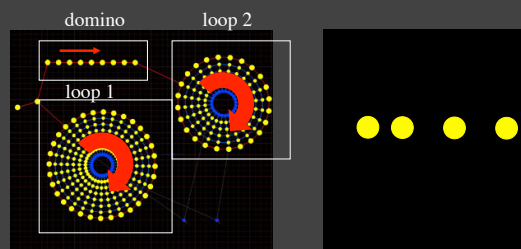
Comp. / Complex Generation of events

- dominos, loops and snakes



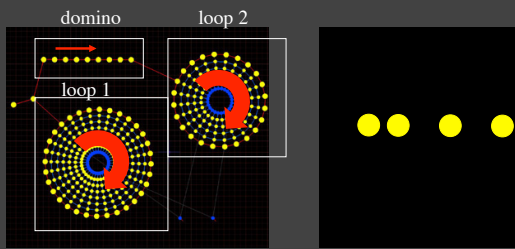
Comp. / Complex Generation of events

- dominos, loops and snakes



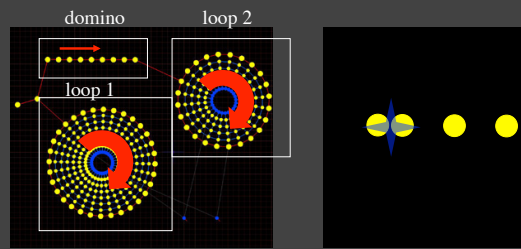
Comp. / Complex Generation of events

- dominos, loops and snakes



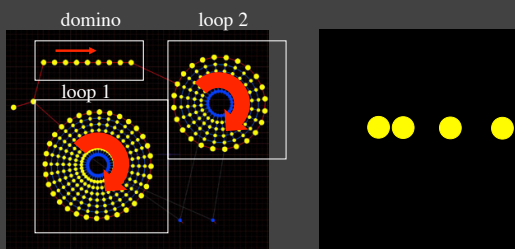
Comp. / Complex Generation of events

- dominos, loops and snakes



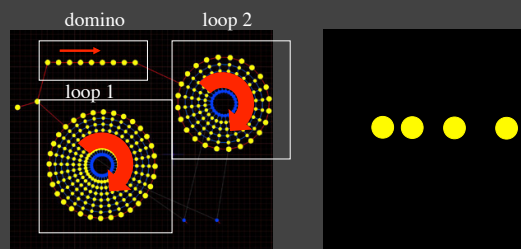
Comp. / Complex Generation of events

- dominos, loops and snakes



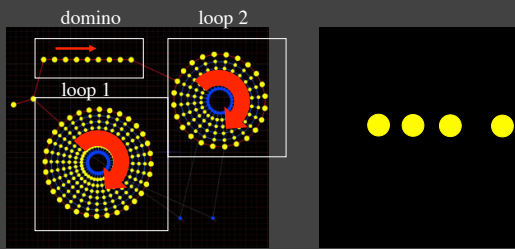
Comp. / Complex Generation of events

- dominos, loops and snakes



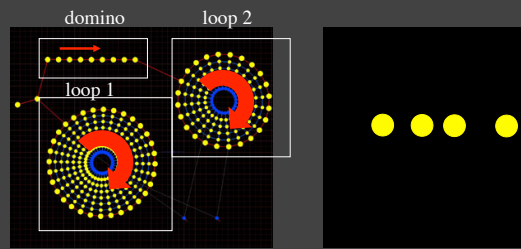
Comp. / Complex Generation of events

- dominos, loops and snakes



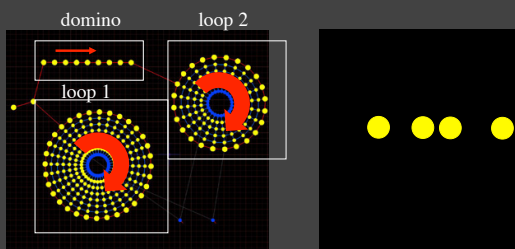
Comp. / Complex Generation of events

- dominos, loops and snakes



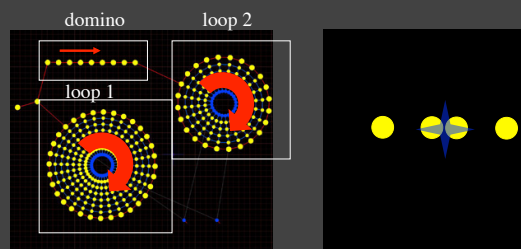
Comp. / Complex Generation of events

- dominos, loops and snakes



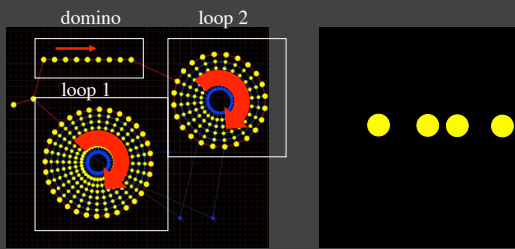
Comp. / Complex Generation of events

- dominos, loops and snakes



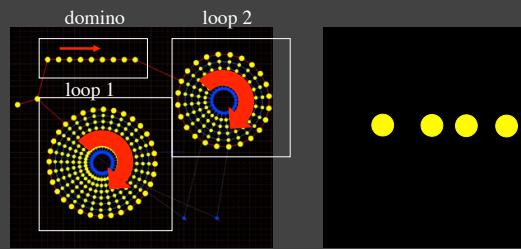
Comp. / Complex Generation of events

- dominos, loops and snakes



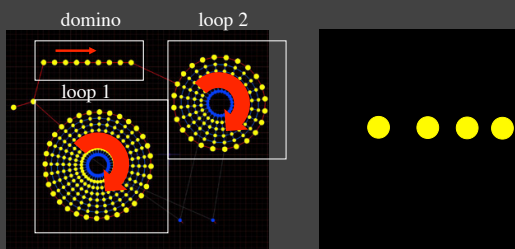
Comp. / Complex Generation of events

- dominos, loops and snakes



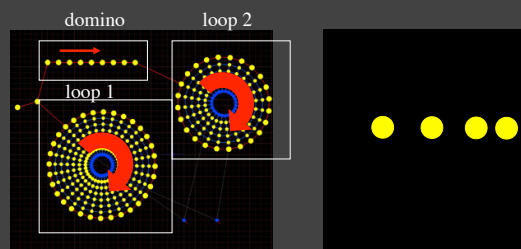
Comp. / Complex Generation of events

- dominos, loops and snakes



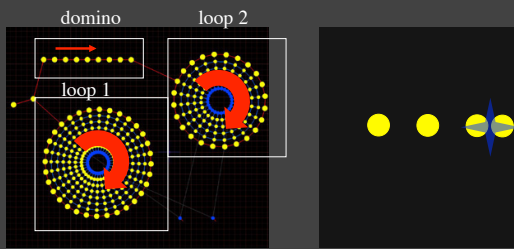
Comp. / Complex Generation of events

- dominos, loops and snakes



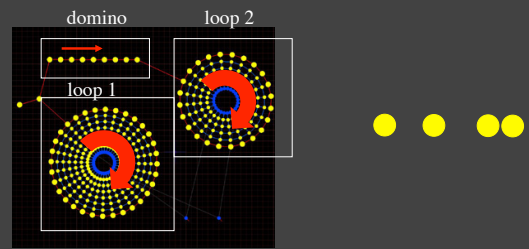
Comp. / Complex Generation of events

- dominos, loops and snakes



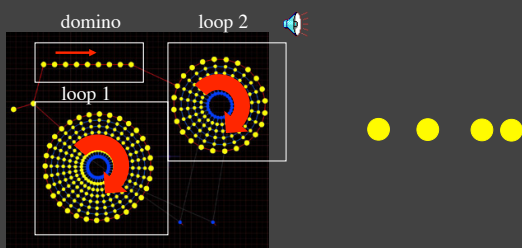
Comp. / Complex Generation of events

- dominos, loops and snakes



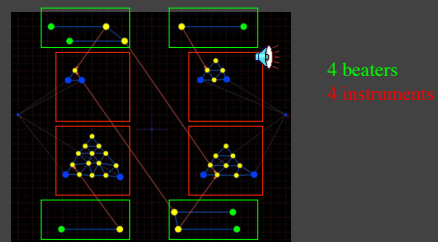
Comp. / Complex Generation of events

- dominos, loops and snakes



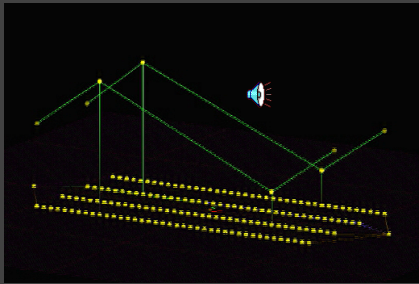
Comp. / Complex Generation of events

- several beaters (polyrhythmy)



Comp. / Complex Generation of events

- interacting instrumentalists



COUPLAGE
with
a small elasticity

