

# *An Exploration of Real-Time Visualizations of Musical Timbre*

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**0. Structure**

**Structure:**

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2. The Patches

3. Examples

3.1 Analysis: Visualizations of Grisey's *Modulations*

3.2 Performance: The Audio Control Patch

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**1. Introduction / Motivation**

*“The role of timbre has extended to that of central subject of the music. Then, paradoxically, the very notion of timbre, this catchall, multidimensional attribute with a poorly defined identity, gets blurred, diffuse and vanishes into the music itself.”*

- J.-C. Risset & D. Wessel, 1999

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## **1. Introduction / Motivation**

- Timbre, the “famous” American Nation Standards Institute definition (1973):

*“Timbre is that attribute of auditory sensation in terms of which a subject can judge that two sounds similarly presented and having the same loudness and pitch are dissimilar.”*

- Defines timbre by what it is not
- Leaves out non-pitched sounds

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## **1. Introduction / Motivation**

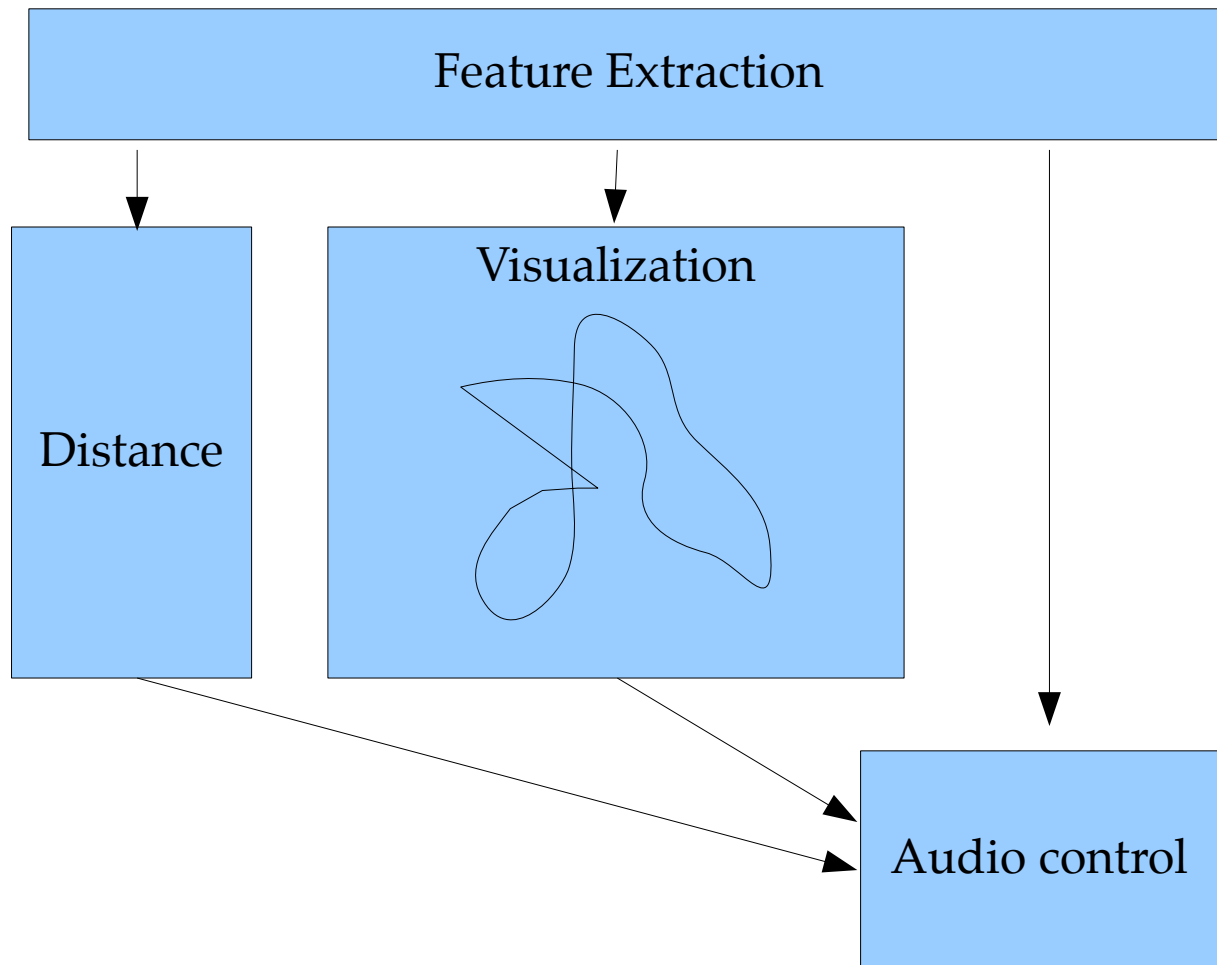
- Increasing relevance of timbre in composition:
  - Schönberg: *Klangfarbenmelodie*
  - Electronic studios: “sounds from scratch”
  - E.g. with Ligeti, Grisey, Murail: timbre central in instrumental music as well
  - Murail, 2005: “The Revolution of Complex Sounds”
- Problem for music theory:  
*How to analyse timbral relations in music?*

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## **1. Introduction / Motivation**

- Exploratory approach:  
*Timbre analysis by visualization and control*
- Visualization of audio features relevant for timbre perception (see e.g. MDS studies by McAdams)
- Patches for extraction of audio features, their visualization and feature based audio control
- Real-time

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**2. The Patches**



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**2. The Patches**

*Feature Extraction.*

- zsa.descriptors
- CNMAT Analyzer (loudness, noisiness, roughness)
- Compound descriptors (bark-flux, centroid-flux, bark based spectral crest factor, ...)
- Defaults: FFT window size: 512, 50% overlap, 44.1 kHz

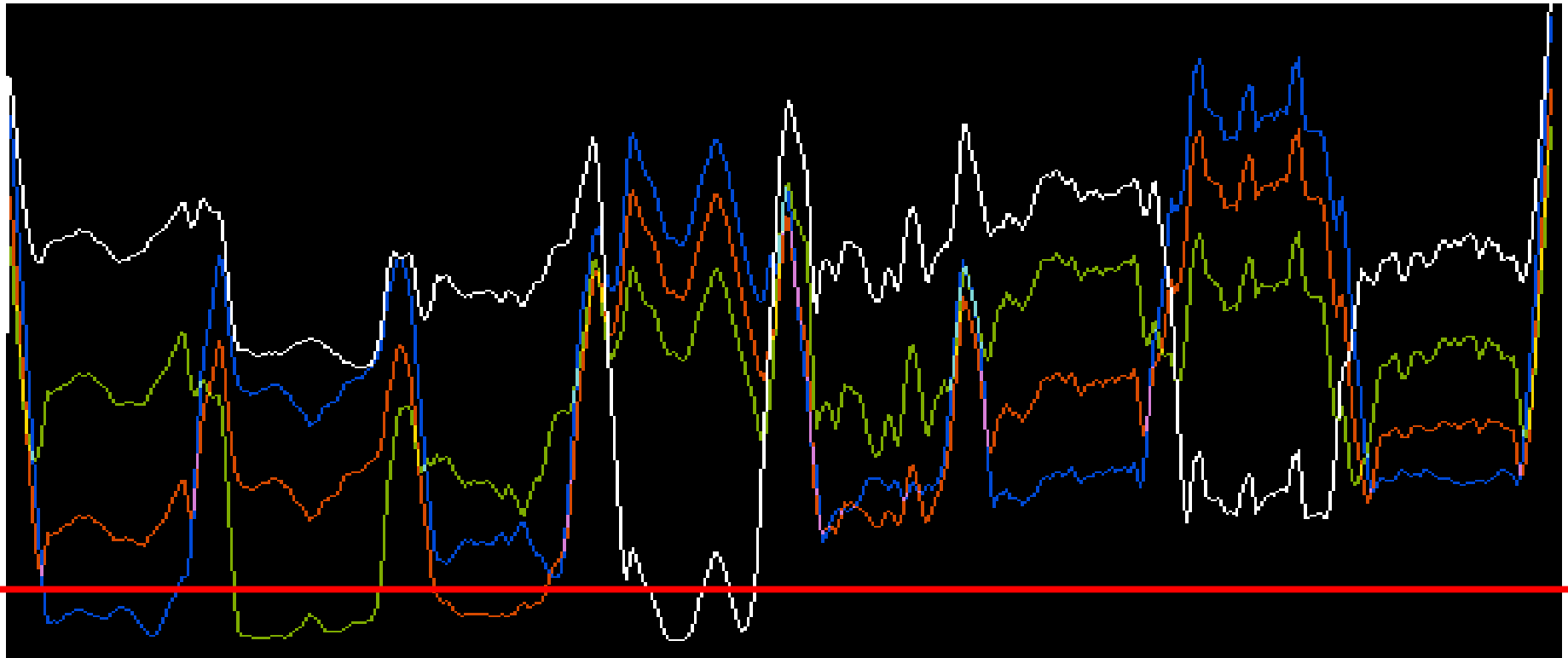
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## **2. The Patches**

*Visualization.*

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**2. The Patches**

*Distance.*



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**3. Examples. 3.1 Analysis: Visualizations of Grisey's *Modulations***

Example: last section (no.44 - end) of Gerard Grisey's:  
*Modulations for 33 Instruments*

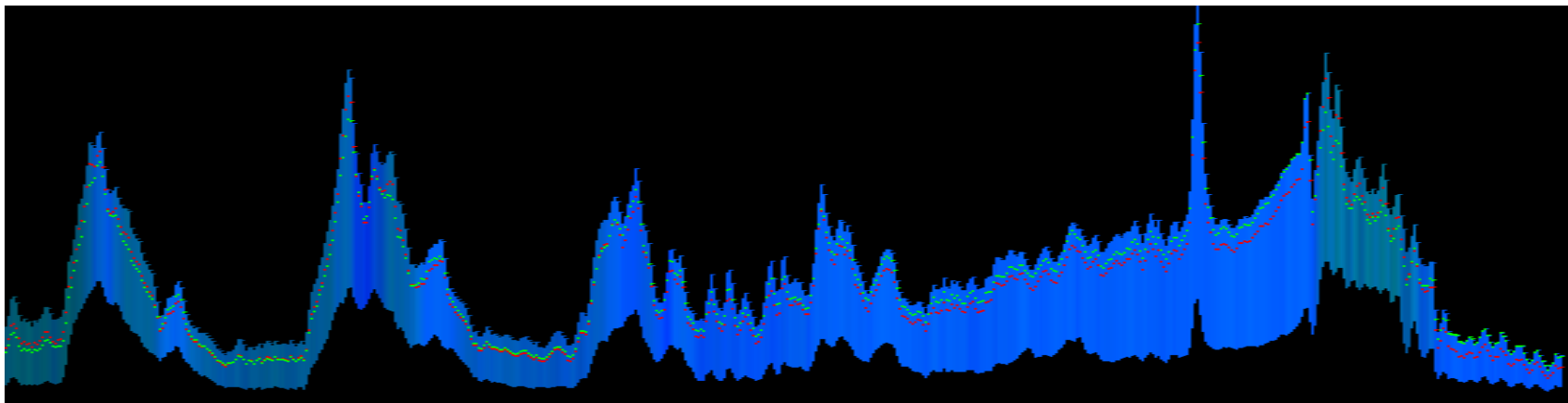
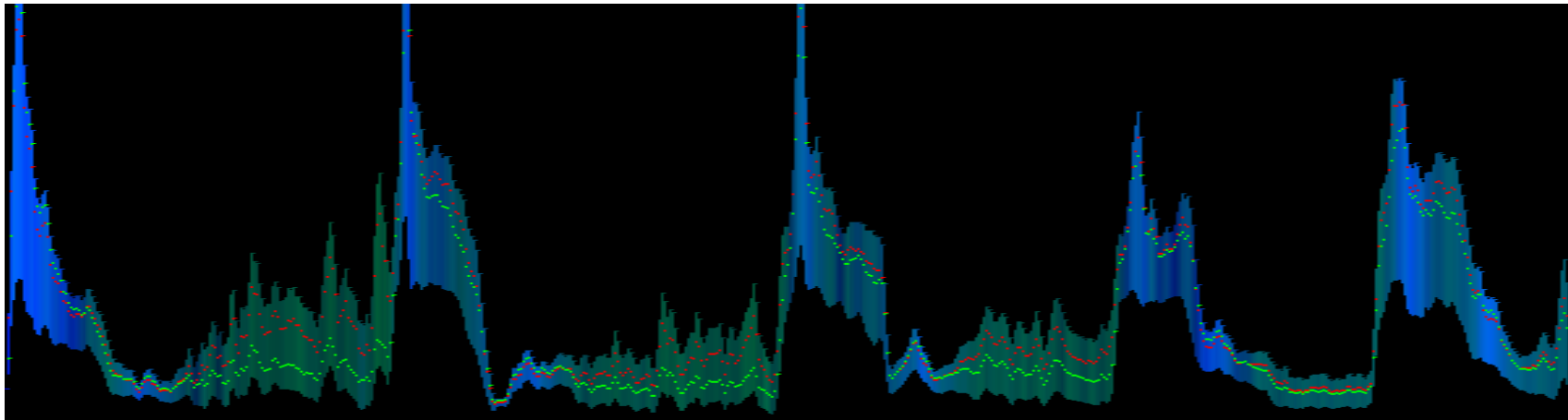
- Musical process from harmonicity to inharmonicity with a crescendo in ten steps
- 3 evolving sound objects: continuous string section, high chords by woodwinds, “subharmonic” chords in brass
- Process ~ convergence of these sounds

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**3. Examples. 3.1 Analysis: Visualizations of Grisey's Modulations**

*River-visualization.*

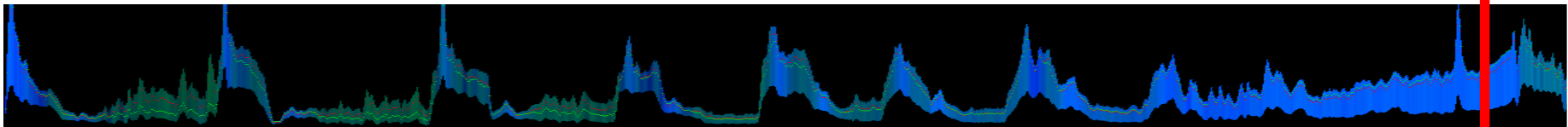
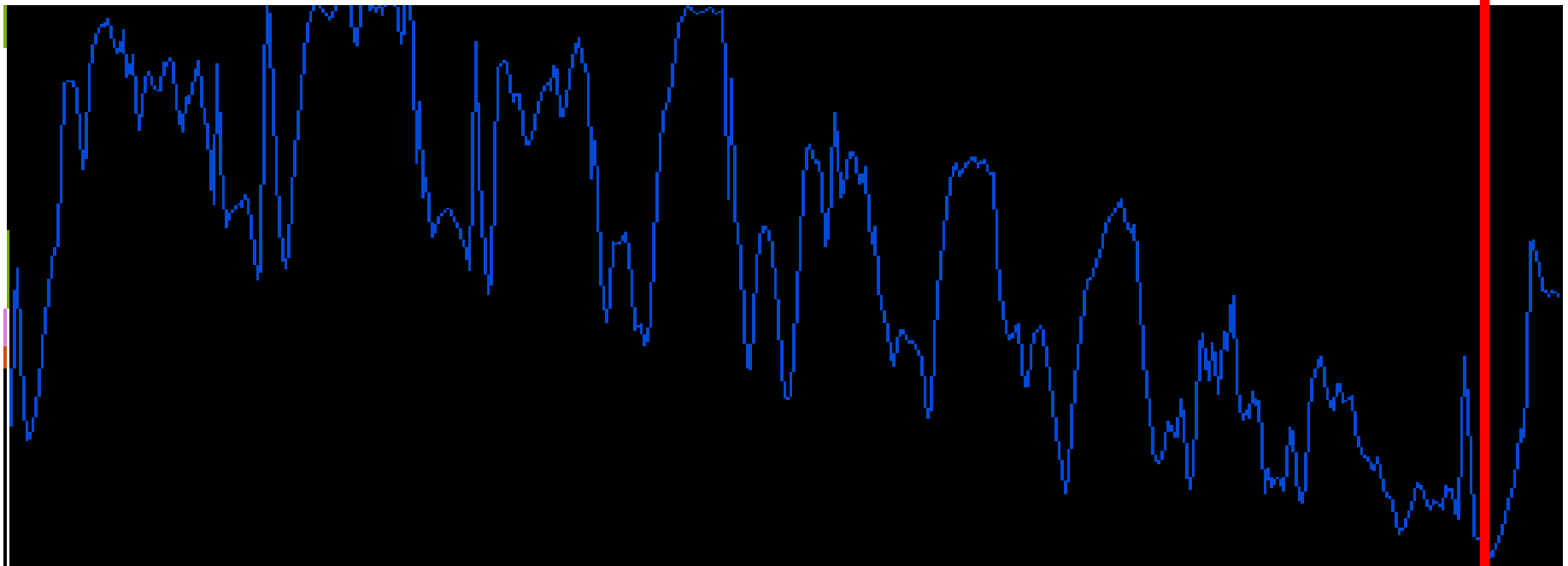
lower bound: centroid, width: spread, intensity of blue: bark based flux,  
intensity of green: flux, red dots: noisiness, green dots: loudness



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**3. Examples. 3.1 Analysis: Visualizations of Grisey's Modulations**

*Distance*

reference point

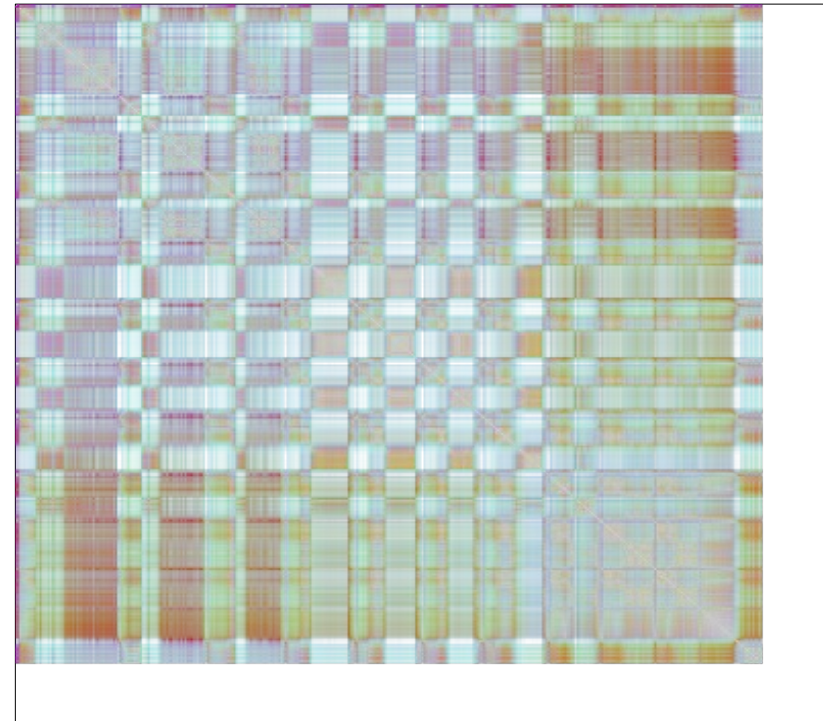
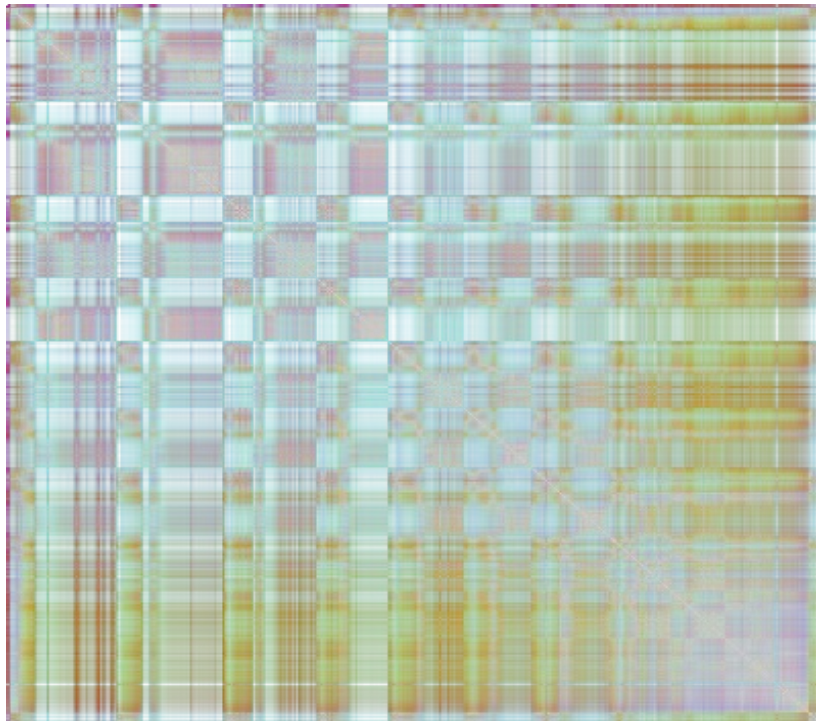


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**3. Examples. 3.1 Analysis: Visualizations of Grisey's Modulations**

Similarity matrices of two different recordings\*:

**Turquoise:** spectral envelope, **Magenta:** loudness, **Yellow:** flux



Left: Gerard Grisey: Les Espaces Acoustiques, Kairos, 2005.

Right: Gerard Grisey: Les Espaces Acoustiques, Accord 2001

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**3. Examples. 3.2 Practice: The Audio Control Patch**

*Audio Control.*

## **4. Conclusion**

### **Conclusion.**

- This project an attempt to find high dimensional visual representations of timbre related audio features to analyse the role of timbre in composition more systematically.
- Visual representation as a “listening / analysis aid” in music pedagogy and research.
- Real time methods suited for artistic exploration...

## **4. Conclusion**

### **Future Directions.**

- *Feature Extraction*: Better higher level perceptual features
- *Visualization*:
  - open GL
  - without real time constrains for analysis purposes
- *Distance*: systematic testing and comparison