Gestural control of sound synthesis

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with the help of

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Plan

- How to « make » sounds?
  - Real-time and non real-time
  - Signal or physical synthesis
  - Digital audio-effects
- How to play (with) sounds
  - Gesture control points in synthesis models
  - gestures
  - Musical strategies
- In concert

models and implementations

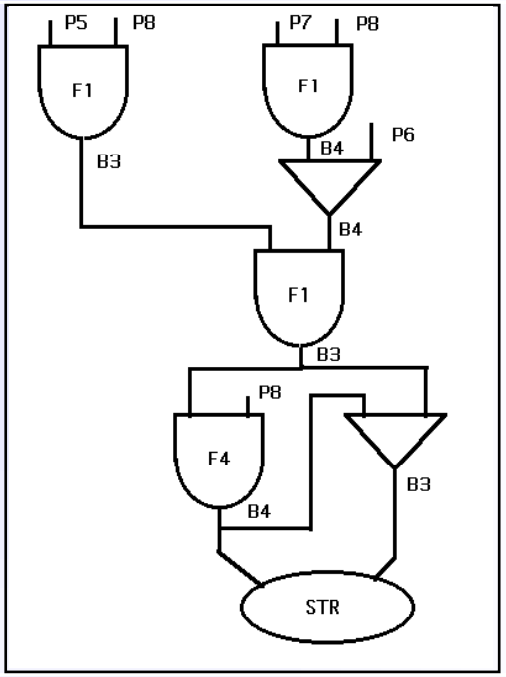
- Sound models are signal processing algorithms
- Implementations are the way to make them run

Real-time and non real-time Implementations

- MUSIC V and Csound : non real-time
  - Modular
    -> new objects
  - Driven by functions and events
- Max-MSP
  - Graphical
  - Real-time
    ->instantaneous values

Music V example

```
COM----------------------------------;
INS 0 1;
P9_HZ(W9) P6_HZ(W6) P7_HZ(W7) P8_HZ(W8)
P5_W5/4;
IOS P5 P8 B3 F1 P30;
IOS P7 P8 B4 F1 P29;
AD2 B4 P6 B4;
IOS B3 B4 B3 F1 P28;
IOS B3 P8 B4 F4 P26;COM DTE GCHE;
SB2 B3 B4 B3;
STR B3 B4 B1;END;
COM----------------------------------;
```

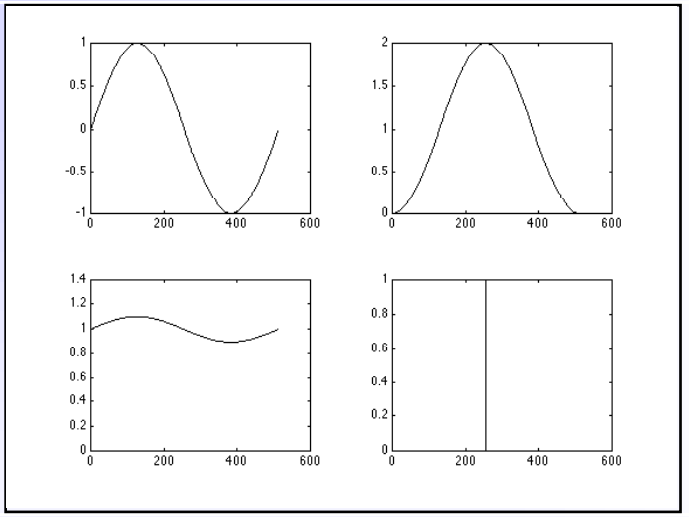


Notes with Music V

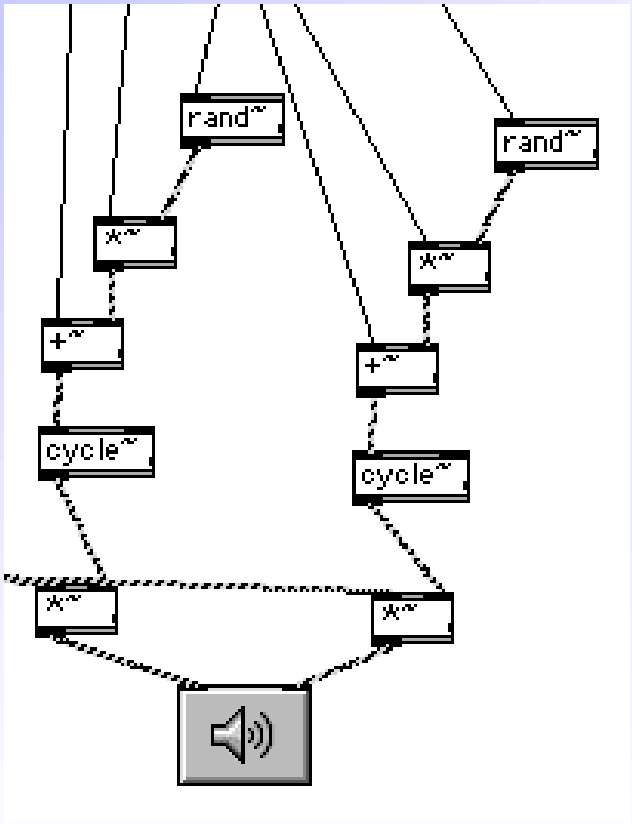
```
NOT 0 1 28 1000 MI 32 .5  6.235;
NOT 2.2 1 28 1000 MI 32 .5  6.235;
NOT 4.4 1 28 1000 MI 32 .5  6.235;
NOT 6.6 1 28 1000 MI 32 .5  6.235;
NOT 8.8 1 28 1000 MI 32 .5  6.235;
NOT 11 1 28 1000 MI 32 .5 6.235;
NOT 13.2 1 28 1000 MI 32 .5 6.235;
TER 48;
```

Fonctions in Music V

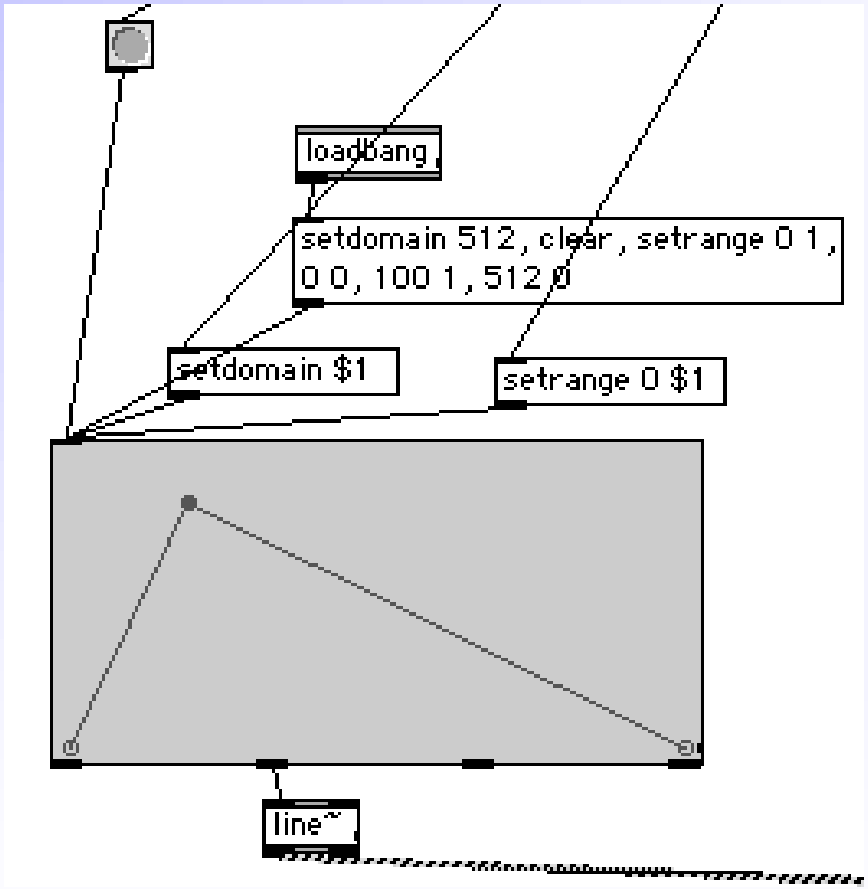
```
COM-----------------------------------.
GEN 0 2 1 512 1 1;
GEN 0 2 2 512 .499 0 -.499 0;
GEN 0 2 3 512 1 .1 1;
GEN 0 1 4 512 1 1  1 255 0 256 0 512;
COM-----------------------------------;
```



Max-Msp example



Curves in Max-Msp



“signal” algorithms

- Perception based
  - Additive synthesis == cumulate
  - Substractive synthesis ==sculpt
  - FM , waveshaping.. ==model (clay)
  - Granular synthesis == ???

“(semi)physical” algorithms

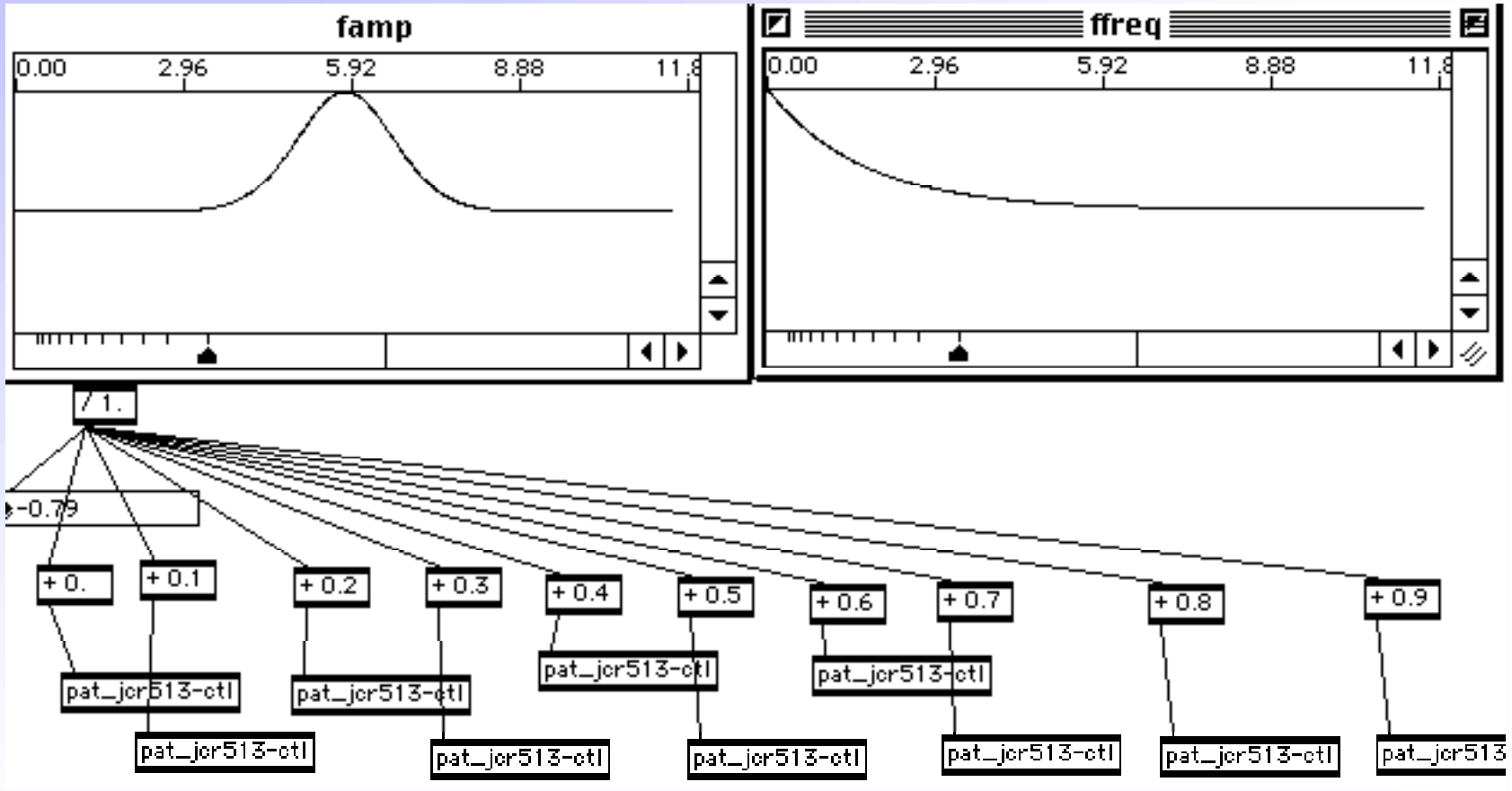
- Construction based
  - Waveguide synthesis
  - Finite elements synthesis

Music V historical examples

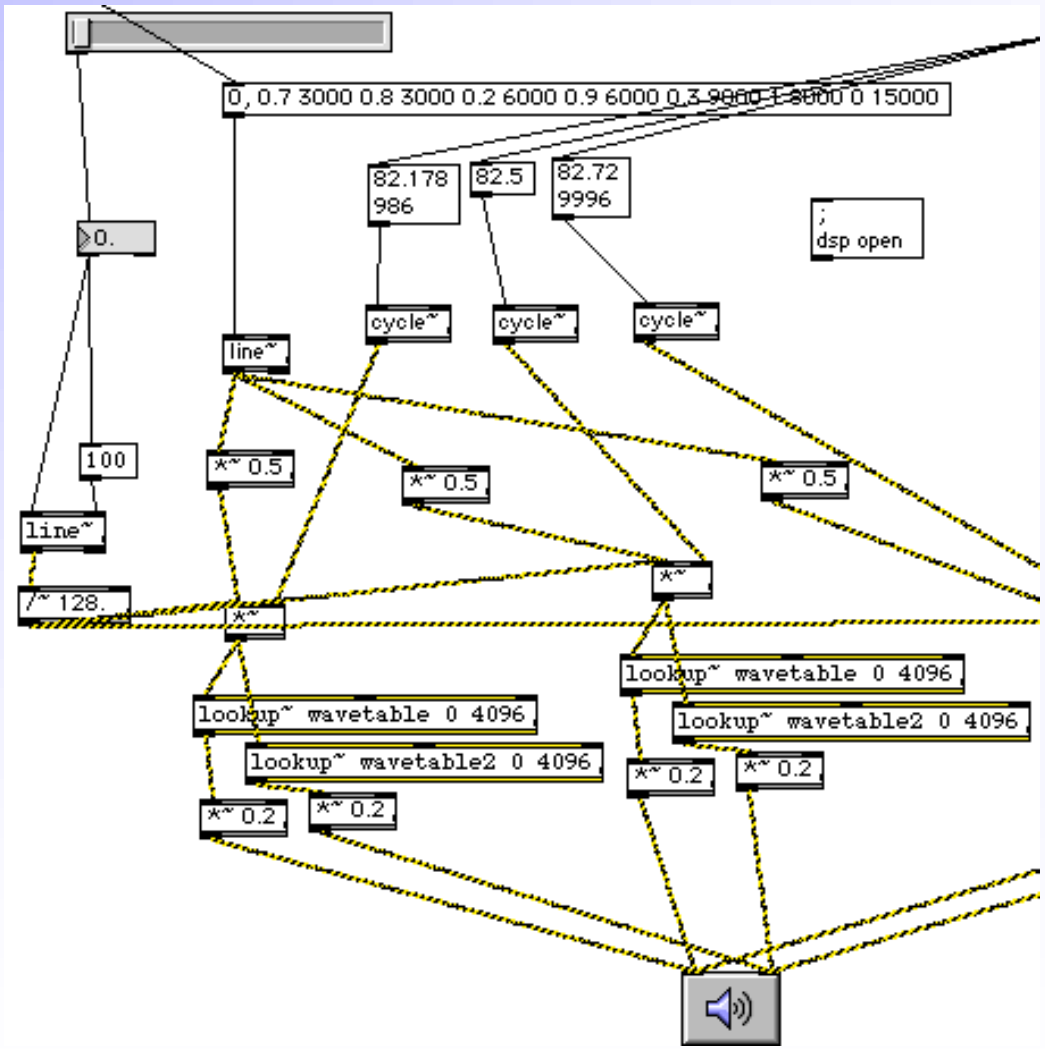
- voice JCR 
- bell 
- jew-harp 
- waveshaping 

“En direct de” Csound

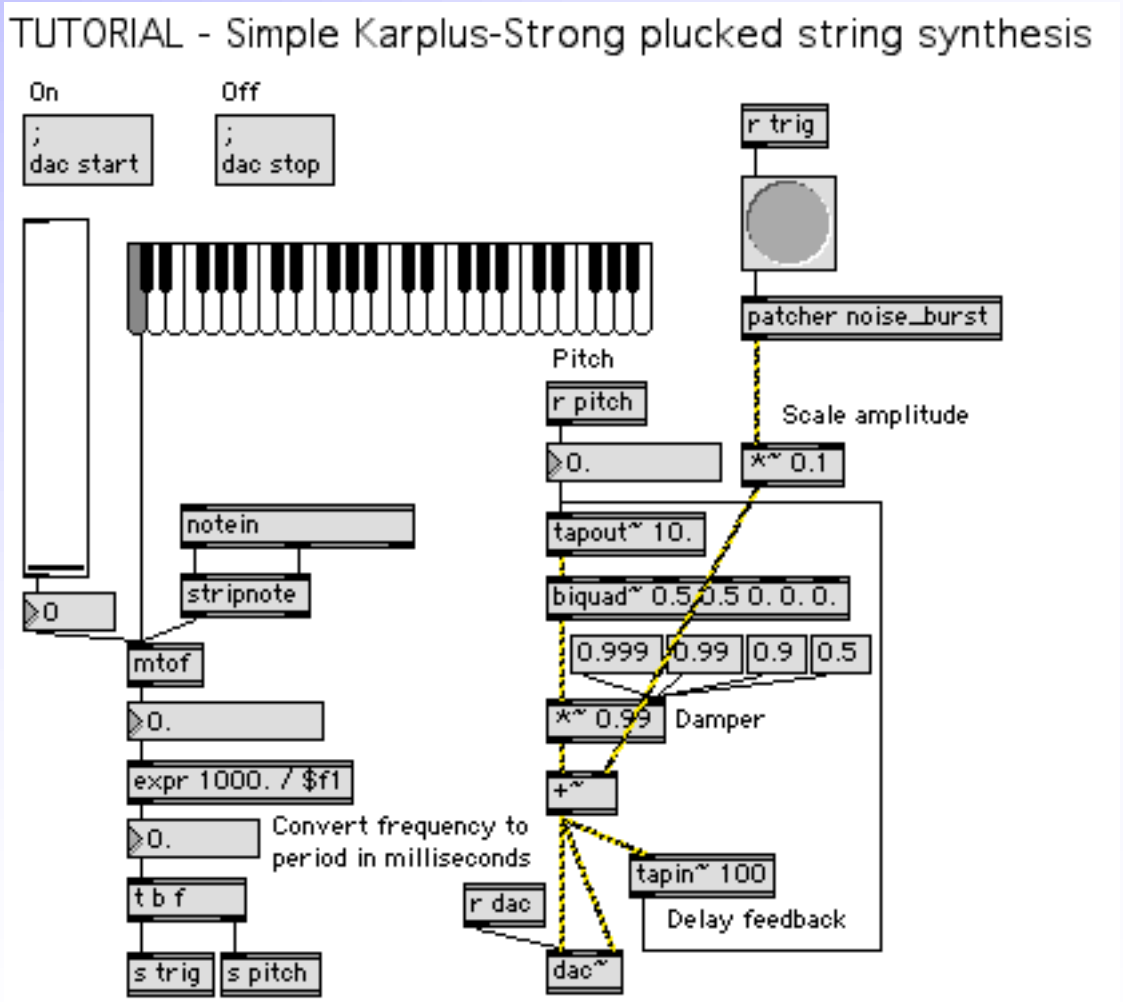
Example 1 (Msp) paradoxal pitch



Example 2 (Msp) waveshaping

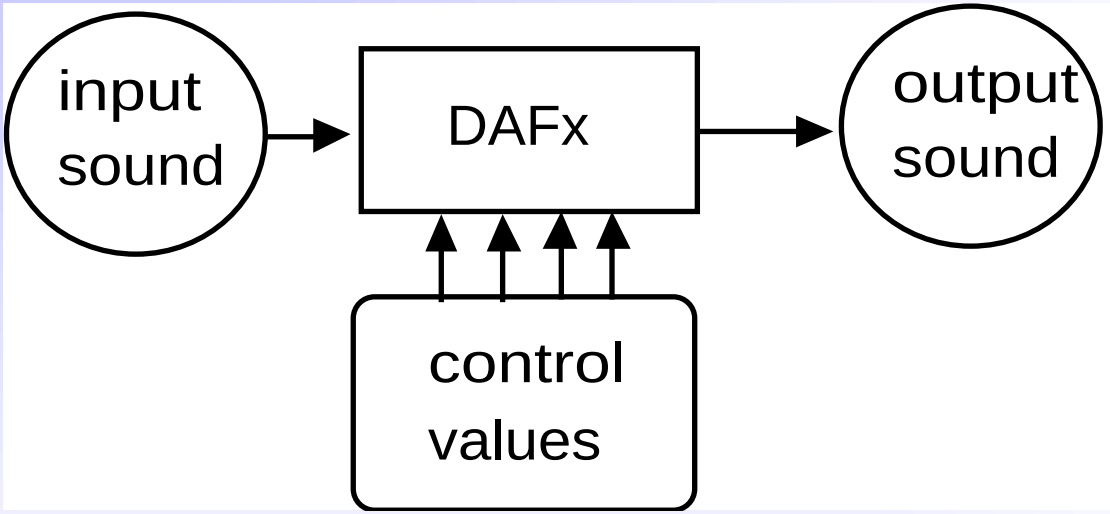


Exemple 3 (Msp) waveguide



“En direct de” Max-Msp

Sound tranformtions :DAFx

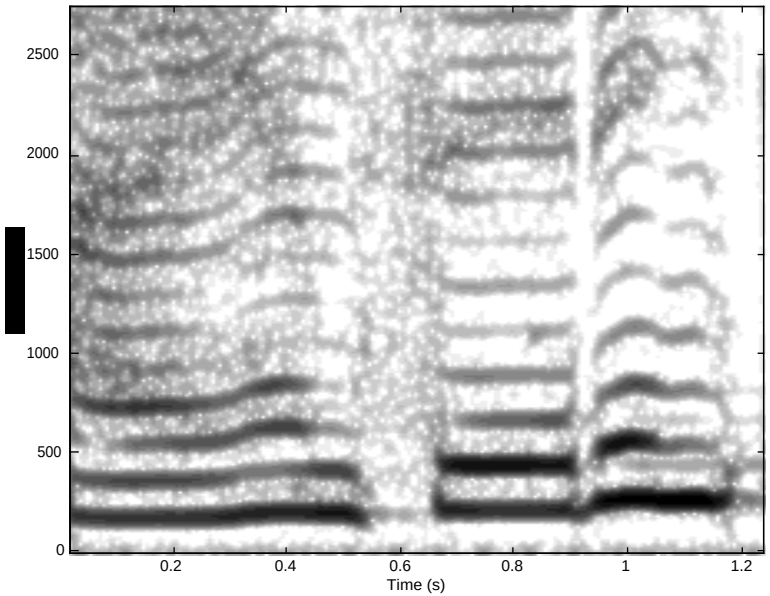


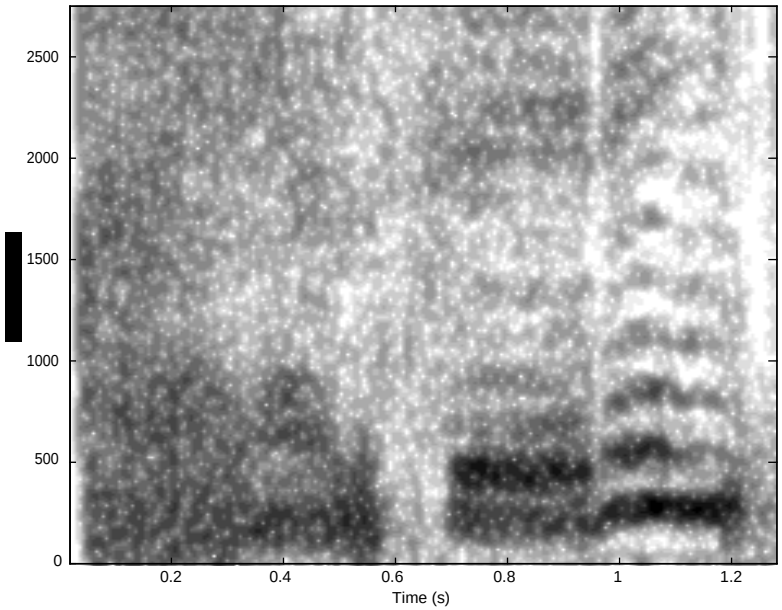
Effet temporel

Effet fréquentiel

Effect example

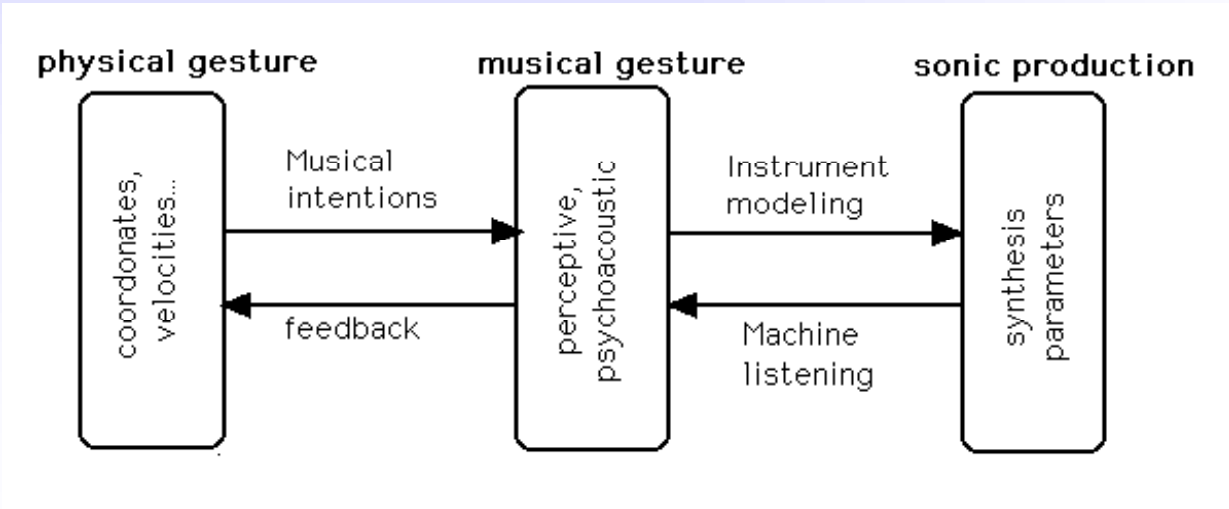
- whisperisation



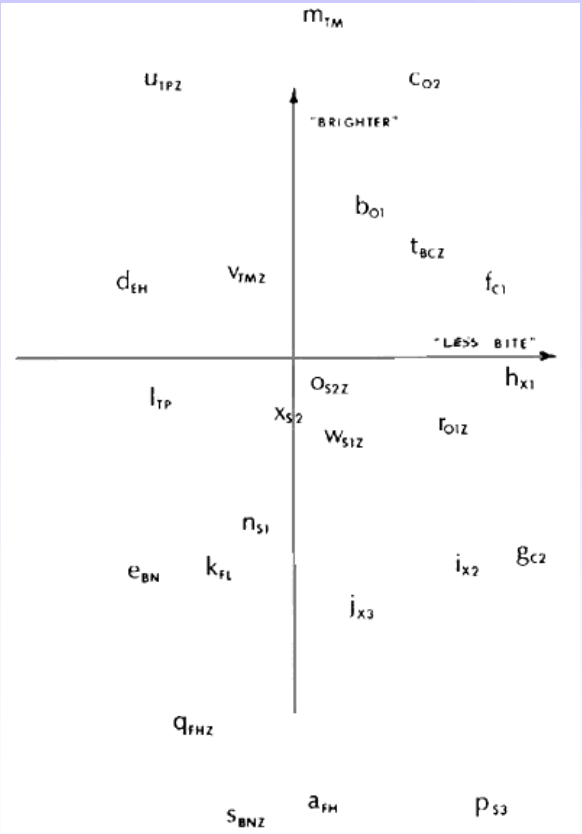


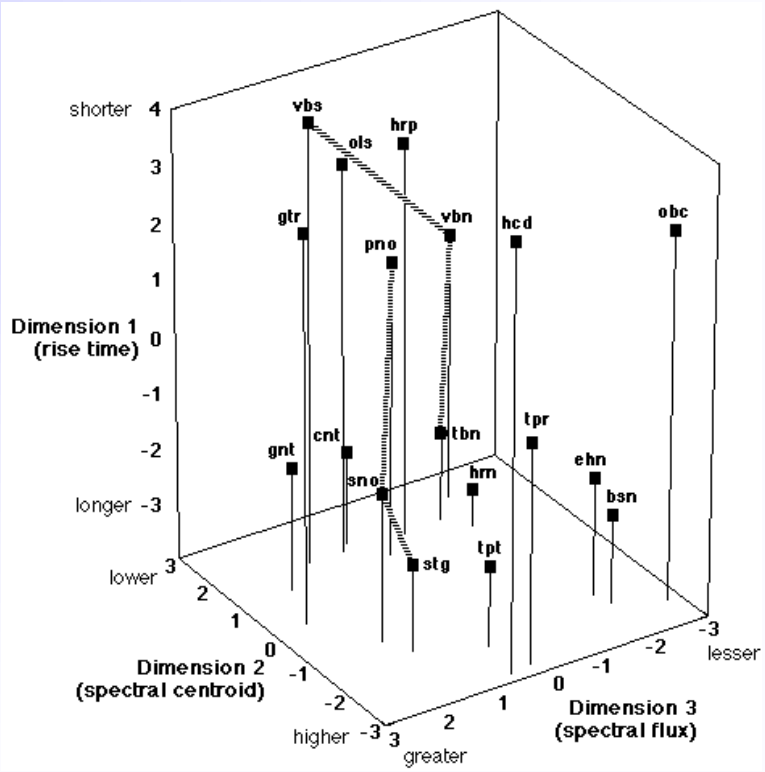
How to play with sounds: entry points

- Introduction of gesture in Max-Msp
- Decision and modulation gestures
- The mapping

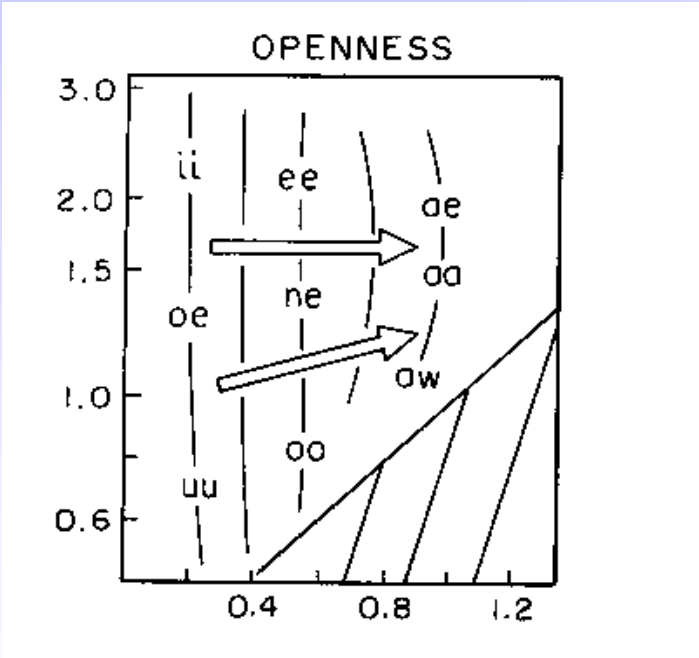


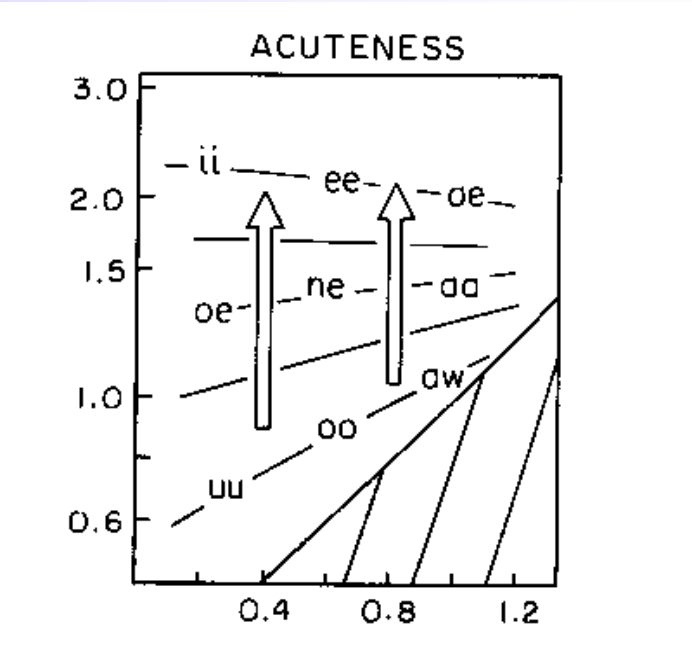
Perceptual space (Grey)





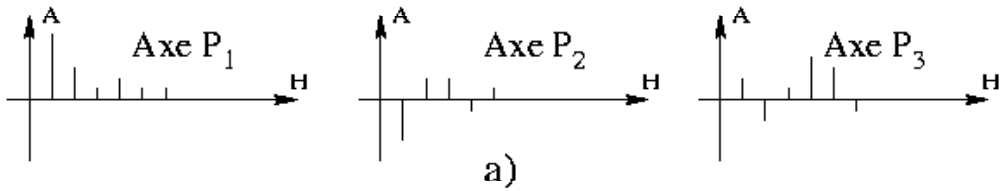
Perceptual space (Slawson)





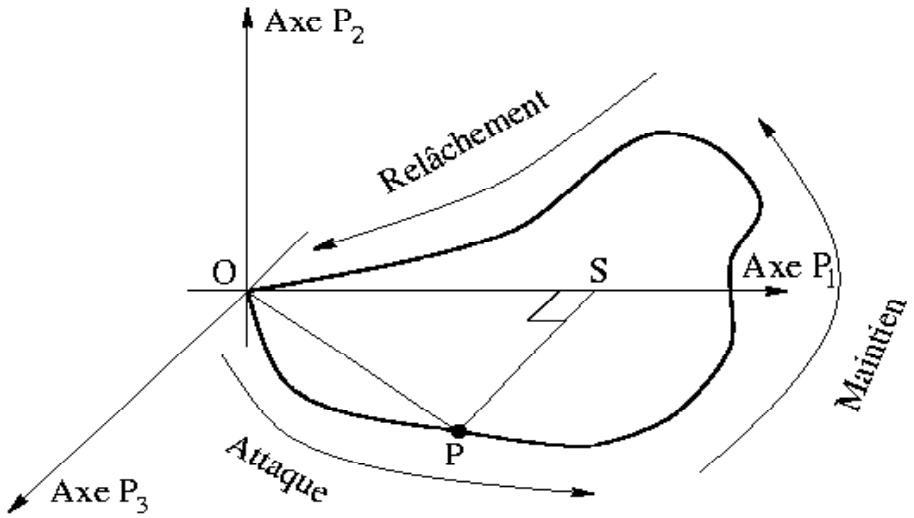
MDS space (Rochebois)

Définition des axes du sous espace principal $\mathcal{P}$



a)

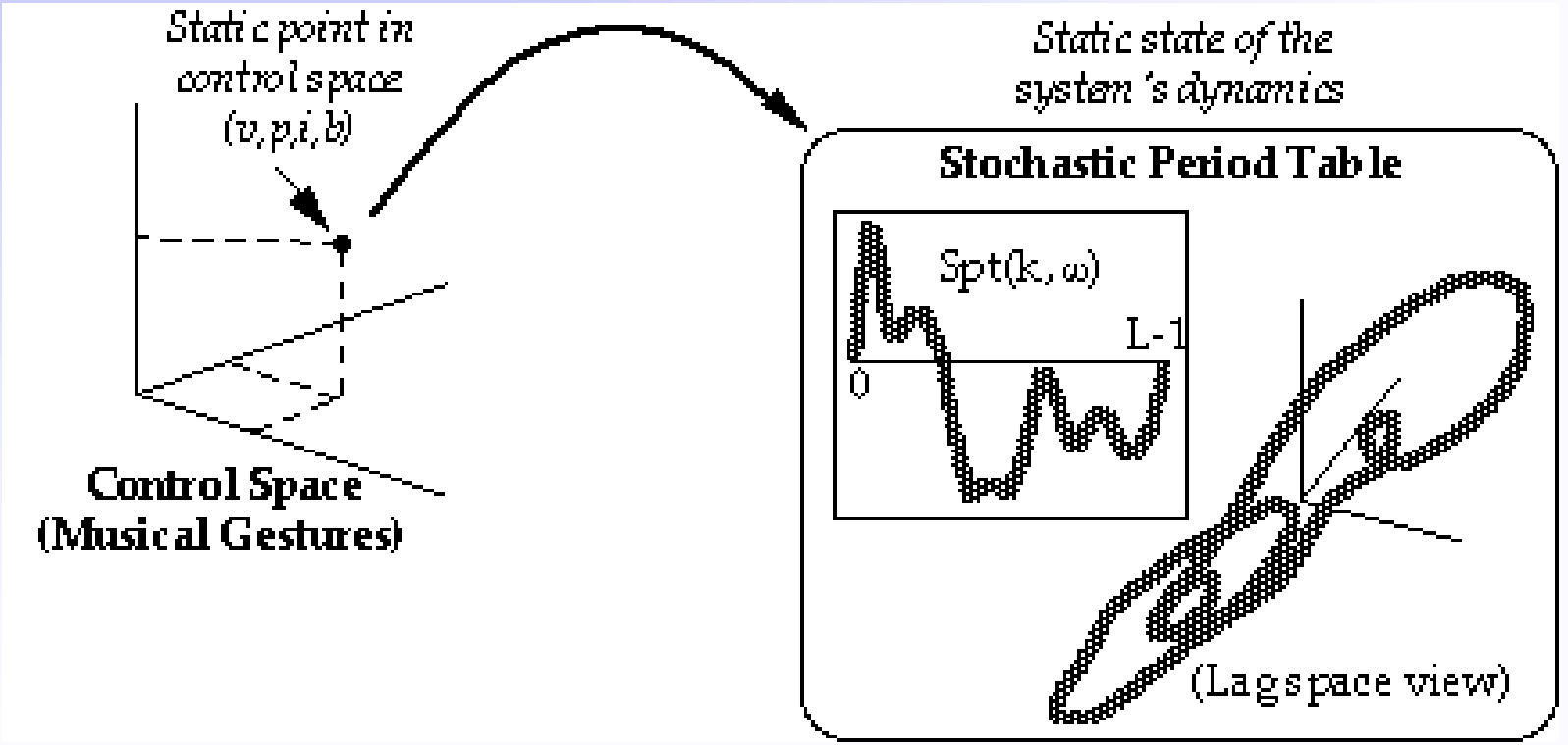
Trajectoire du son dans le sous espace principal $\mathcal{P}$



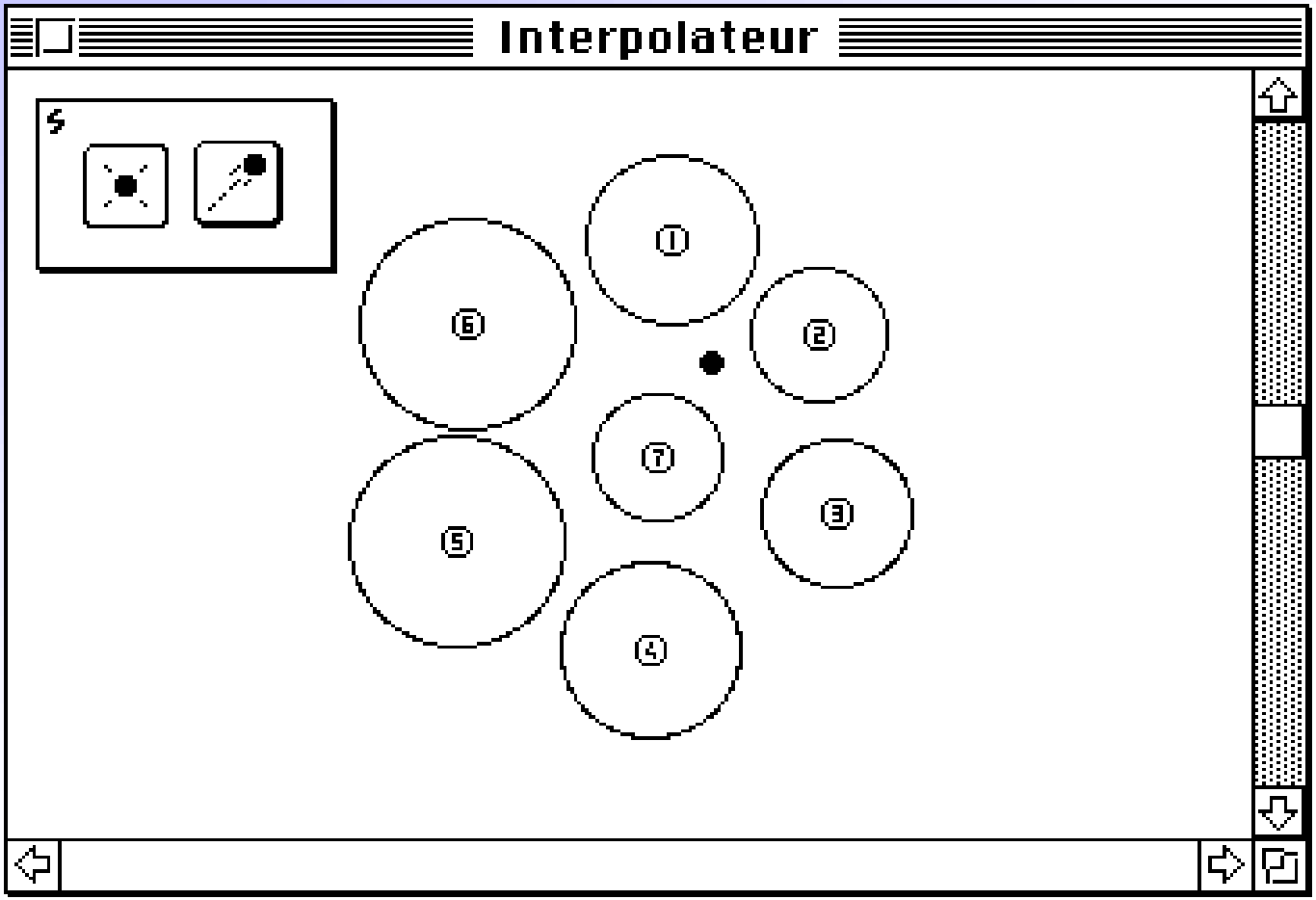
b)

FIG. 2.9 – *Axes et trajectoire*

Phase space (Métois)



Dedicated space (à la Syter)



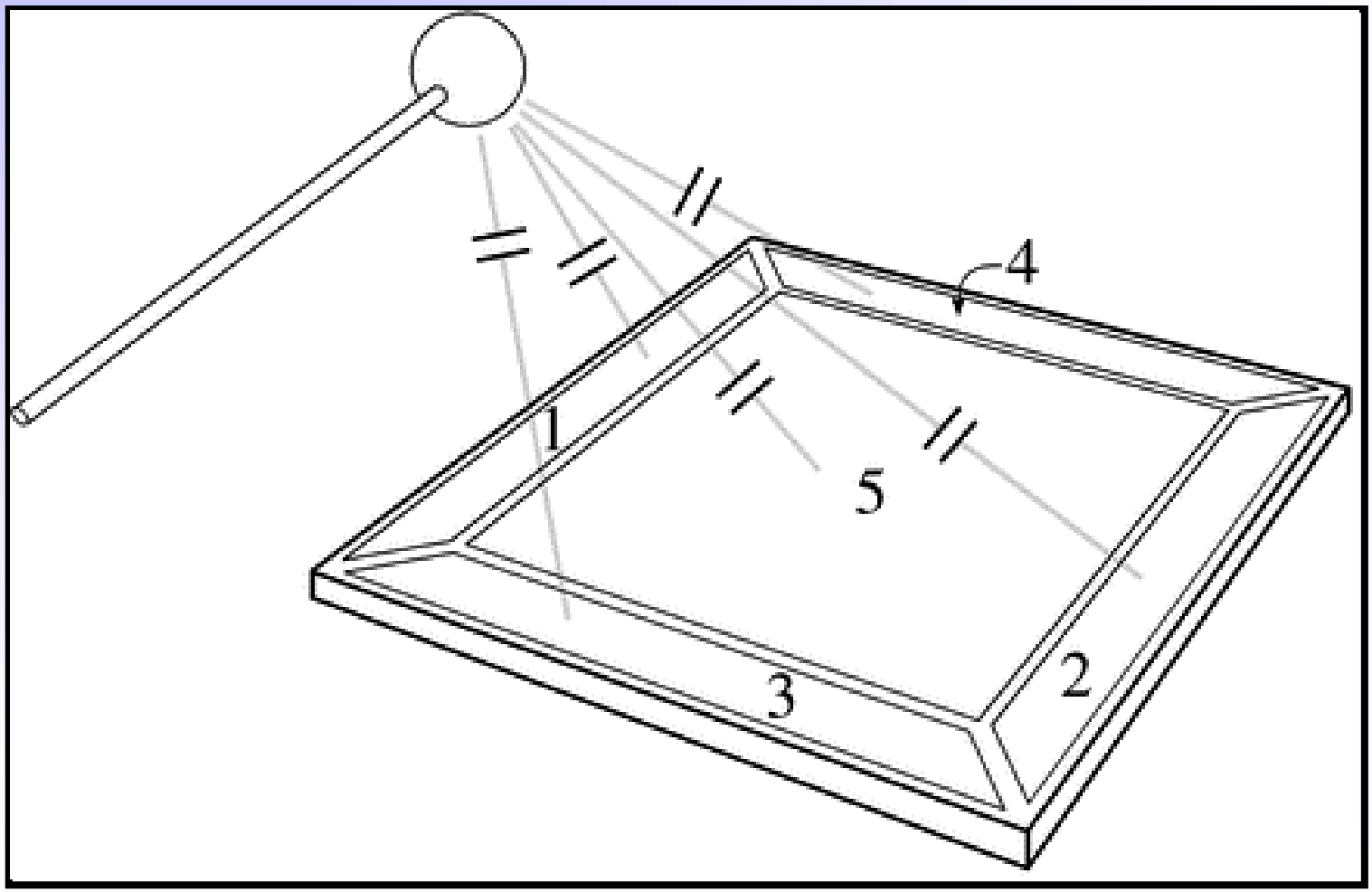
Gestural devices

- classical : keyboards, potentiometers and joysticks
- less classical : radio baton
- other: caption of position and movement (rotation, acceleration)

Bank of potentiometers

Graphic tablets

Max-drum (radio baton)

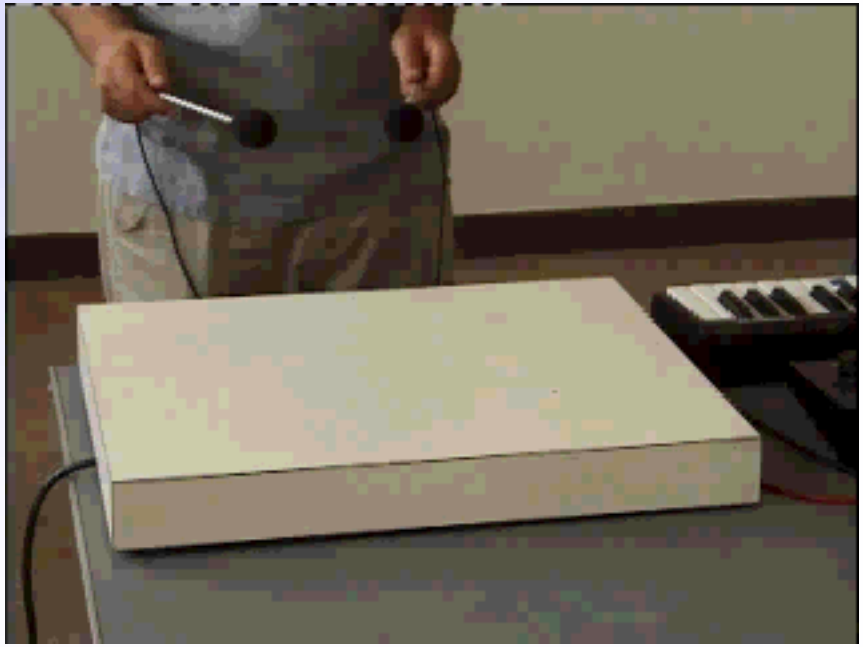


Driving wheels and pedals

« digital » gloves

vidéo1 : rotations

Video 2 waveshaping



Video 3 :
Le Souffle du Doux

Interpretation or improvisation?

- Interpretation with digital music
  - curves and values depend upon gesture
- Improvisation?
  - How much freedom?
  - Strategic choices

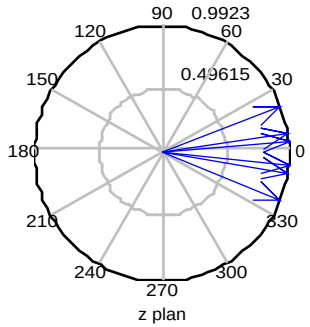
“Creative gesture in Computer music”

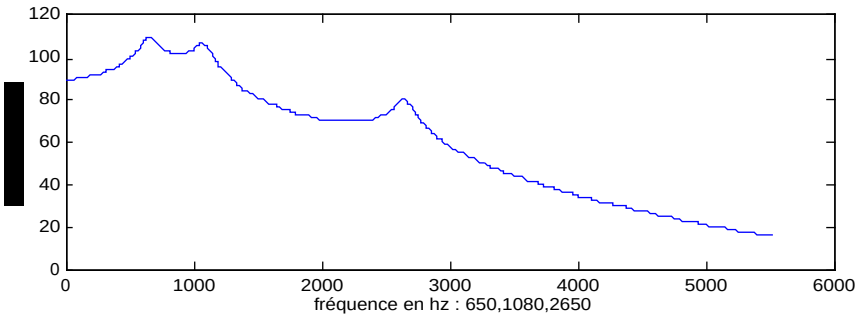
- Musical strategies:
  - From sound to gesture
  - Use of both hands (bi-manuality)

Ex 1 : The voicer

The voice synthesizer model

- 2 pole model
- R and θ are controllable
- Preset of vowels

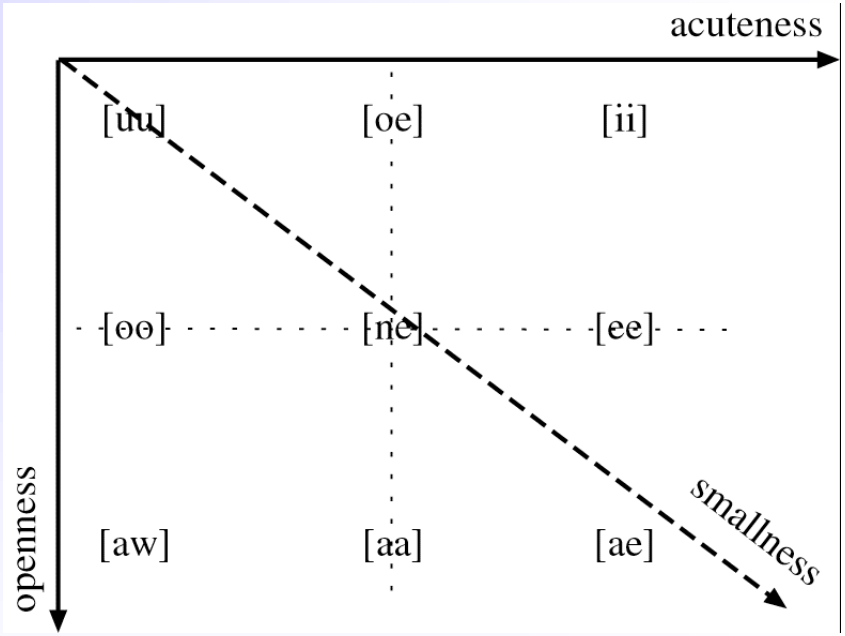




Digital control of a voice model

"How to do the vowels map"

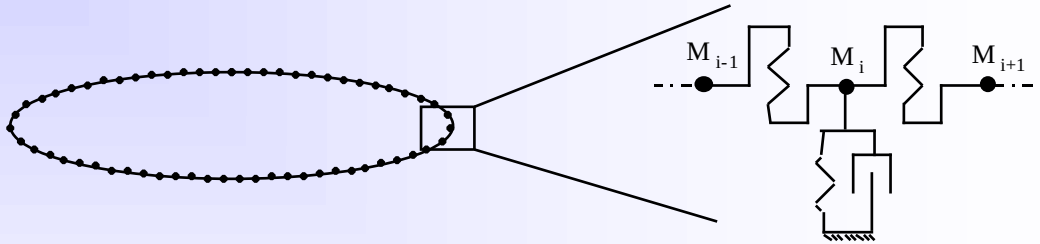
- Find bi-dimensional gestures
- do a specific mapping
- Use the voice synthesizer filter



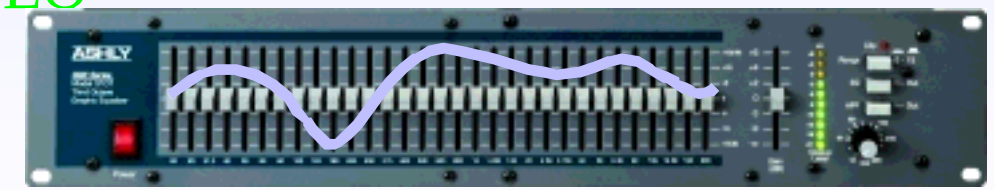
Ex 2 : Scanned synthesis control

The Scanned Synthesis string

- The Scanned Synthesis consists of a slow dynamical system whose shape is scanned periodically
- The string model: a circular string in finite differences

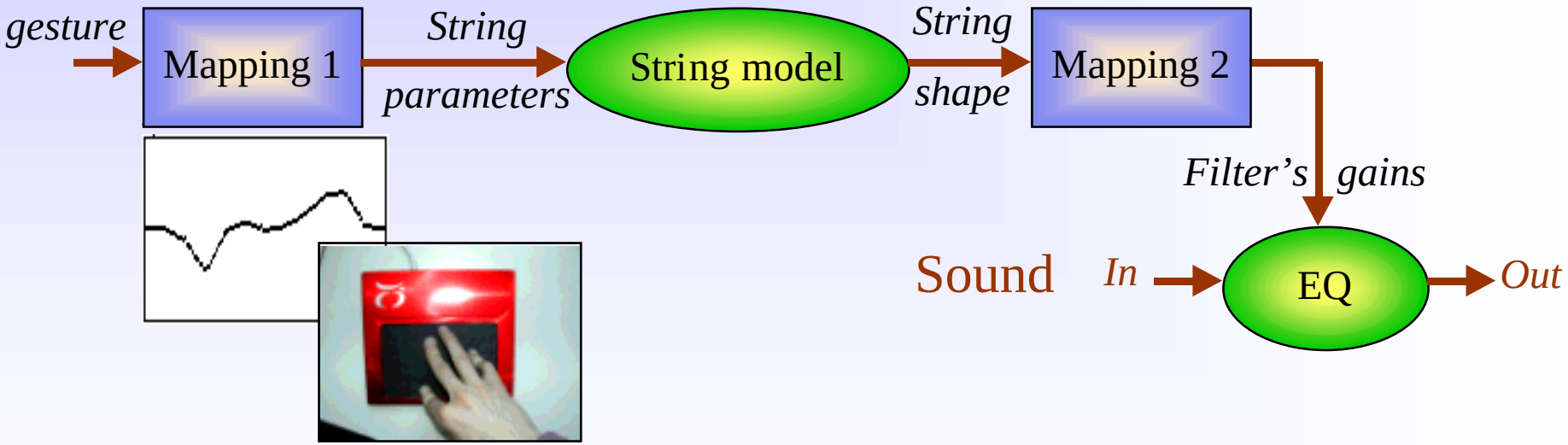


- We can also use the string shape to control the sliders of the graphical EQ



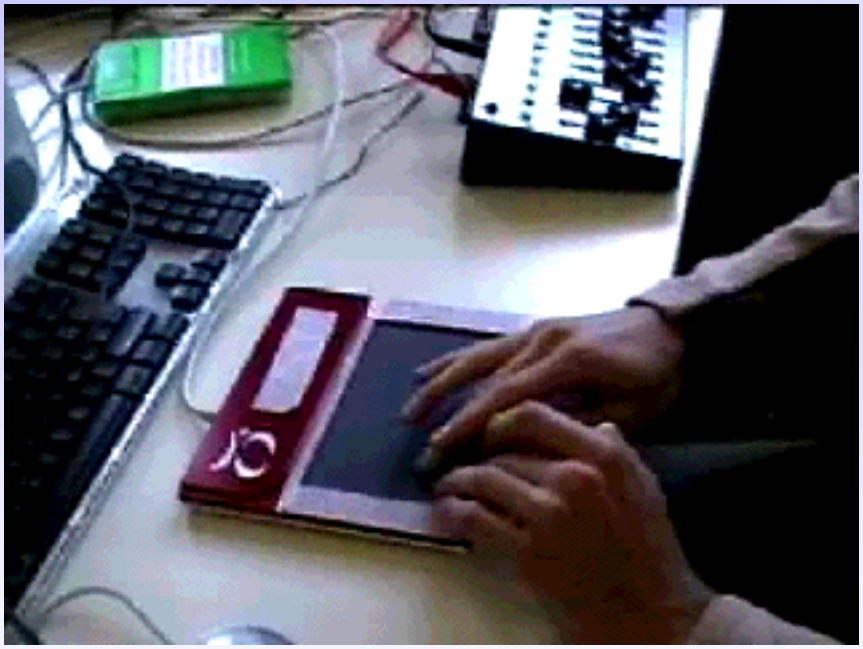
Gestural Control and Mapping

- 2 different EQ:
  - Bank of IIR filters
  - EQ with a FFT process



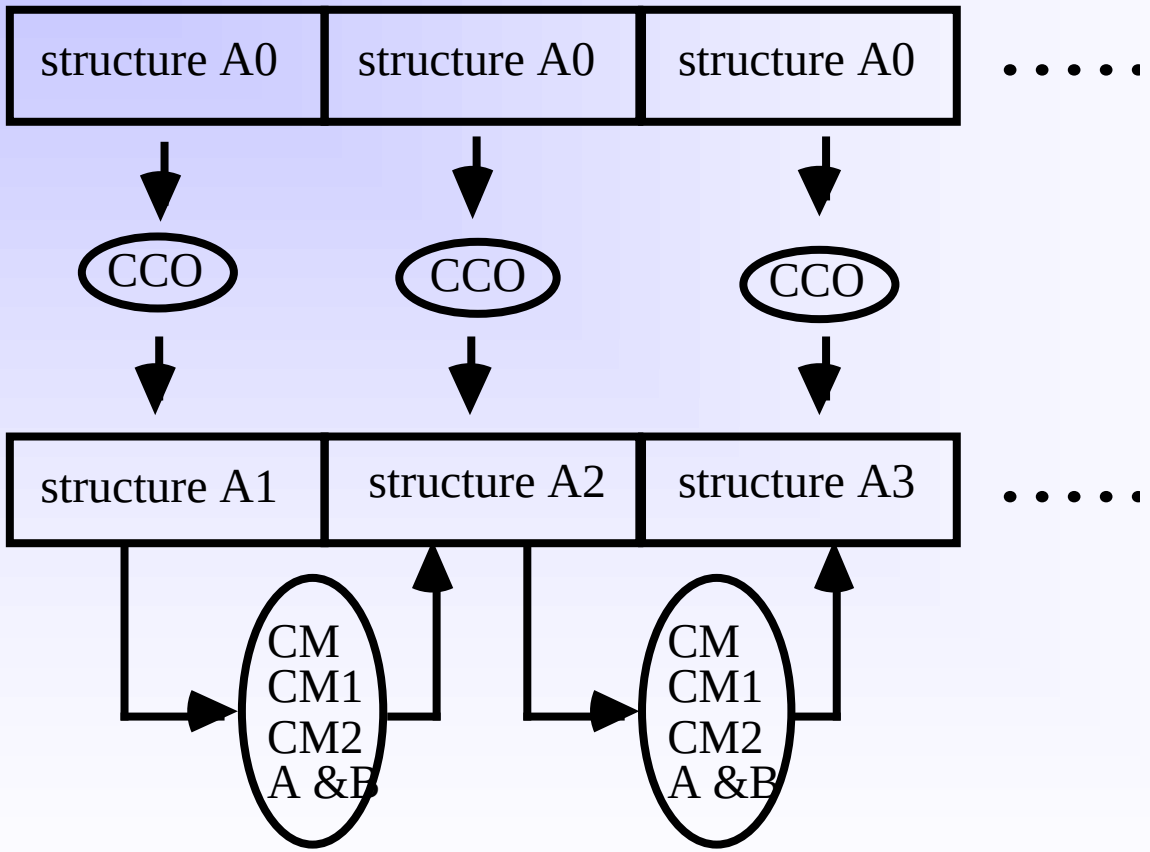
- Number of masses in the string model = Number of filters in EQ

Video examples



- The EQ is controlled though the string dynamic: algorithmic gesture
- More powerful than a direct gestural control of the EQ

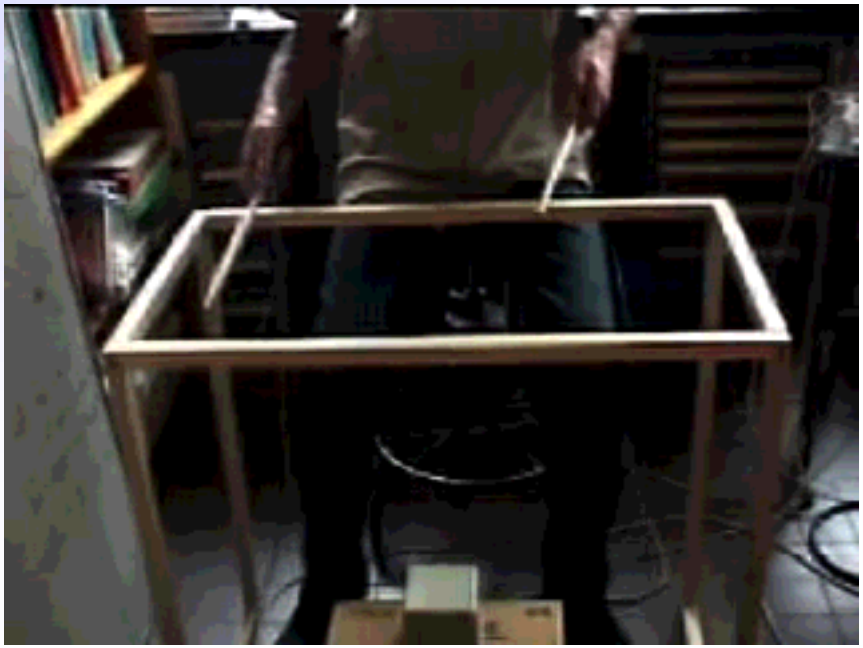
Ex 3: stochastic processes



Using a MIDI pad

Ex 4: a virtual instrument

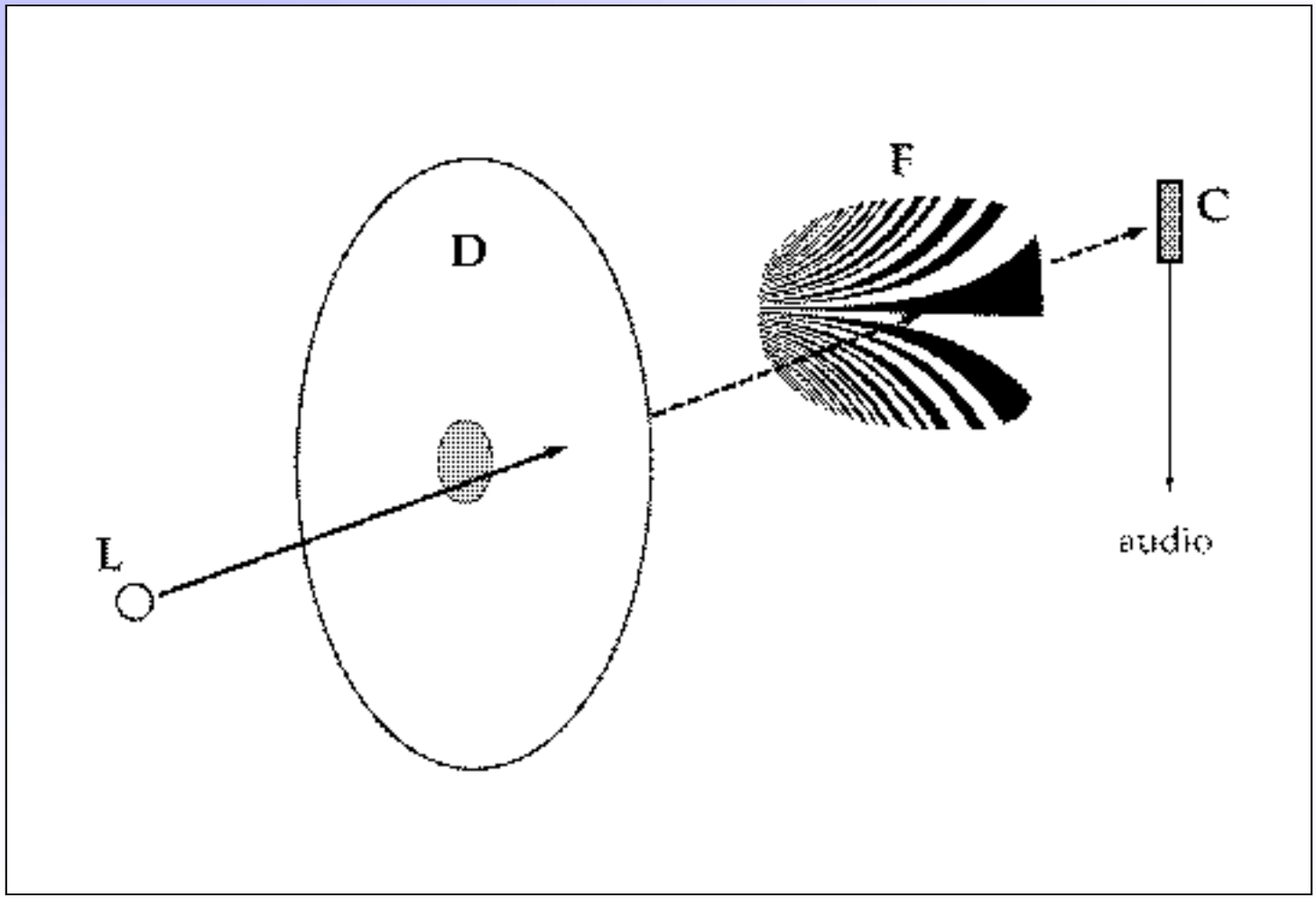
- From the position of a sensor
- Mapping with a MacIntosh
- Linked to an expander



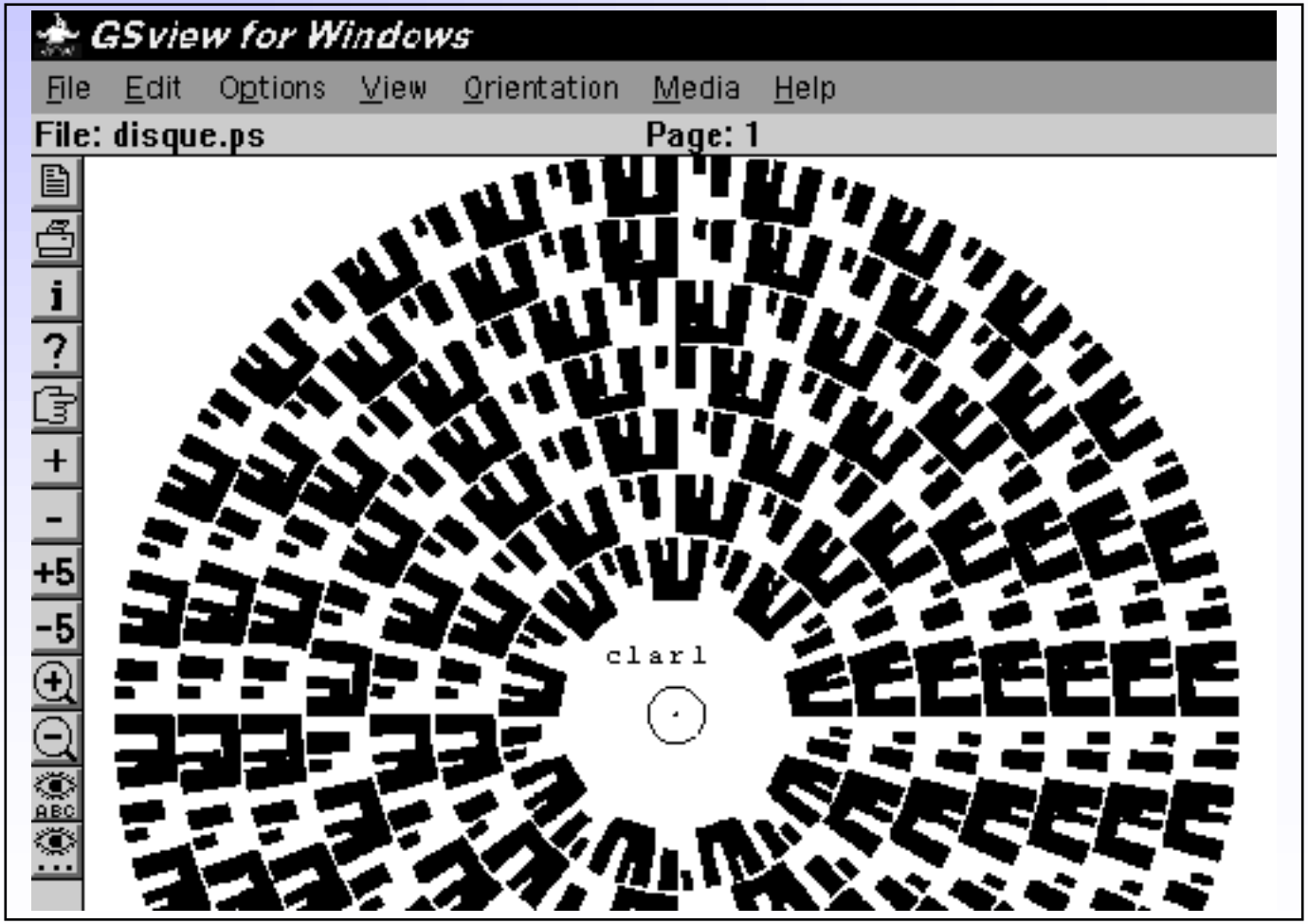
Ex 5: driving a DX7

- A DX7 is driven by a MIDI pad
- Sounds are mapped on two axis
- A Max program is used

Ex 6:The Photosonic instrument

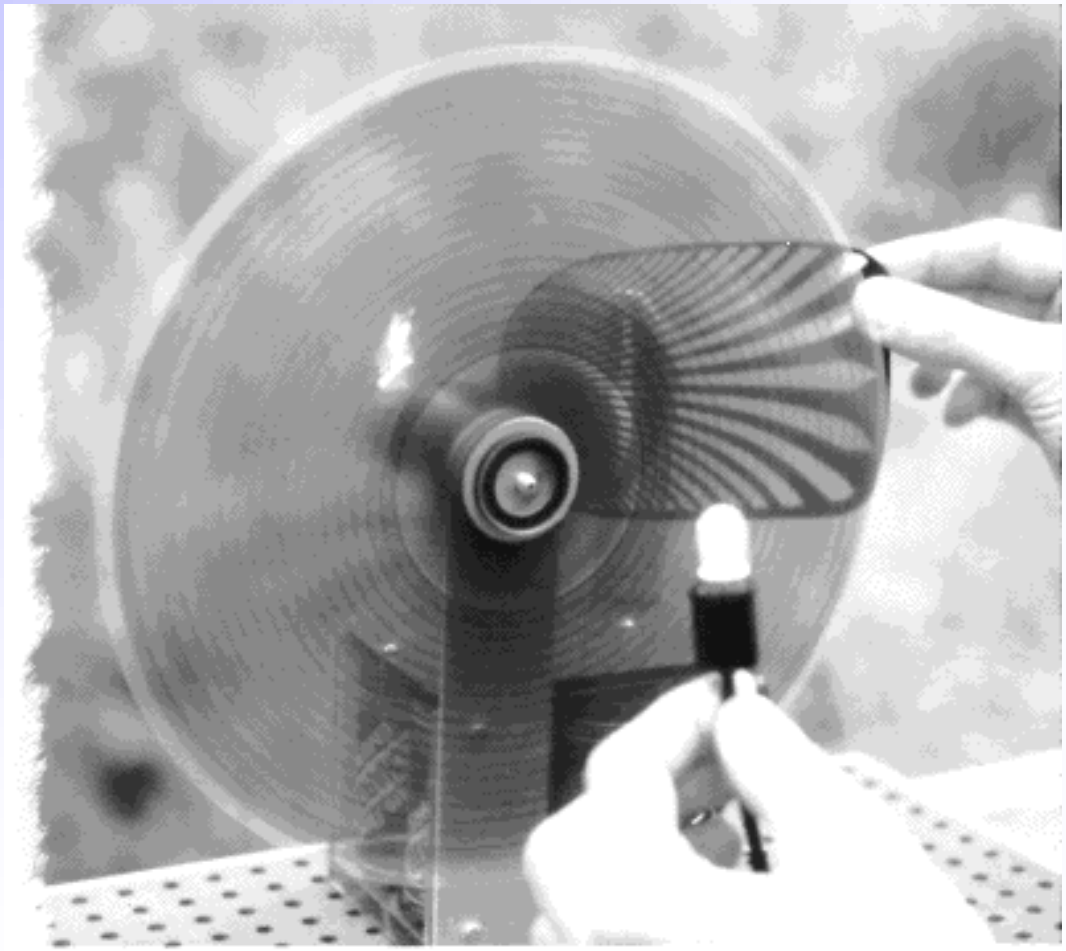


A photosonic disc

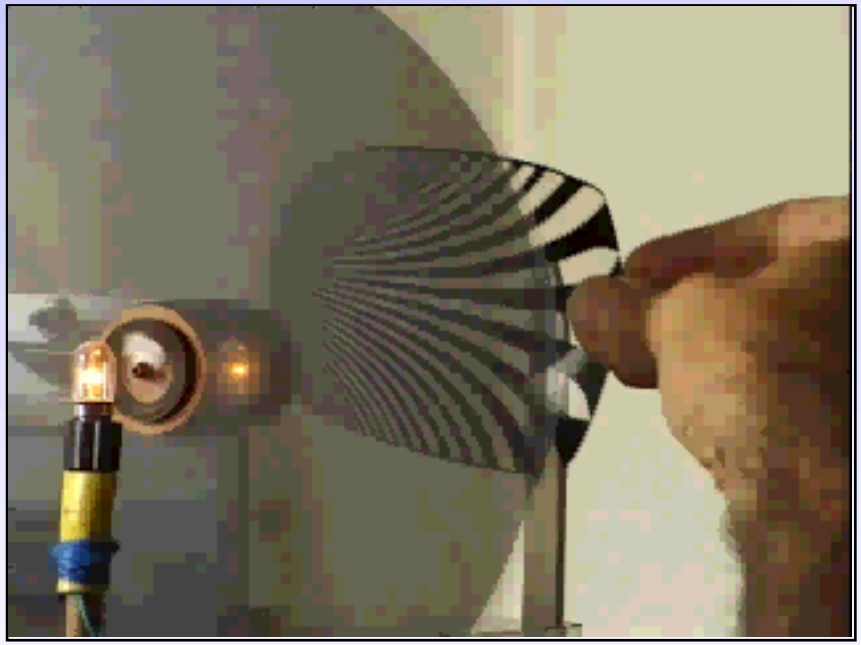


The real instrument

- Nice Instrument
- Works with light
- No electronics



Basic gestures



- An optical filter is used (right hand).
- The left hand chooses in a palette of sounds

Sounds of a photosonic instrument

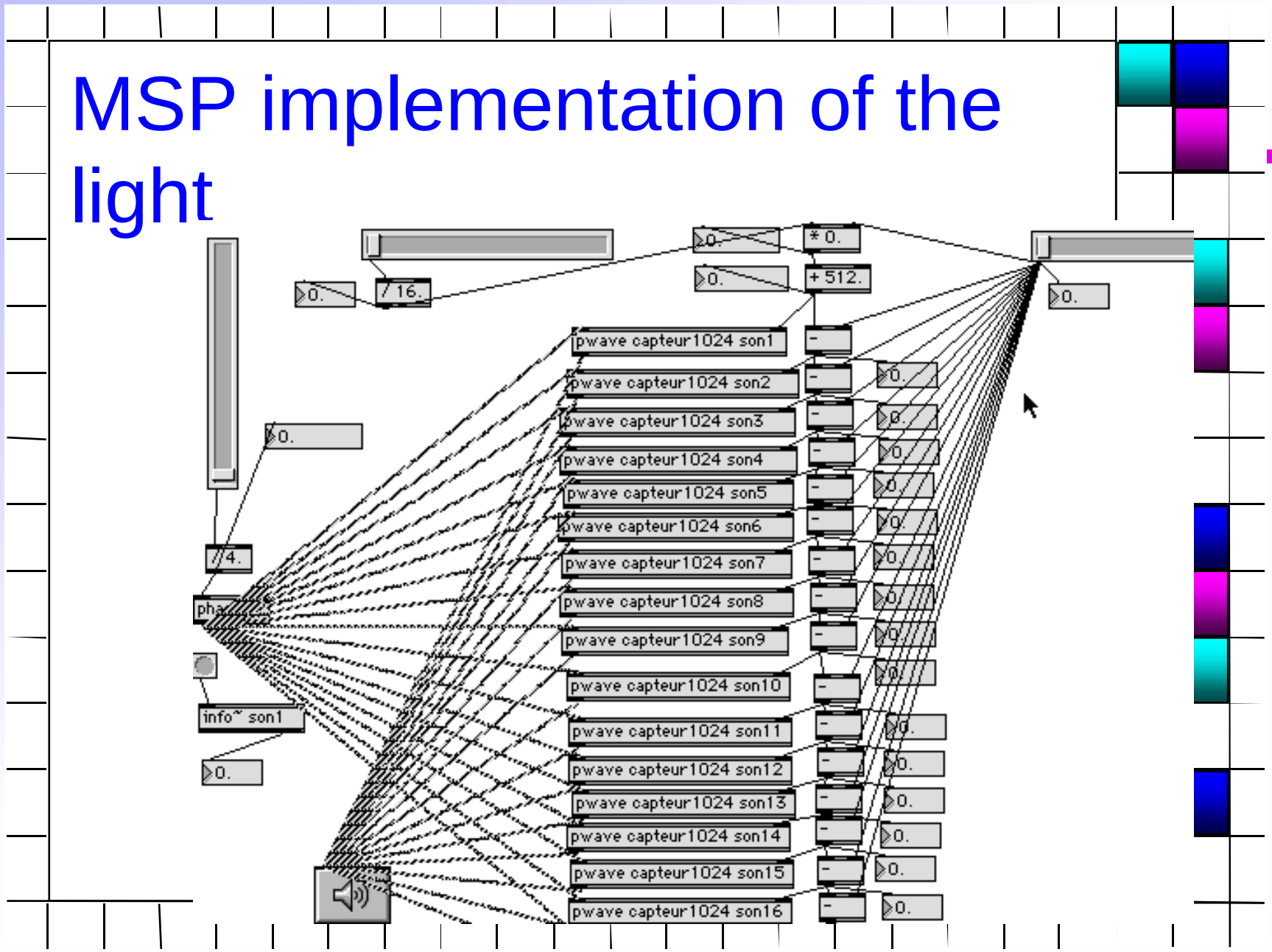
Digital simulation

- Gesture Oriented :
- A position of the light (3D) and the filter (2D) -> one sound

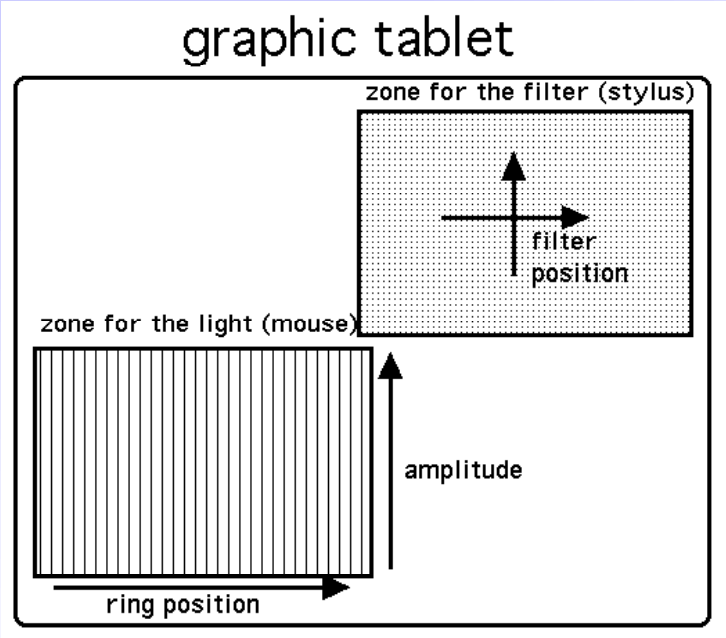
 Plutôt filtre

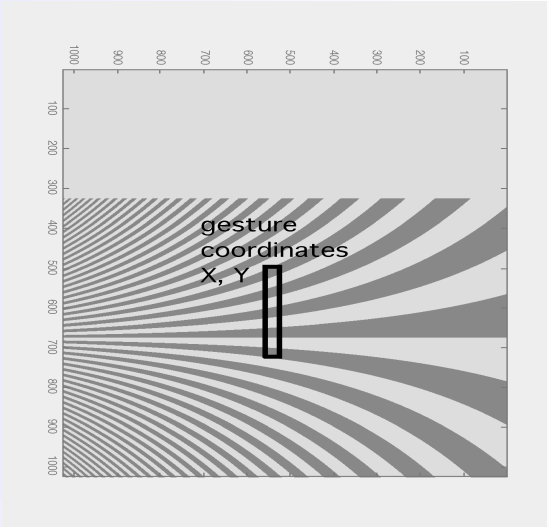
 Plutôt lumière

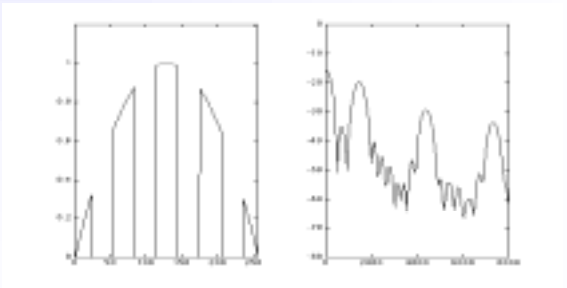
MSP implementation of the light



The filter simulation

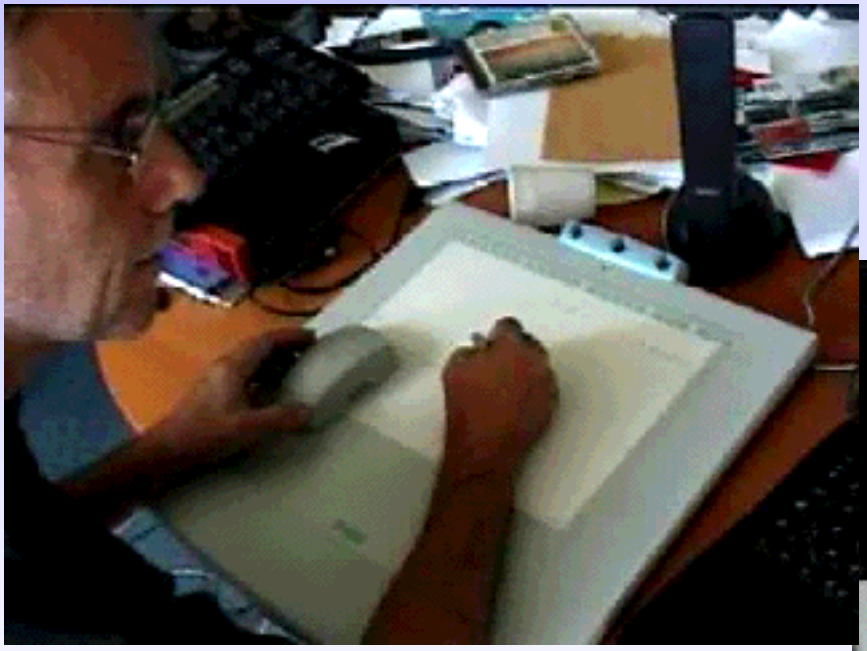




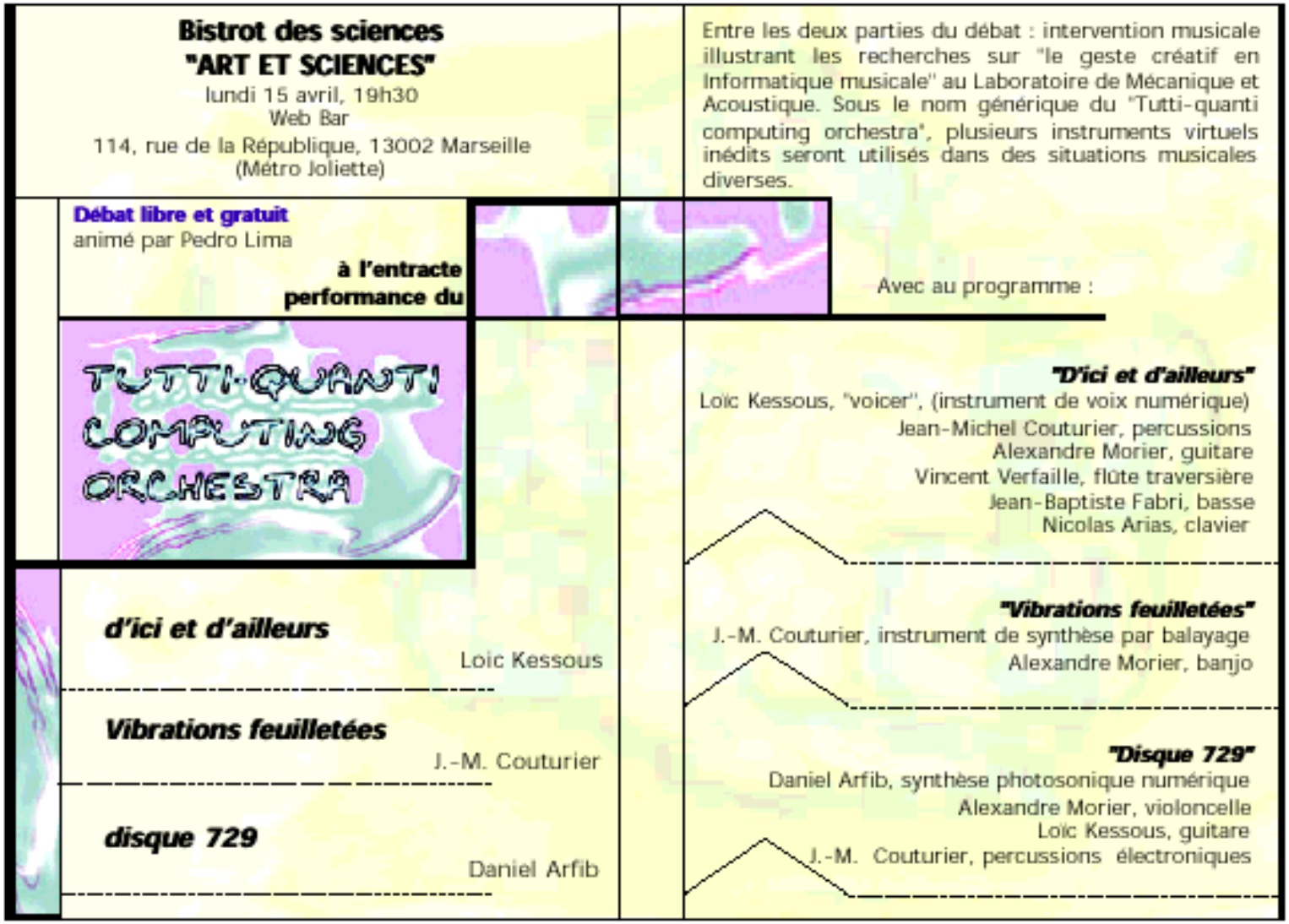


Zones on the tablet

The photosonic emulator



In concert


Bistrot des sciences
"ART ET SCIENCES"
lundi 15 avril, 19h30
Web Bar
114, rue de la République, 13002 Marseille
(Métro Joliette)
Débat libre et gratuit
animé par Pedro Lima
à l'entracte
performance du
TUTTI-QUANTI
COMPUTING
ORCHESTRA
d'ici et d'ailleurs
Loic Kessous
Vibrations feuilletées
J.-M. Couturier
disque 729
Daniel Arfib
Entre les deux parties du débat : intervention musicale illustrant les recherches sur "le geste créatif en Informatique musicale" au Laboratoire de Mécanique et Acoustique. Sous le nom générique du "Tutti-quanti computing orchestra", plusieurs instruments virtuels inédits seront utilisés dans des situations musicales diverses.
Avec au programme :
"D'ici et d'ailleurs"
Loic Kessous, "voicer", (instrument de voix numérique)
Jean-Michel Couturier, percussions
Alexandre Morier, guitare
Vincent Verfaille, flûte traversière
Jean-Baptiste Fabri, basse
Nicolas Arias, clavier
"Vibrations feuilletées"
J.-M. Couturier, instrument de synthèse par balayage
Alexandre Morier, banjo
"Disque 729"
Daniel Arfib, synthèse photosonique numérique
Alexandre Morier, violoncelle
Loic Kessous, guitare
J.-M. Couturier, percussions électroniques

Videos (1)

- Tutti quanti computing orchestra at the Web Bar

Videos (2)

- Tutti quanti computing orchestra at the Web Bar

Videos (3)

- Tutti quanti computing orchestra at the Web Bar

Conclusion

- Digital musical instruments
- Computer-human interaction