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Designing Sound Representation for Musicology

Pierre Couprie

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1 Introduction

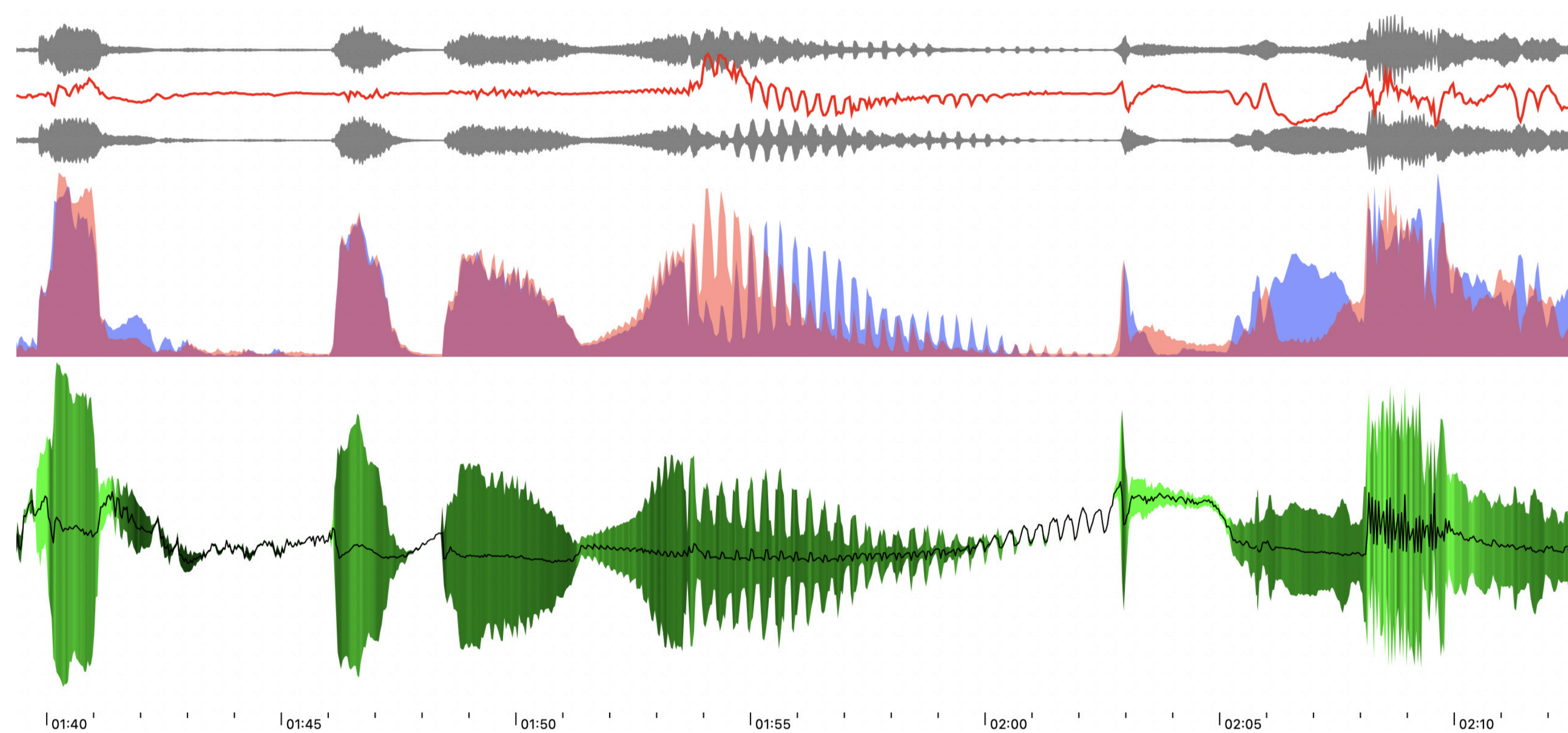
There are many forms of representation of the sound signal: from the waveform to higher-level representations such as FFT visualization, audio descriptors or the chromagram. Some of them are commonly used by musicians or musicologists, others are used more rarely.

Using a sound representation in musicology does not only mean using technology coming from acoustics and computer science, but also means using a digital method of musical analysis.

2 Challenges

The transfer of methods from exact sciences to musicology poses serious challenges:

- Musicologists are generally limited to using tools developed for other sciences that are basically inadequate when applied to their scientific methods.

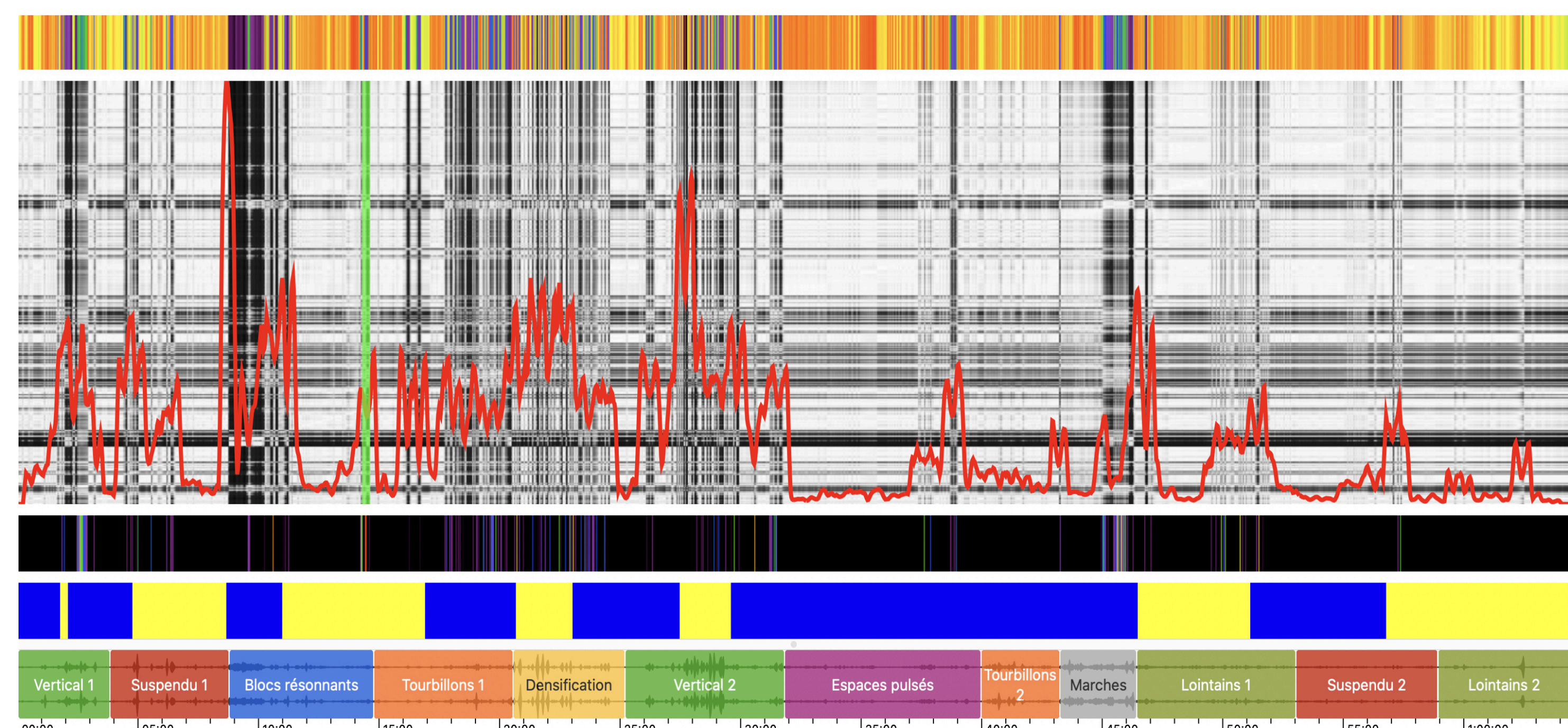


and the OMax software.

The interaction between the musician (in red) and the software (the other colors) is clearly visible whereas the spectral texture is somewhat complex: response of the musician on some morphologies, morphological differentiation of pitches, improvisation strategies between the musician and each iteration of the software, software fragmentation of sounds.

5 Self-Similarity Matrix Interpretation-Assistance System

Self-similarity matrices (computed from the FFT data or from a set of audio descriptors) are particularly relevant in the analysis of musical form or microstructures. They also facilitate the exploration or navigation of long audio files. However, interpretation is difficult for the musicologist, which is why we



- The production of software is often limited to a few Python scripts that are difficult to use for a musicologist.
- The application of these techniques is therefore not to be found in a simple transfer between the exact sciences and musicology but in the development of new musicological methods.

For the last fifteen years, we have developed the software **iAnalyse** which allows the musicologist to use complex technologies with representations adapted to their field of research.

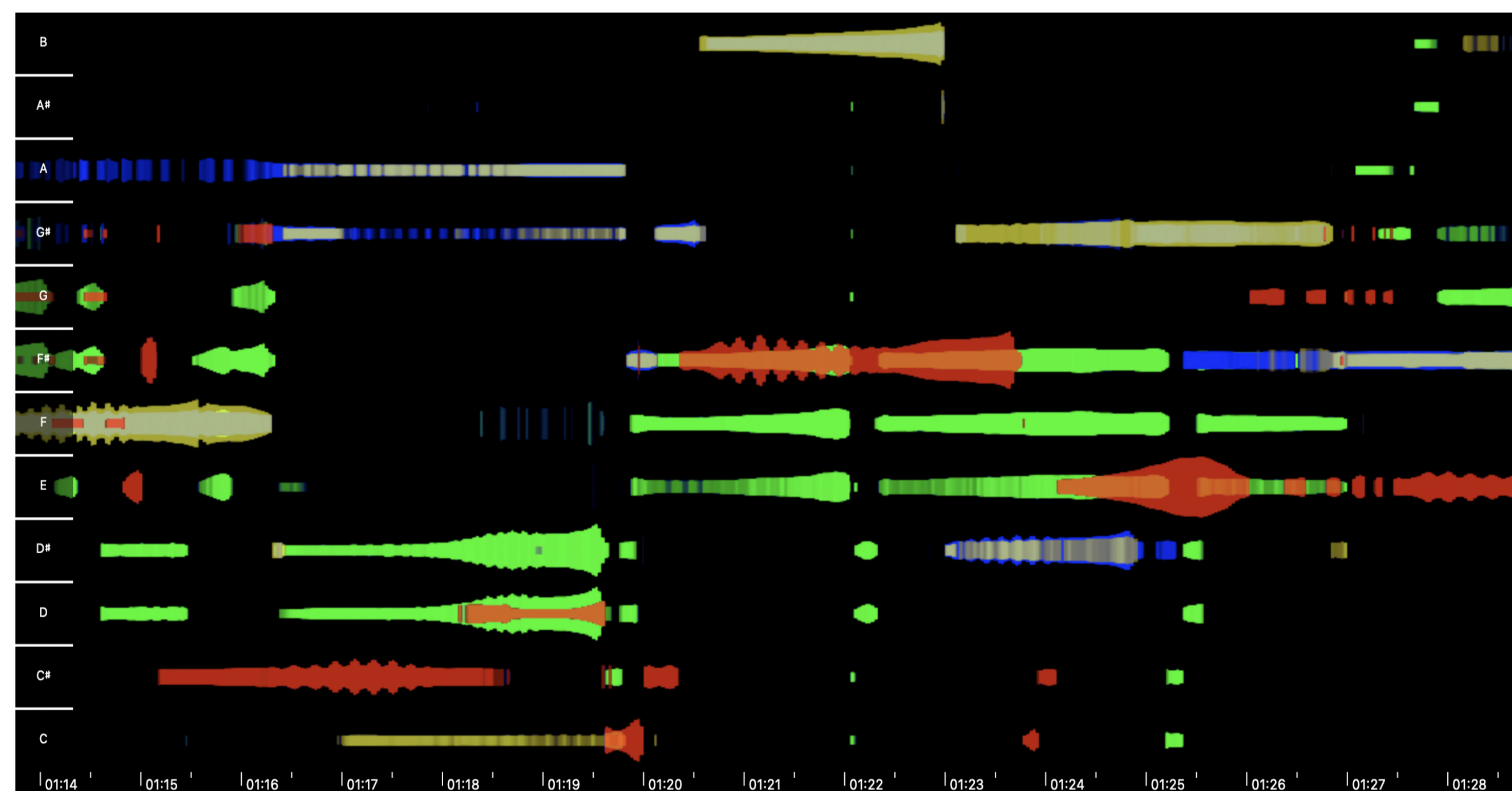
3 Augmented Waveform

The representation of the sound amplitude or the waveform facilitates identification of the temporal relationship between sound characteristics such as attacks, musical intensity, morphologies or occurrence of silences.

- Two channels and their deviation.
- Two channels on different layers, it facilitates the visualization of their differences.
- Augmented waveform based on BStD (Malt & Jourdan 2015): Spectral centroid (y-axis), RMS amplitude (height) and the zero-crossing rate (colors)

4 Multilayered Chromagram with Amplitude Envelope

The goal is to study the behavior of OMax software (played by Benjamin Levy) with the sheng improvisations (played by Li Lin Chin). We recorded the audio in multitrack and then developed representations to visualize interactions between the musician



have developed an interpretation-assistance system based on Foote and Cooper segmentation and similarity visualization.

- Main similarity.
- SSM + Novelty.
- Similarity values at the green playhead position.
- Result of novelty segmentation (Foote & Cooper 2003).
- Manual segmentation from CD tracks.

