

# A typological space for representing collections of sound objects

More than 40 years after Pierre Schaffer's *Traité*, almost 50 years after Varèse's *Poème électronique*

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# 1. Introduction

about the description of sound material

# 1. Introduction

**Sound (not only music) description: soundscape, sound design, ea music**

Studies

1. phenomenological-perceptual categories (Erickson 1975, Cogan 1984, Slawson 1985) for the description of sound, also in popular music (Tagg 1994, Fabbri 2002)
2. spaces for the description of sonic features  
→ “timbral spaces” (Grey, Wessel, Slawson)
3. Pierre Schaeffer’s *Traité* (Schaeffer 1966)
  - double analytical device: “tipo-morphologie”
  - with respect to “contexte/contexture”

# 1. Introduction

## Typo-morphologie

**Morphology:** “analytical” description of the objet (*contexture*)

→ cfr. Smalley 1986, 1999: morphological, more than typological attitude

**Typology:** “synthetic” description of the object (*contexte*)

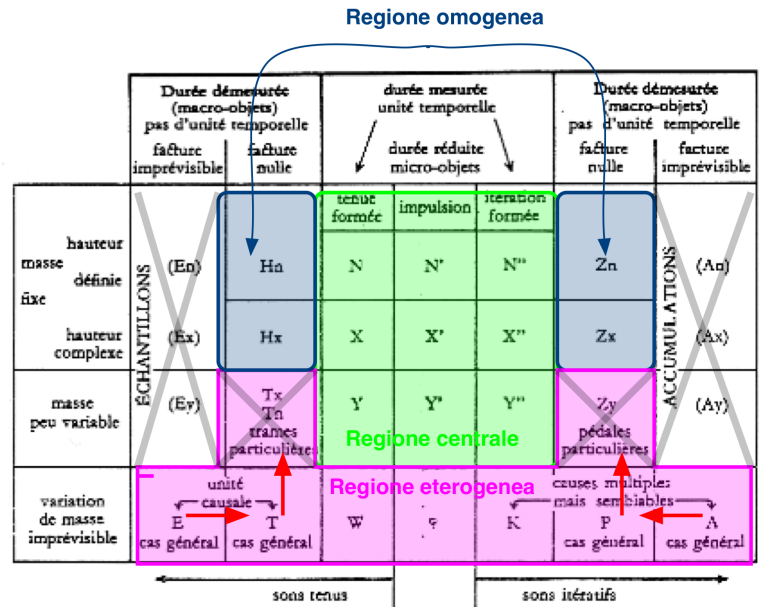
→ sound object collection

- every object is given a position in a relational space
- geography of sound (“cartographie du sonore potentiel”, J.C. Risset)

# 1. Introduction

## Typology: from Schaeffer

- 6 criteria allowing to assign each object to a class
- combines “dans le cadre d’une épure a deux dimensions” (35 areas)
- **Critical aspects:** 6 → 2D reduction is not obvious
- **Goal:** continuous, consistent, inter-subjective space



**Fig. 1** Space: classes, notation, proposed revision

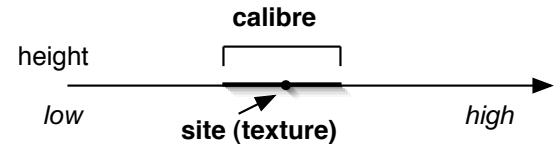
## 2. A typological space

starting from Schaeffer's *Traité*

## 2. A typological space

### Typological criteria: 1. mass

- generalization of the notion of pitch
  - “la masse d’un objet sonore, c’est sa façon d’occuper le champ des hauteurs”
- mass: *couple* of notions:
  1. **Site**: position
  2. **Calibre**: range



**Fig. 2** Mass axis: site, caliber

pitch mass vs. fixed-mass = pitch vs. register

## 2. A typological space

### Typological criteria: 2. variation

(See also morphology → variation criteria: melodic profile, mass profile)

- variation in time of the site (calibre:  $\pm$  constant)
- variation in time of calibre (→ if calibre is changing, typically the site changes too)



## 2. A typological space

### Typological criteria: 3. profile

Sensibility with respect to processuality (**not** duration):

inchoativity, durativity, terminativity (see verbs *to start*, *to last*, *to end*)

Profile → temporal form (“forme”)

- **eumorphism**: relevance of all the three categories (inchoativity, durativity, terminativity)
- **amorphism**: durativity dominates, inchoativity and terminativity irrelevant
- **anamorphism**: profile is compressed, inchoativity and terminativity coincide, durativity irrelevant.

## 2. A typological space

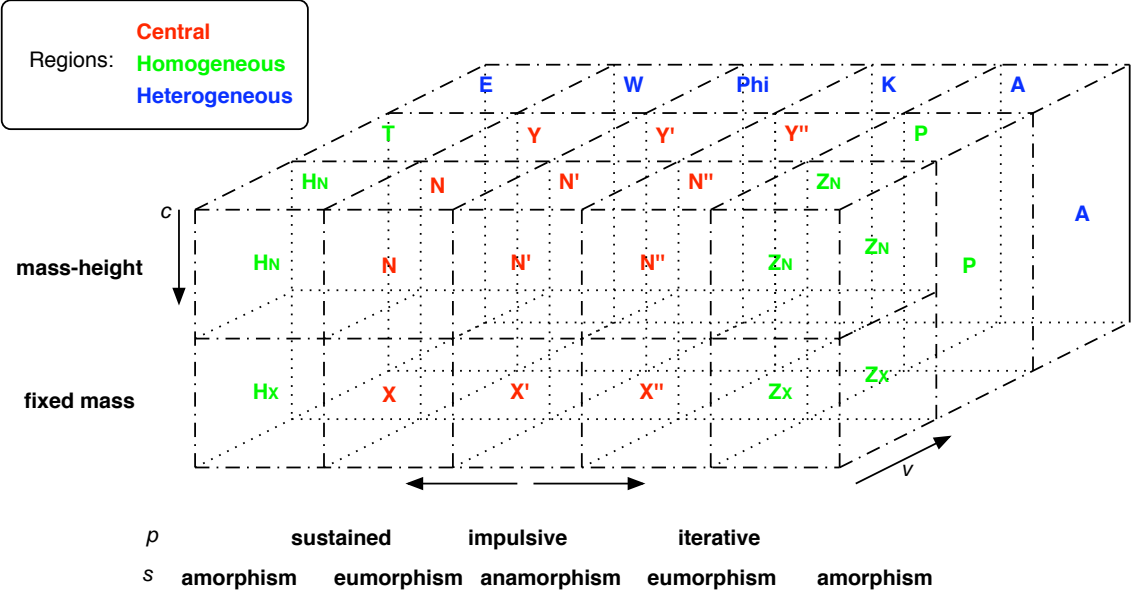
### Typological criteria: 4. sustain (“entretien”)

Examples from string technique

- **sustained**: constant activity over time → colpo d’arco (bow)
- **impulsive**: activity as a singular moment → pizzicato
- **iterative**: activity as a series of repeated contributions → tremolo

# 2. A typological space

## Combining the criteria: resulting space



**Fig. 3** Space generated by profile/sustain - calibre - variation

## 2. A typological space

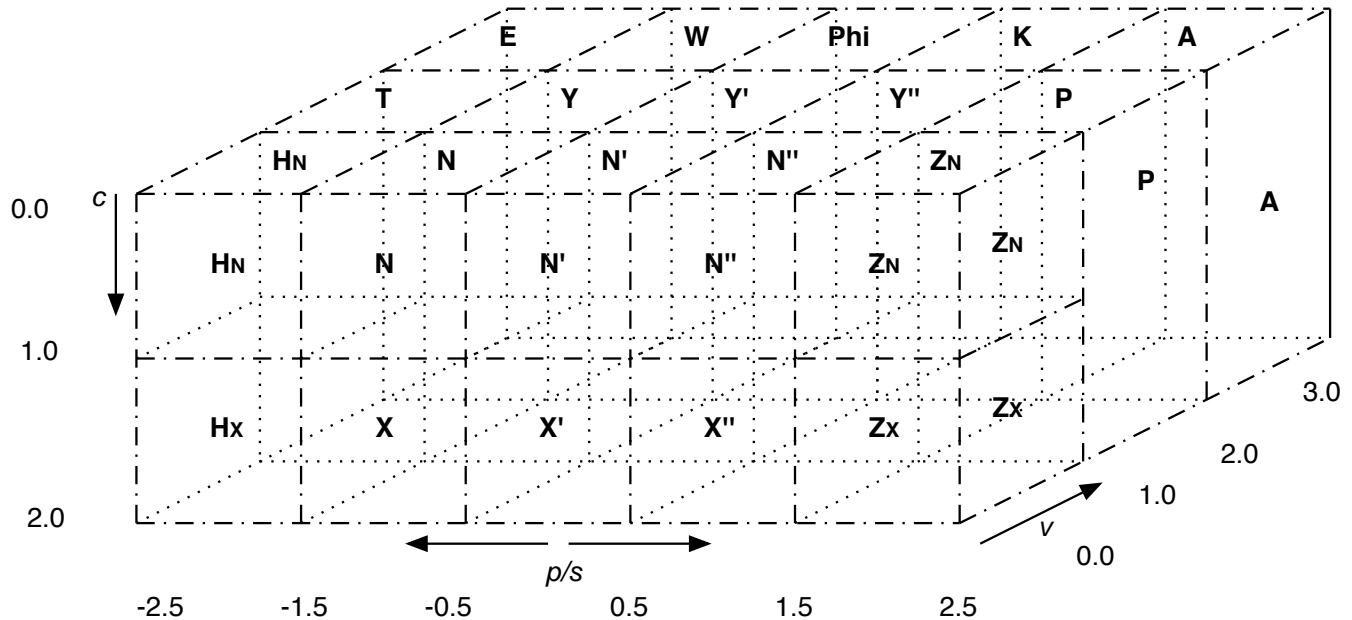
### Methodology: quantitative approach

### Goal

1. to convert Schaeffer's qualitative space into a quantitative one
  2. by assigning an *explicit* and *arbitrary* range to the 3 (4) dimensions of the typological space
- **profile and sustain:**  $[0, 2.5]$  &  $[+, -] \rightarrow [-2.5, 2.5]$
  - **calibre:**  $[0, 2]$
  - **variation:**  $[0, 3]$

**Model** → evaluation of human practices by a competent community  
(e.g. alpine climbing)

## 2. A typological space



**Fig. 4** Typological space: metrics

# 3. Sketch of a methodology

annotation and visualization

# 3. Sketch of a methodology

## Methodology: steps, I

→ For each

1. (partition)

2. **figurative labelling**

→ **Name:** breaking glasses, electric humming, whisper, etc.

3. **phenomenological evaluation . . .**

**Remarks** (→ *better start here*)

*Profile:* amorphous but near to eumorphism, iterative, extremely heterogeneous

*Mass:* complex

*Variation:* present, but not excessive

# 3. Sketch of a methodology

## Methodology: steps, I

4. ... **assisted** through some acoustic cues

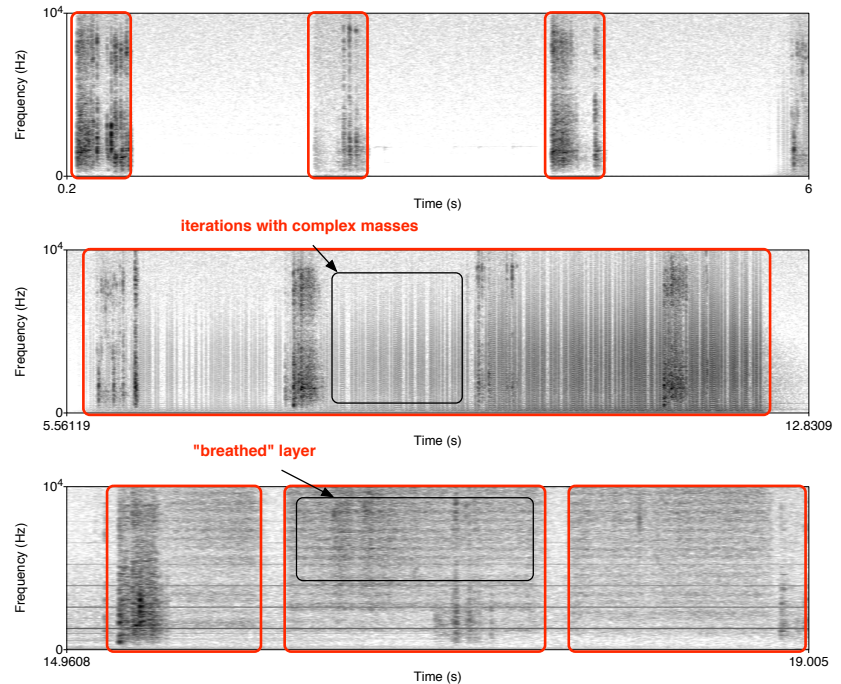
→ sonogram

→ pitch extraction

5. **positioning**

assigning a tuple  $(p, c, v)$

→ (1.6, 1.8, 1.2)



**Fig. 5** Sonograms and annotations



# 3. Sketch of a methodology

## Methodology: steps, II

→ Globally

### 6. creation of a data file

→ xml file

→ can be parsed automatically

→ automated documentation

(xml transformation, e.g. CONTEXT)

```
<?xml version="1.0" encoding="ISO-8859-1"?>
<!--
Created with Typologus
Andrea Valle 2006
andrea.valle@unito.it
http://www.semiotiche.it/andrea
!-->

<collection>Sentimental Journey

<object>
<name>nastri oggetti</name>
<position>(1.6, 1.8, 1.2)</position>
<remarks>Profilo: amorfo ma prossimo all'eumorfismo, iterativo, estremamente disomogeneo
</remarks>
</object>

<object>
<name>humming elettrico</name>
<position>(1.7, 0.9, 0.2)</position>
<remarks>Profilo: amorfo, sostegno iterativo Massa: calibro costante, notale con rumore,
</remarks>
</object>

<object>
<name>sibilo</name>
<position>(-1.8, 1.8, 0.2)</position>
<remarks>Profilo: amorfo, sostegno tenuto costante Massa: fissa Variazione: scarsa

[...]
</collection>
```

Fig. 6 Typological xml file

# 3. Sketch of a methodology

## Methodology: steps, II

### 7. **collection visualization**

→ automatic generation of the representation of objects' position in the space

### 8. **neighborhood evaluation**

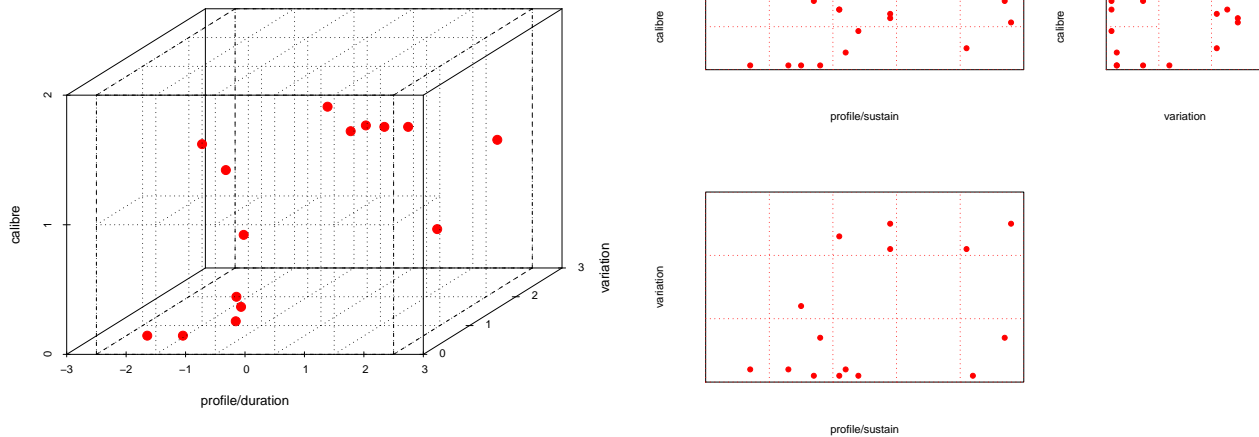
→ to increase consistency (can be iterated)

### 9. (optional) **position re-assignment**

→ changes are possible

# 3. Sketch of a methodology

## Space automated visualization



**Fig. 7** “Sentimental Journey” (Pere Ubu): 3D representation of the typological space and 2D projections

# Psycho\_TheMurder

## Sound Object Typological Classification

including for each sound object

1. 3D representation
2. name
3. position
4. remarks

+ global presence of all the objects in the space

Created with Typologus on June 08, 2006  
Typeset with ConTeXt on June 8, 2006

## 1 water

## 1.1 Position (profile, calibre, variation)

(2.0, 1.8500000000000001, 0.0)

## 1.2 Remarks

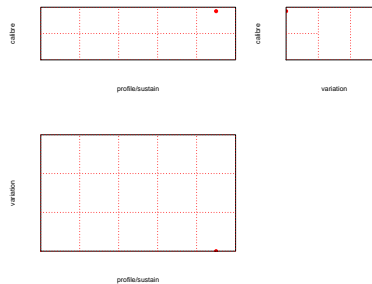
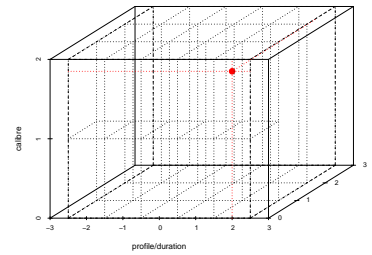
**Profile:** iterative, amorphous, unchanging**Mass:** nodal, large calibre, high textured**Variation:** nodal, large calibre, high textured

Figure 1 water: typological placement

## 2 voice

## 2.1 Position (profile, calibre, variation)

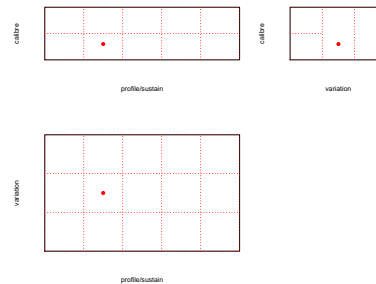
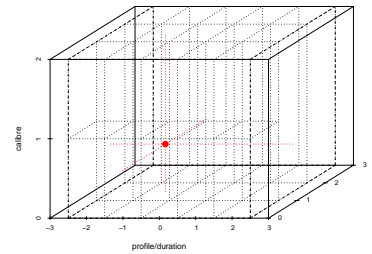
(-1.0, 0.5999999999999998, 1.5)

## 2.2 Remarks

**Profile:** sustained, eumorphic, series of well-shaped object

**Mass:** tonic, but dense (-> scream)

**Variation:** large glissandos even if short objects



**Figure 2** voice: typological placement

### 3 highStrings

#### 3.1 Position (profile, calibre, variation)

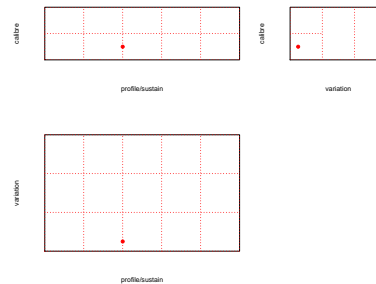
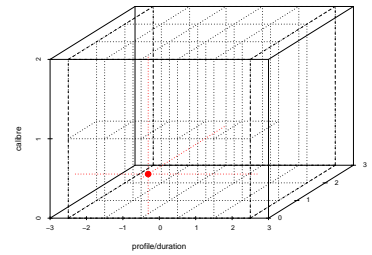
**(-0.5, 0.5, 0.25)**

#### 3.2 Remarks

**Profile:** sustained, anamorphic

**Mass:** tonic (pitched)

**Variation:** unchanging, with timbral coloration



**Figure 3** highStrings: typical placement

## 4 lowStrings

### 4.1 Position (profile, calibre, variation)

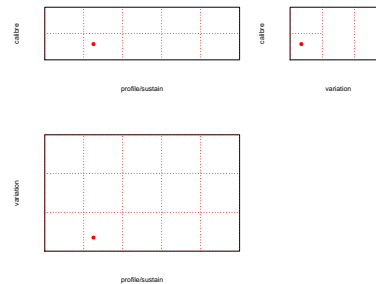
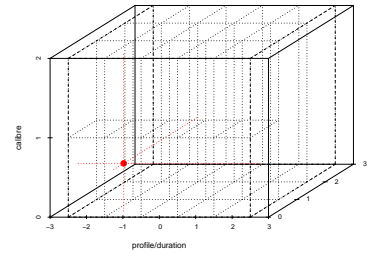
**(-1.25, 0.5999999999999998, 0.3499999999999998)**

### 4.2 Remarks

**Profile:** sustained, eumorphic, but stable

**Mass:** pitched, but dense

**Variation:** two pitched fragment



**Figure 4** lowStrings: typological placement



5 beats

5.1 Position (profile, calibre, variation)

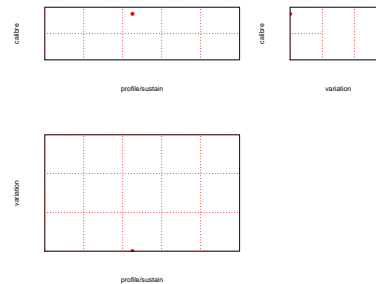
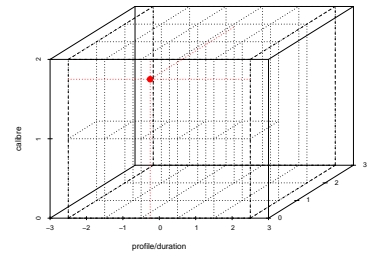
(-0.25, 1.75, 0.0)

5.2 Remarks

**Profile:** sustained, anamorphic

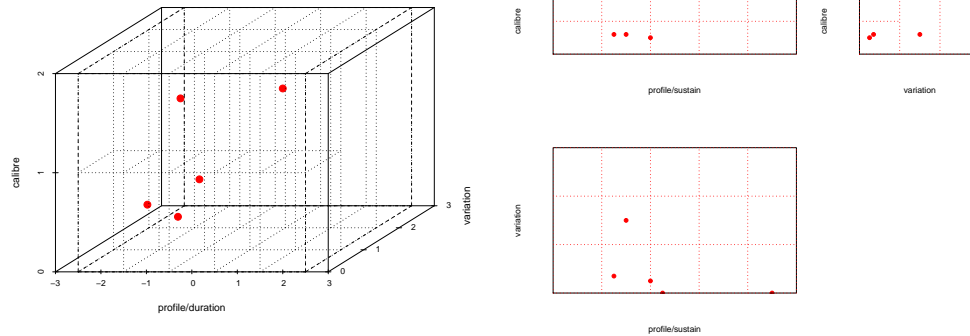
**Mass:** nodal,

**Variation:** unrelevant



**Figure 5** beats: typological placement

## 6 Summary



**Figure 6** Typological placement of all the objects

# 4. Varèse's *Poème électronique*

an analytical application

## 4. Varèse's *Poème électronique*

- Brussels Expo 1958
  - Le Corbusier → Varèse, Xenakis
  - first multimedia work with audio spatialization
    - video projections and light effects
    - 3 tracks of electronic music
    - over 350 loudspeakers
- (→ *Interlude sonore*, i.e. *Concret PH*) by Xenakis



**Fig. 8** Philips Pavilion: external

## 4. Varèse's *Poème électronique*

### The Virtual Electronic Poem (VEP) Project

- VR, stereoscopic, binaural reconstruction of the *Poème électronique*
- philologically correct
- allowing to live again the complex immersive experience

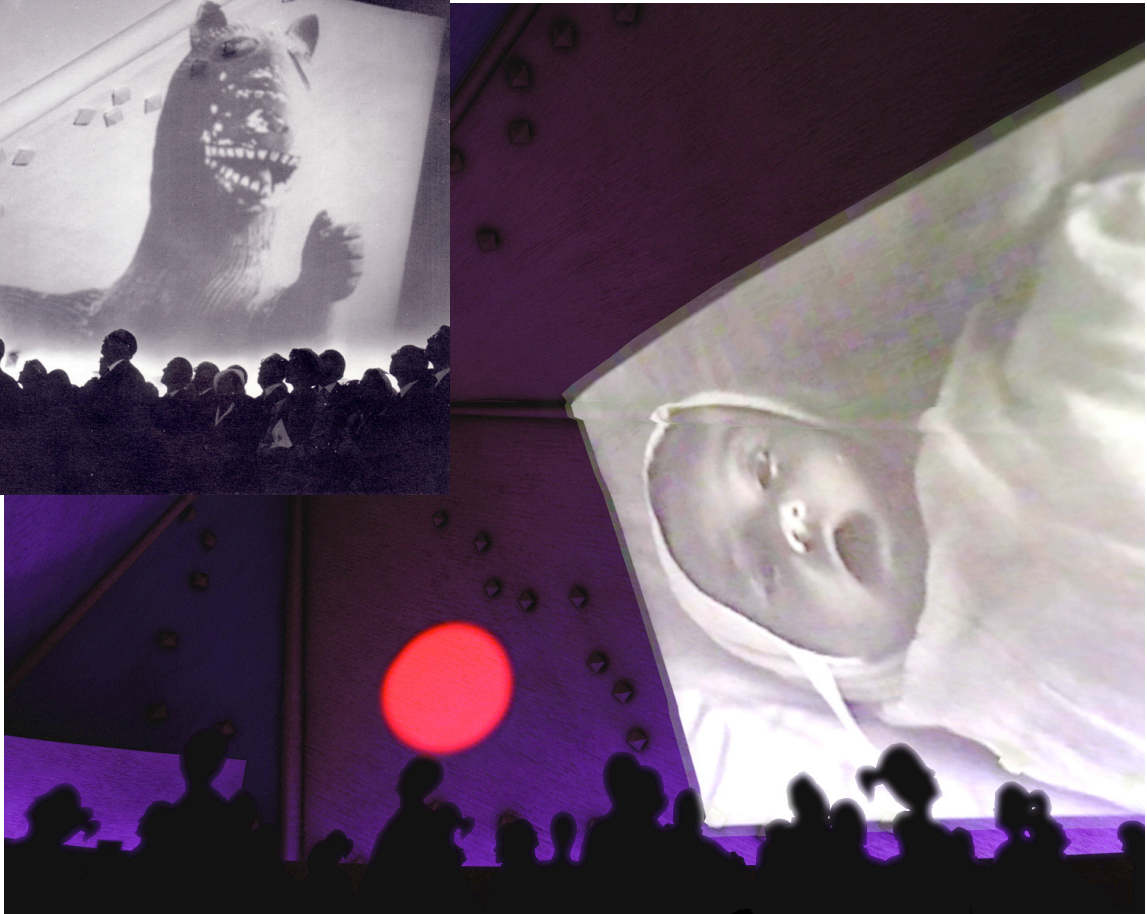
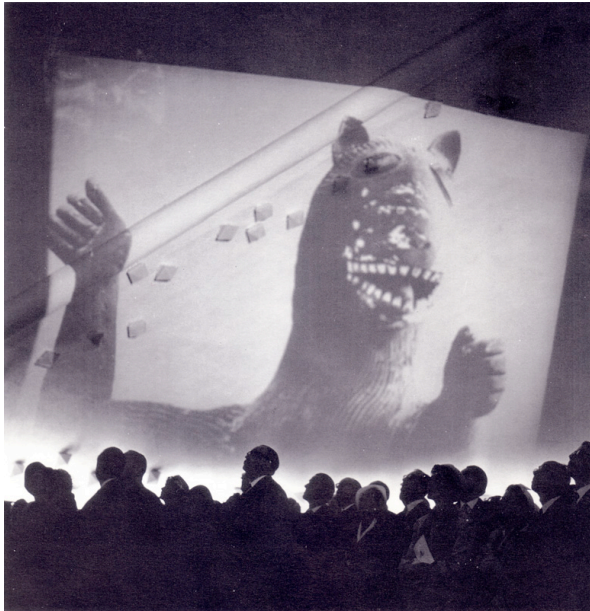
<http://www.edu.vrmmp.it/vep/>

EU Culture 2000 programme (CLT2004/A1/CH/IT352)

VRMMP - Turin, TUV Berlin, University of Bath, Silesian Politechnic School

→ Barcelona, ICMC 2005; Santa Barbara (CA), ACM 2006

→ Berlin, Eindhoven, Basel, Paris

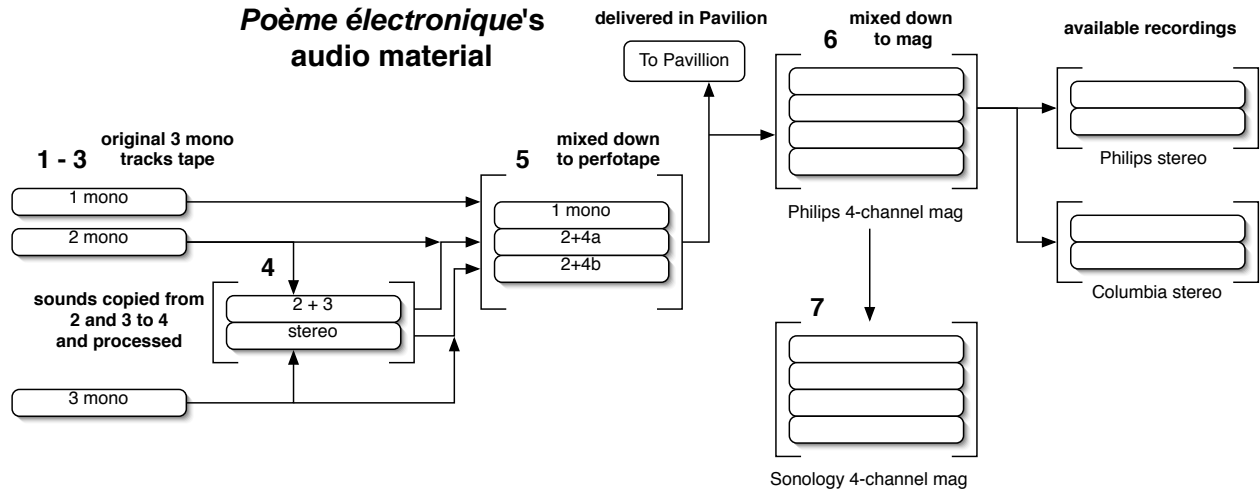


## Original audio material

- complex productive history
  1. Eindhoven (Philips)
  2. Eindhoven (Electronic studio)
  3. Utrecht (Sonology)
  4. The Hague (Conservatory)
- Kees Tazelaar: study and digitalization



# 4. Varèse's *Poème électronique*



**Fig. 10** Production of the *Poème électronique*'s tapes



# 4. Varèse's *Poème électronique*

## Compositional logic

### Material

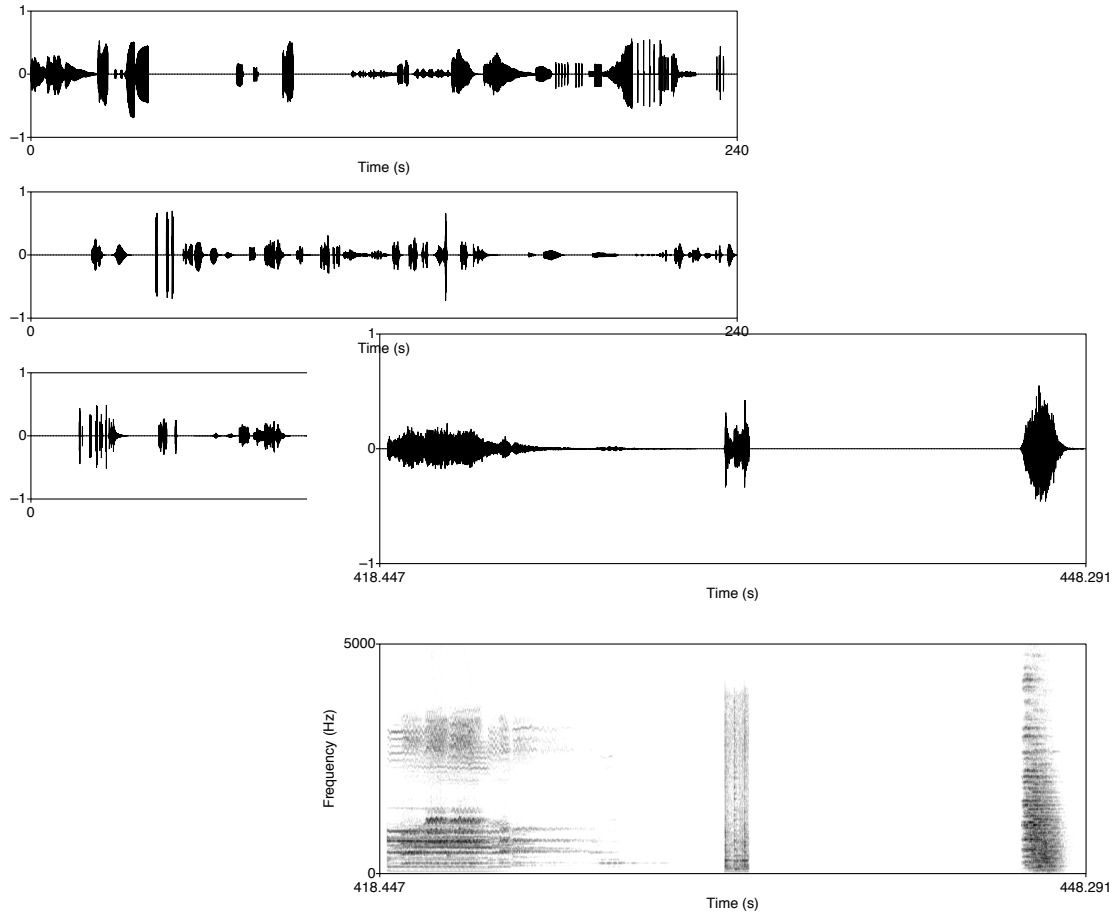
- 3 track organization does not depend on technology (e.g. amplitude maximization)
- 3 parallel strata prepared according to the principle of the “sensation of non blending”  
→ vertical segregation
- sequence of blocks of sound separated by silence  
→ horizontal segregation

### Space?

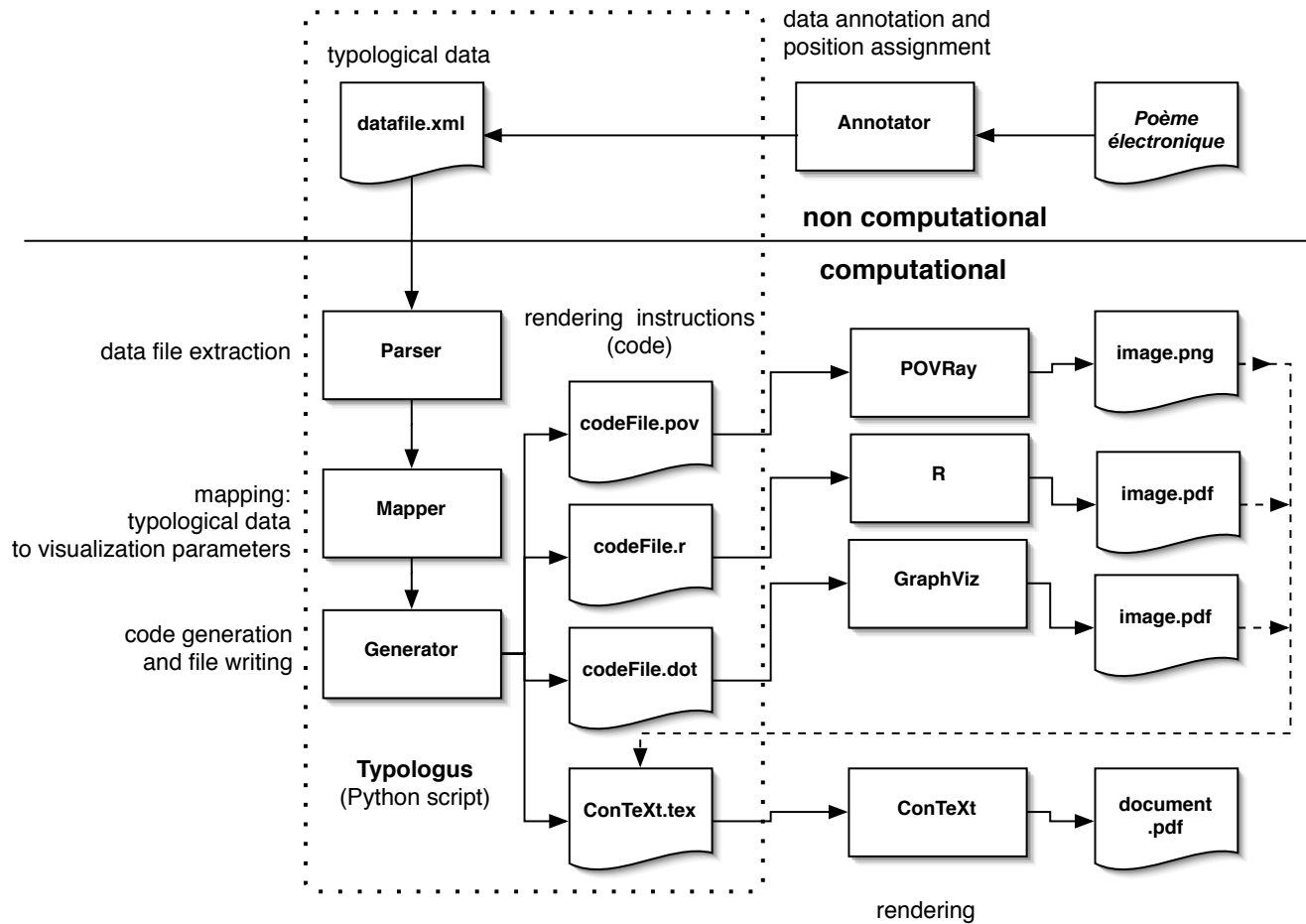
- spatialization is fundamental but in the classic Varèsian sense  
→ *inside* the sound (e.g. sirens, glissando)
- “Intonation” work was implemented by Tak (following Varèse’s indications)
- **consequence**: segmentation is not a problem

**Q:** Is it useful to study sound materials autonomously in the 3 tracks?

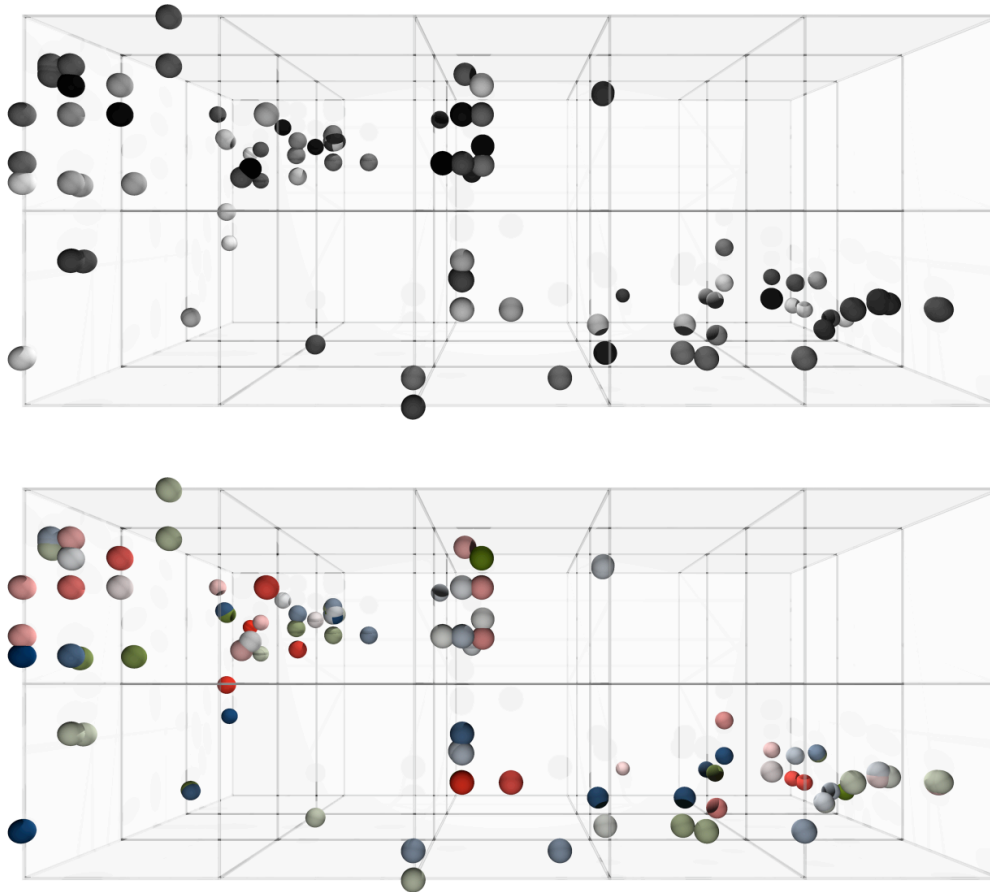
**A:** Yes, to find the logic of organization (→ “organized sound”) in terms of sonic properties



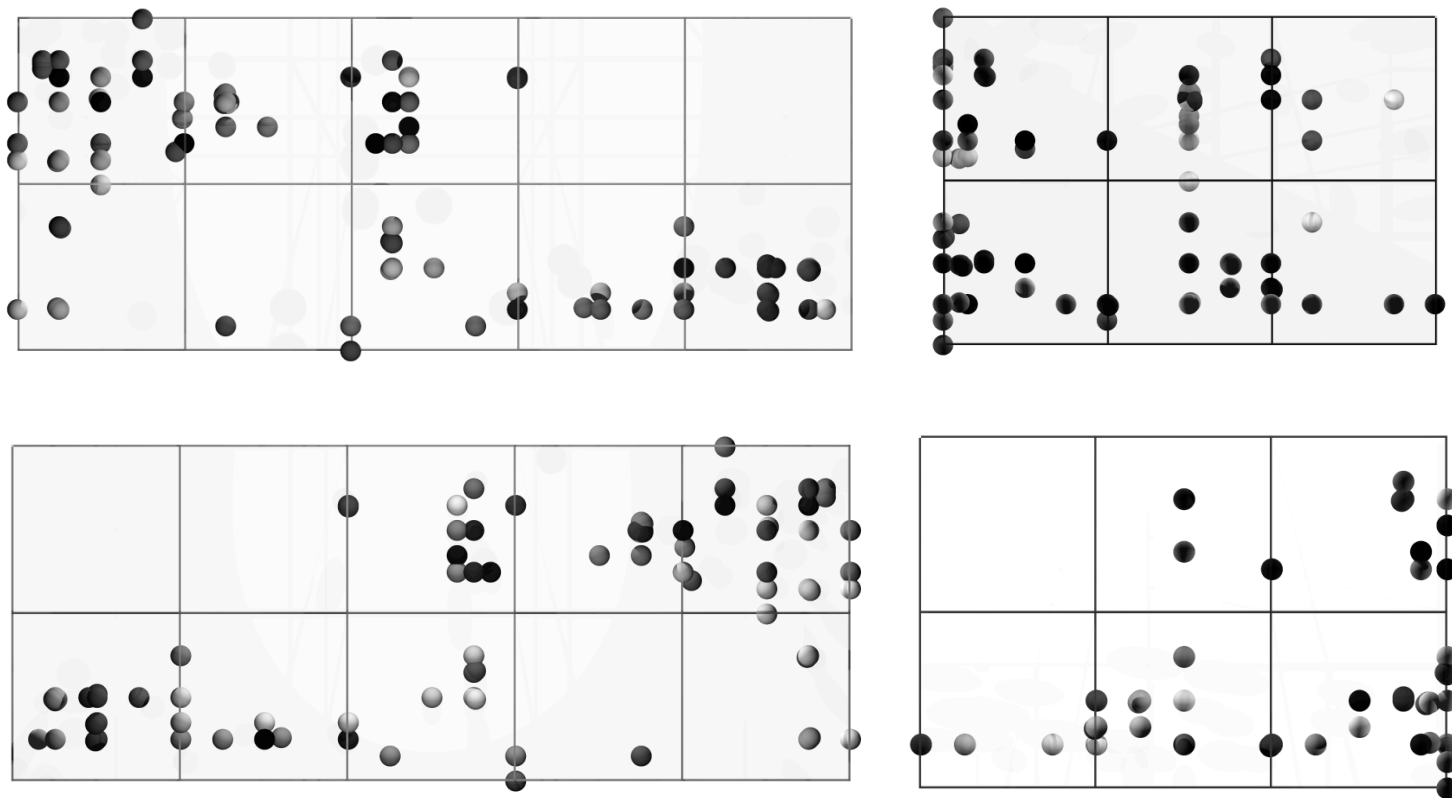
**Fig. 11** Tracks: **1, 2, 3, all, excerpt**



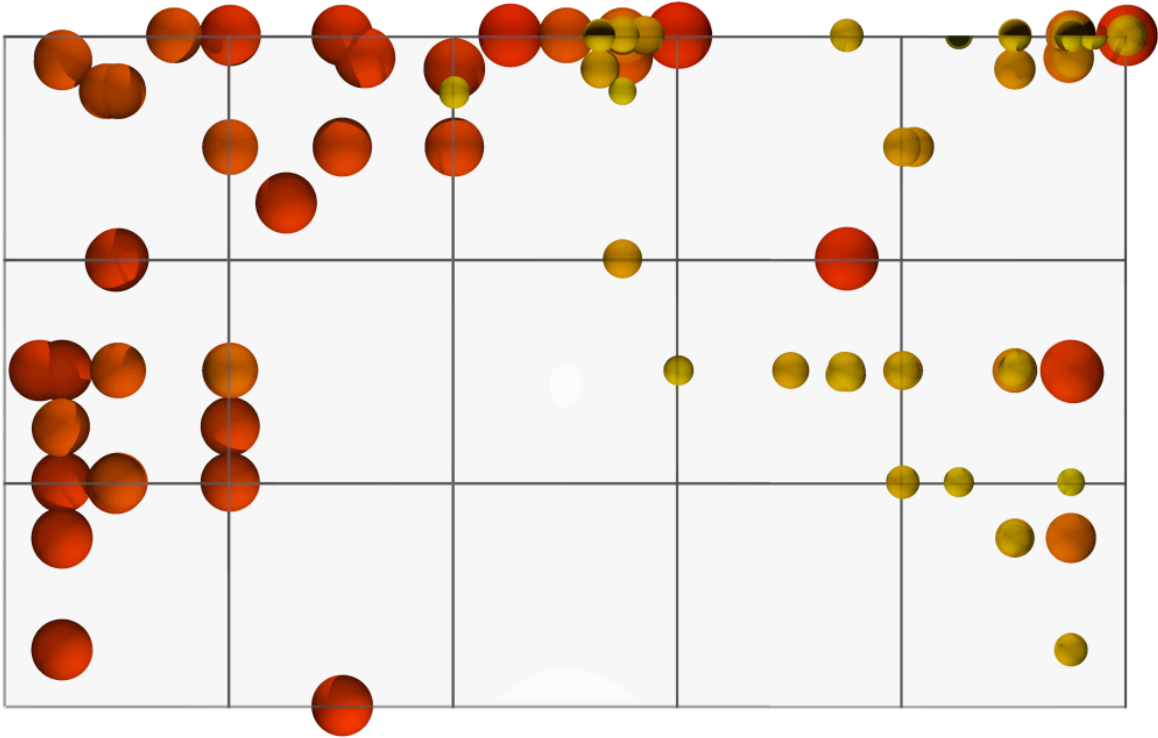
**Fig. 12** Annotation system architecture



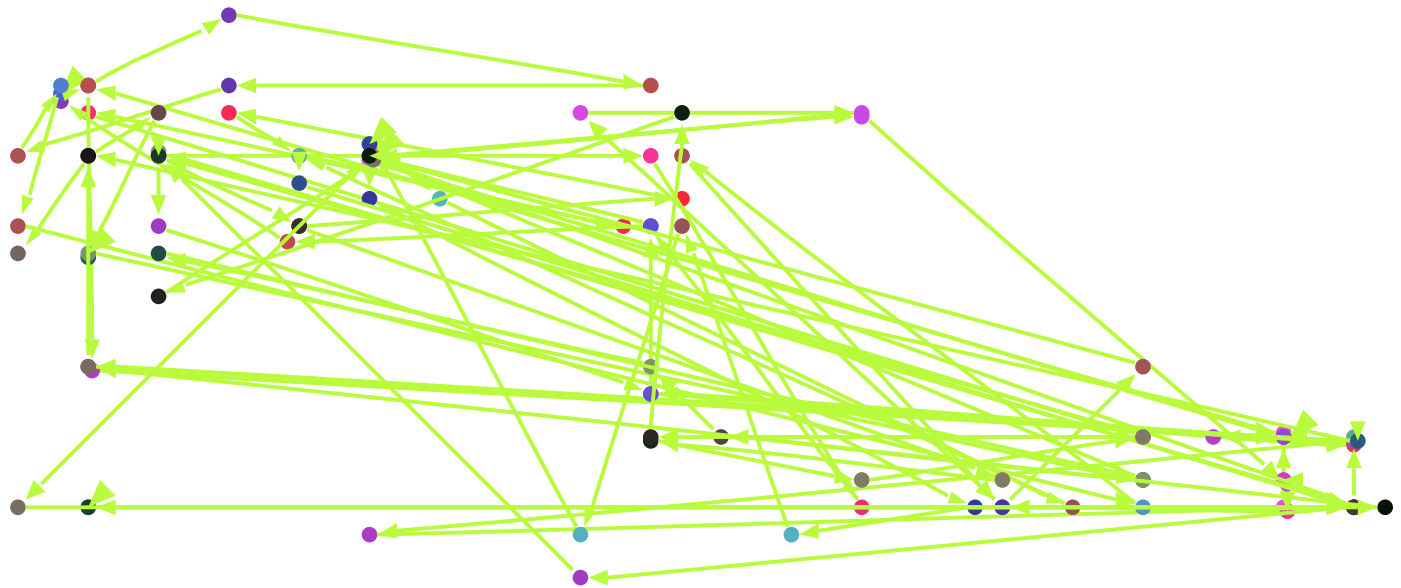
**Fig. 13** Temporal positioning:  
black → white; RGB → tracks



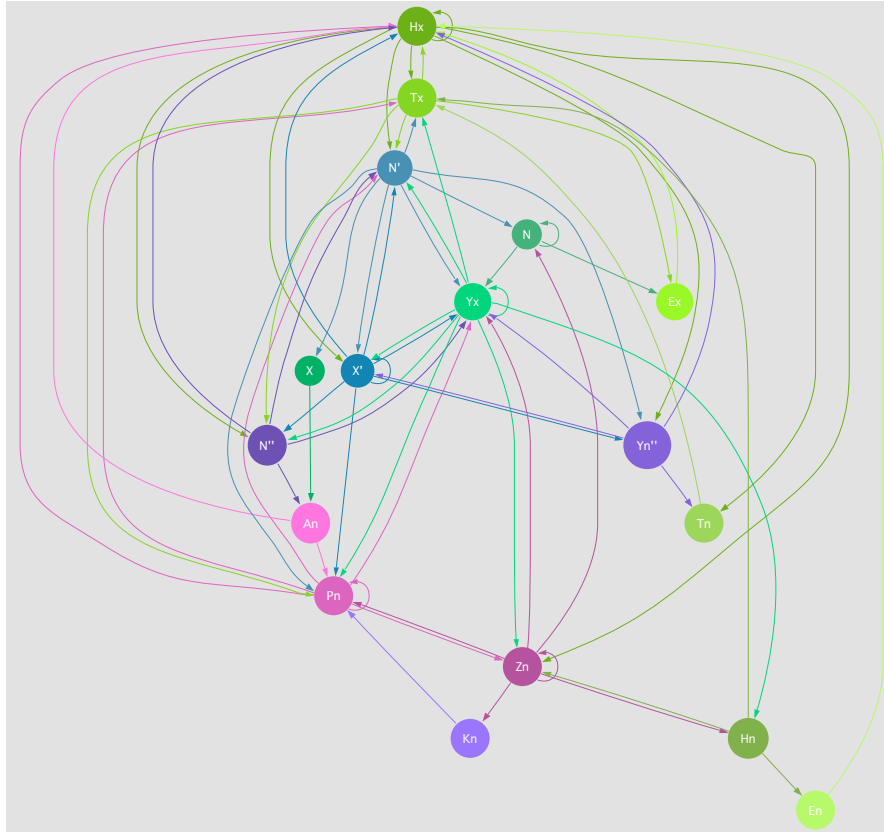
**Fig. 14** Typological space: sections



**Fig. 15** (Orthographic) red to yellow and diameter:  $\propto$  calibre



**Fig. 16** Temporal sequence (GraphViz), frontal view



**Fig. 17** Graph of typological relations (sketch of a syntax)



## 4. Varèse's *Poème électronique*

### Some observations on *Poème's* space

- There is not a specific trajectory (→ linear transformation)
- but a progressive movement towards an increase of variation and calibre
- sounds objects tend to occupy the peripheral parts of the space

# Conclusions

## 1. Evaluation and positioning: criteria and praxis

### criteria

- **mass**: it is difficult to define relative positions in case of chords/sons cannelées/complex spectra
- **duration/profile**: a wide grey area between eumorphism and amorphism
- **variation**: as noted by Schaffer, the evaluation of calibre becomes more difficult when variation increases

- **sustain**: (very few) cases demonstrate a continuous transformation

### praxis

- differences between iterated evaluations ( $\approx 0.25$ )
- the continuum seems to be a gradatum

## 2. Typological space

- needs to be refined and accurately fine-tuned
- allows an explorative approach to sound description
- allows to identify trajectories and subspaces peculiar to specific corpora
- can be used to implement “sonic browser” for interactive approaches to analysis and for sound design (see timbral space)

Thank you  
Merci  
Grazie