Strette

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Abstract. Strette[1] *is a 14 minutes monodrama for soprano, live electronics, lighting and real time video, based on the poem by Paul Celan* Engführung. *The intended effect of the piece, in which the various elements of the show (sound, human voice, text, image and scenography) are processed, and relate to each other, in such a way that the dramatic nucleus is constituted by the sound flow itself, is to immerge the public in images and in psycho-acoustic space. This may result in a polyhedral perception of the content of* Engführung.

In the pages that follow I will attempt to explain the specific issues and problems we tackled while composing Strette. *An important role was played by the Computer-Assisted Composition program OpenMusic in the development of the musical structures and the vocal score.*

1 Dramatic and musical issues

1.1 The interplay between language, poetry and vocal music

Engführung by Paul Celan is a vivid and poetic example of the restoration of the German language after it had been perverted by the Nazis. The poem does not describe a reality; it is the text that constitutes the "reality itself". Consequently, there is no room for mimicry nor for the representation of a reality lying outside the language. This noteworthy characteristic of Celan's poem makes it possible to establish direct links between music and text at a very basic language level. The music benefits from a greater degree of autonomy, allowing for a less destructive treatment of its acoustic and syntactical identity than is usual in vocal works. We could say that the primary goal of *Strette* is the recovery of the tragic ethos through a more abstract dramatization than those customarily afforded by declamatory performances. If the experience is a moving one, it is the result of the tension between the temporal sound flow created by the music (vocal and electronic) and the simultaneous interacting flux of visual images.

The first step was to develop a style of vocal writing that, while maintaining reasonable contact with the rhythmic and declamatory characteristics of the poem, would be strictly based on organizational musical principles.

[1] *Strette* was composed during the *Cours de Composition et d'Informatique Musicale* de l'IRCAM 2002-2003 and premiered by the soprano Valérie Philippin at IRCAM on October 15$^{\text{th}}$ 2003. The teaching assistant was Mikhail Malt and the video assistant was Emmanuel Jourdan. Benjamin Thigpen, Jean Lochard and Mauro Lanza helped with the electronics. I would like to thank all of them for their confidence and for their help in writing *Strette*.

This work was sponsored by a grant from the Departament de Cultura of the Catalan Government. I would like to thank Josep Manel Parra for his wise advice and his help in creating the present text.

The next phase, linking music and image (shape and colour) was accomplished in writing a vocal and instrumental script according to principles analogous to those of the colour theory in oil painting. Greatly inspired by Cézanne's *Château noir*, a set of patches in OpenMusic was constructed, allowing me to compose along strongly gestural lines.

Finally, with the help of the program Max/MSP-Jitter, certain image-based control procedures were carried out in realtime, enabling live interaction between the soprano's singing face and the music.

In a nutshell, a certain amount of hard work using the above mentioned computer programs resulted in a set of new questions and opened new paths in the search for more direct (i.e. non-metaphorical) relationships between acoustic and visual thought, and sensory experiences.

1.2 Dramatic role of the image. Communication between sound and image

The intention was that the public would experience as absolute reality the interaction between the text, the sound and the transformed image of the soprano. In accordance with the essentially open nature of Celan's poem, the soprano does not give a theatrical performance. She simply sings. The drama, which lies within the sound itself, is simultaneously developed and exposed in the visual domain. A veil, which together with the lighting, constitutes the only scenery, acts as a kind of resonating membrane for the action in the piece. The projection of the video-image of the soprano transformed in realtime with Max/MSP-Jitter creates technology-driven communication between the singer and the public.

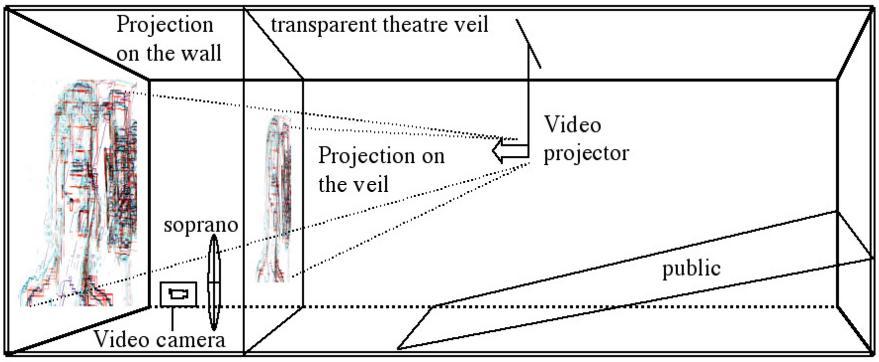

Figure 1. The stage.

Strette ends much in the same way as it begins. But for the listener there is a striking difference—at least there should be! After having watched the dramatico-musical piece he or she should have gained a more acute and distinct perception of the musical, textual and spatio-visual material, as well as a vivid awareness of having been in a unique global communication space.

2 Working Strette's vocal part

2.1 Starting points: *Engführung* and *Château Noir*

The structure and articulation of the vocal discourse, comprising not only its main division into sections but also the rhythmic and interval sequences, are based on a twofold source. The first one is obviously the poem itself, with its nine sections and multiple subsections. We have tried to respect the semantic and syntactical elements of each stanza and each verse. This was necessary in order to achieve a meaningful musical development of the drama expressed by Celan.

The other source was *Château Noir* (1904); an oil painting by Cézanne that was owned by Picasso and that now hangs in the Picasso Museum in Paris. I believe it was the perception of a deep structural analogy between Celan's impact on language through the poem and a "pictorically guided" two-dimensional visual intended to convey Cézanne's impact upon form and colour that make up the basis of this work. I believe this is important in understanding the present essay.

Thus, *Strette* was conceived as a sequence in which the rhythmic and interval materials are subjected to driving forces and structural tensions that follow aesthetically significative colour relationships. With this in mind, we began to search for quantifiable relationships between spaces that would parametrize the music or sound phenomena and perception on one hand, and the spaces that parametrize colour vibrations and modulations on the other. These relationships, which we will consider in detail, were a way of gaining control over the rhythm and the intervals, which were intended to be a flexible representation of the poem's rather strict syntactical and semantical character. The analysis of the poem *Engführung* by Peter Szondi [6] and Werner Wögerbauer [7] proved a useful guide, and provided valuable ideas for controlling the dramatic flow and achieving proper coordination.

In *Château Noir*, after a strong initial blue-orange polarization, the light is progressively broken down into its spectral components. At the same time, because of the emerging gray scale tones, and the tension generated by the diminishing colour, we begin to penetrate the various levels of the painting. It is as if the modulation allows us to bridge the chasm between the initial extreme blue and orange tones. However, a feeling of tension is generated by the conflict between this depth and the bi-dimensional character of the surface, a character that Cézanne strongly reinforces by means of abstract patches.

We subjected the rhythmic and internal parameters to temporal formalization, in accordance with the above described chromatic path taken by [the treatment of] Cézanne's painting. The guiding idea was that because of its specific musical nature, the rhythmic and interval characteristics of the vocal line could act upon the listener's hearing in a similar way to the effect of the colour modulations of *Château Noir* upon visual perception. The tool used to implement this idea was OpenMusic.

We must stress that only a fraction of the colours used in the realtime modification of the soprano's video-image actually correspond sequentially to those that have were used in structuring the vocal part. We believe that this process, carried out via the Max/MSP-Jitter program, shows up the structural linkages that were created between sound and colour.

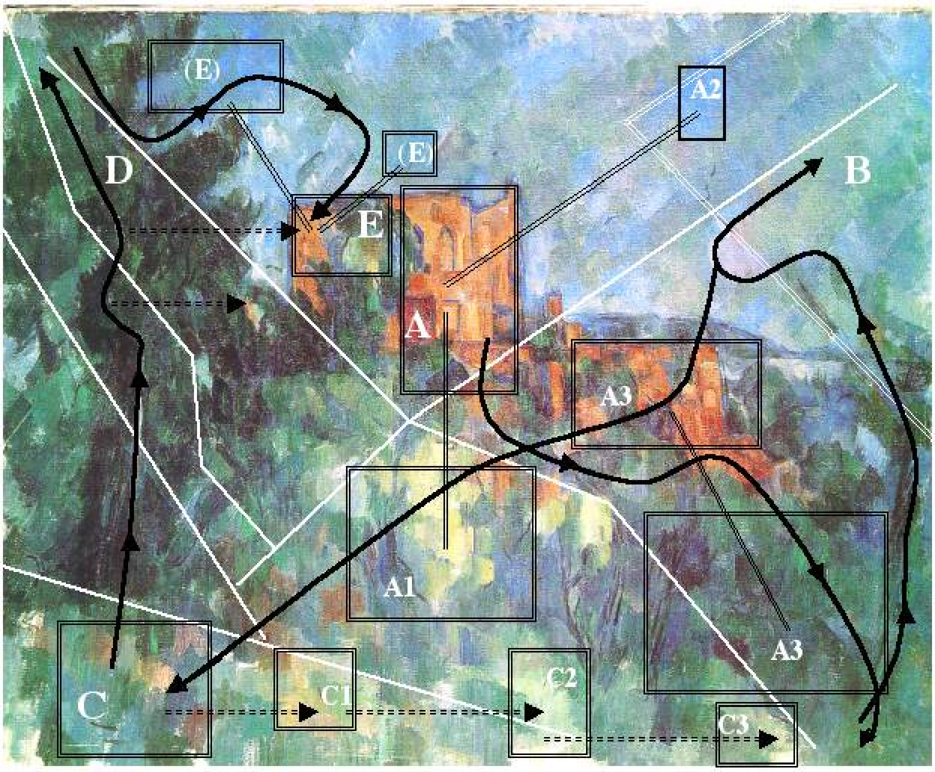

Figure 2. *Château Noir* by Paul Cézanne.

2.2 Formalization of the relationships colour-rhythm and colour-pitch. Implementation in OpenMusic

I should mention that the expressed aim to connect and develop parallel lines in colour and sound spaces does not imply any confusion of identity or actual mixing of the two spaces—I aware that each has its own distinct character and behaviour. Rather the idea was to take advantage of the qualities of the colours and their effect on our perceptual and cognitive processes in order to create a set of pitch and duration values. The latter, based on clear and effective organisational principles, turned out to be able to accommodate a considerable degree of musical variation and richness.

Colorimetric system used as a basis for the formalization process. Data taken from *Château Noir*

The colorimetric system is founded upon the three perceptual colour parameters: Hue-Saturation-Intensity (HSI). HSI lies at the basis of my formalization of rhythmic and interval thought, which may be subject to a parallel (and even synchronous) development. The three dimensions of HSI space are usually represented by a solid cylinder with luminosity along the vertical axis, saturation along the radial coordinate and hue along the angular one. Each colour is then represented by three coordinates or numerical values: the specific colour tonality (from 0 to 360), and saturation and intensity from 0 to 100 (Figure 3).

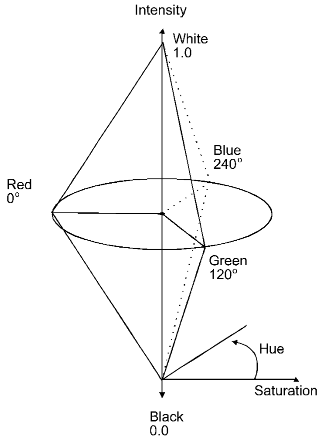

Figure 3. Hue-Saturation-Intensity.

It is obvious that the painting possessed many other interacting dimensions specifically related to colour and plasticity as, for instance, texture density, opacity and directionality of the brushstroke (fundamental in Cézanne), the shapes and kinds of colour patches, etc. They are very difficult to analyze and cannot be manipulated in a simple way, even using a computer.

After a number of visits to the Picasso Museum for detailed study of Cézanne's masterpiece I was able to gain some ideas for my visual path through the painting, as well as an understanding of which colour patches were interacting at any given moment, and to what degree of intensity. I then carried out a temporal articulation of the chosen sequence of interacting patches, assembling them in little groups which could be made to correspond to each of the stanzas of Celan's poem. This segmentation process was in no way a straightforward mechanical one. Each segment had to possess its own pictorial sense and, at the same time, share some semantic or syntactical characteristics with the corresponding stanza. The central part of the poem provides an illustration of this. The language possesses a highly detached character and the two worlds, in opposition at the beginning, are reconciled at the end. The pictorial equivalent can be found in the full spectral breaking down of the light after the extreme initial blue-orange polarization. Although it is subjective to draw parallels of this kind, we are convinced they are often at the very root of creative artistic activity. Naturally Celan's poem has its own very special and suggestive qualities; as Wögerbauer has noted, "*Tout au long du* Engführung *la création poétique est analysée dans une succession d'étapes au sein d'une synesthésie générale*".[2]

[2]Wögerbauer, Analyse de *Strette*, 1991.

With this in mind I proceeded to choose, for each colour patch in a digitized image of the *Châteaux Noir*, those pixels that seemed to me as close as possible to the colour I had experienced at the museum. Then I evaluated the colorimetric mean of each zone that seemed to be of relevance during my visual path or pictorial reading of Cézanne's work.

The network of HSI indices obtained in this manner was the expression (albeit a partial and oversimplified one) of the successive strains and stresses I experienced while looking at the painting. This data was now ready to be used as a starting point for the set of musical patches that we present below.

Colour to rhythm: formalization and implementation into OpenMusic

In accordance with the overall plan of the piece, I designed a rhythmic space based on small units, each of them possessing its own temporal identity. Each has a minimum of three attacks and a maximum of seven. Each is associated with a colour, and the vertical polyphonic interaction between them had to produce a dynamic tension similar to that generated by the visual clash of colours. A way could now be found to translate Cezanne's pictorial rhythmical structures and tensions into musical language. We outline below how this translation from the colorimetric to the musical space generated a rich basic material appropriate to the original conception of the piece.

Each of the rhythmic units comprises two superimposed cells of attacks, one in progressive *accelerando* and the other in progressive *rallentando*. Each attack is triggered by a fixed discrete amount of an exponential (for the accelerando) or logarithmic (for the rallentando) curve that is characteristic of Hue and is defined as Saturation=100. The number of attacks for each rhythmic unit was kept to a minimum to maintain the character of each cell. The colours in the blue-orange axis, which constitute the pillars of Cézanne's painting, were assigned either seven or eight attacks while other colors were assigned six attacks. With decreasing saturation these functions tended to become linear, producing regular attacks in such a way that grays corresponded to complete regularity. The upper or first cell in time has its maximum acceleration at yellow, and maximum rallentando at magenta. The lower or second cell is opposed in character. The opposition is reduced for the flat complementary colours red and green in which one of the cells presents equally spaced attacks. These characteristics are shown in Figure 4.

The size ratio of the upper to lower cell is also fixed as a function of hue for each value of saturation. It ranges from 1/10 at yellow to 5/1 at violet. Again the relative size tends towards value 1 (uniformity) with decreasing saturation, as is reflected in a non-quantified manner in Figure 4. The delay between the upper and lower cell is also a characteristic function of hue that tends towards zero with decreasing saturation in a hue-dependent way: hot colours decay more quickly than cold ones, in accordance with colour perception theory. Flat colours (red and green) always present zero delay (simultaneity). Orange, yellow and violet, that give pictorial depth can achieve a maximum delay of a 20% of the size of the first cell. Again this fact has been qualitatively reflected in Figure 4.

Finally the physical extension of the time of each rhythmic unit is also a function of hue and intensity. At the maximum intensity of 100, yellow-orange colours have a maximum duration of 6 and 5 seconds, respectively. Their complementary colours violet and blue are given the minimum duration of 1 second. With decreasing intensity this distribution of duration values becomes almost inverted, in accordance with the visual

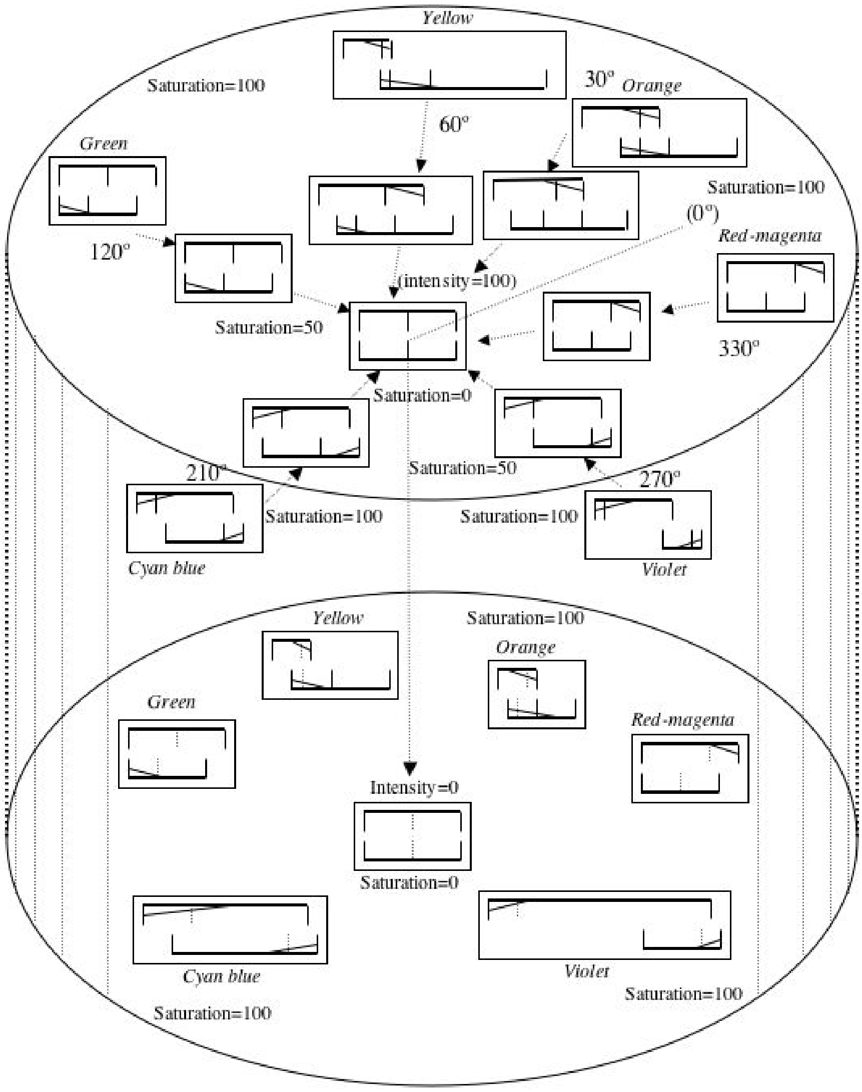

Figure 4. Rhythmic units.

rhythmic tension in Cézanne's painting: in the brightest zones blues act as accents or activators of the more extensive orange patches while in the dark regions blues become dominant and profound, corresponding to rhythmic units of greater duration and fewer attacks. In fact, the displacement towards the dark regions of less "luminic vibration" corresponds to the disappearance of a part of the rhythmic content, specifically those attacks that by their closeness make the rhythmic unit more vibrant.

Figure 5 is a simplified outline of how the rhythmic patch generates and utilises the above-mentioned variables. The example contains the rhythmic unit that corresponds to the colour orange (Hue=30), Saturation of 50% and Intensity of 80%. The as yet unquantified intervals between attacks are given in milliseconds.

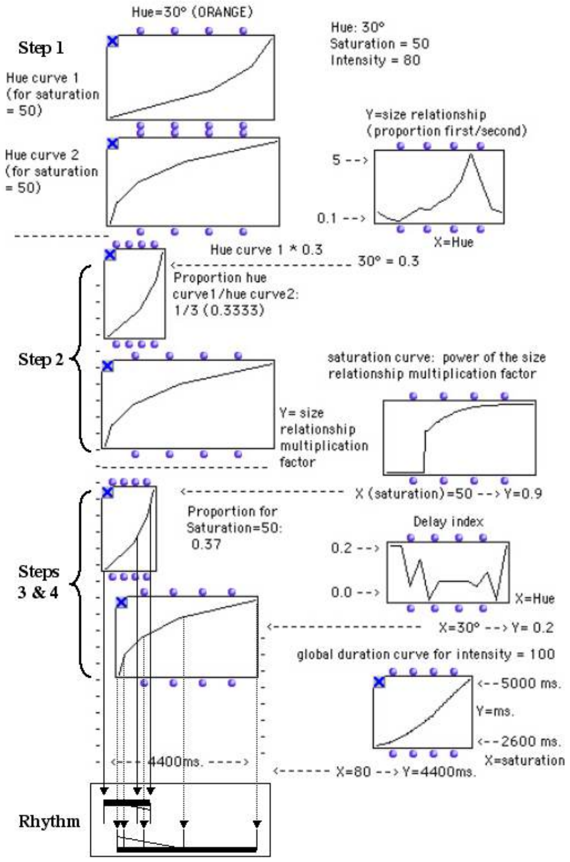

Figure 5. Construction of the rhythmic unit corresponding to the colour (H=30, S=50, I=80).

Thus, as shown in Figure 6, the patch that gives the rhythmic variables consists of three main parts. First, the three entries corresponding to the colorimetric data in the ue, Saturation and Intensity codification. This input is represented by the three upper arrows. Then there is the complex subpatch network that sequentially implements the transformation of a colour path into a rhythmic path. Finally there is an effective construction of the rhythmic units expressed in the form `chord-seq`, parametrized in milliseconds, and represented by the bottom arrow.

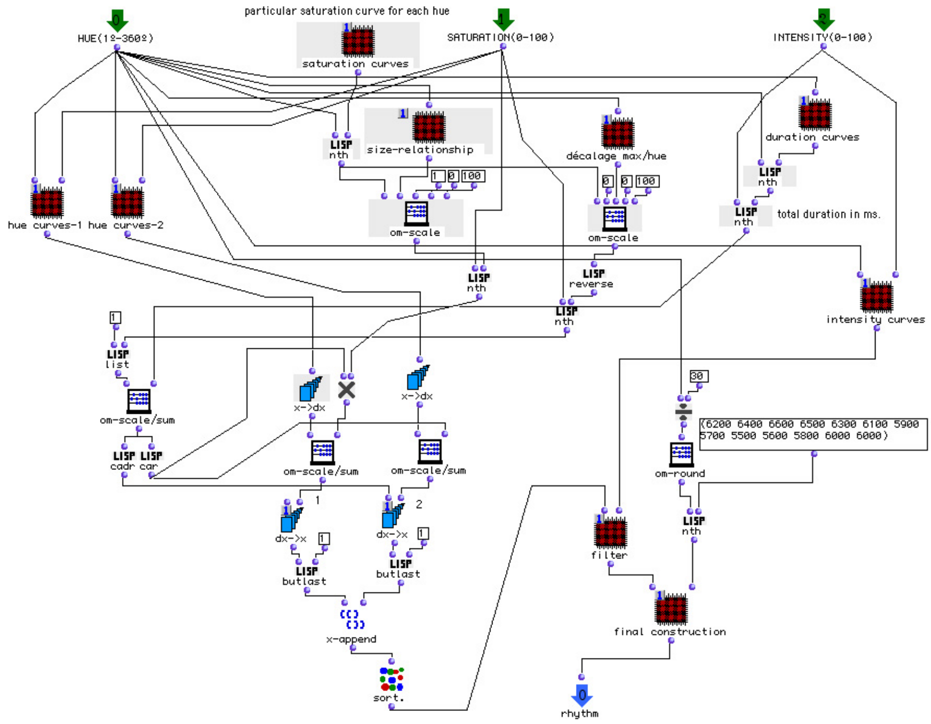

Figure 6. The rhythmic patch.

Figure 7 is an example of the rhythmical musical tensions generated by the opposing colour pairs orange-blue and red-green, and the rhythmic sequences that result from the superimposition of the two corresponding rhythmic units. In the orange-blue case, the perception of extreme closeness and depth requires characteristic time values that amount to a deformation of the uniform flow of time. In musical terms these irregularities take the form of an initial energy propulsion (initial blue attacks) followed by a central development (orange and blue together), suddenly stopped by a second propulsion (blue ends) that gives way to the final expansion (orange alone). In the red magenta-green case, the pictorial flat colours, we have the superimposition of two regular patterns of different durations that express less energetic vibrations, and start at the same time. These interaction types between rhythmical units take place in the maquette.

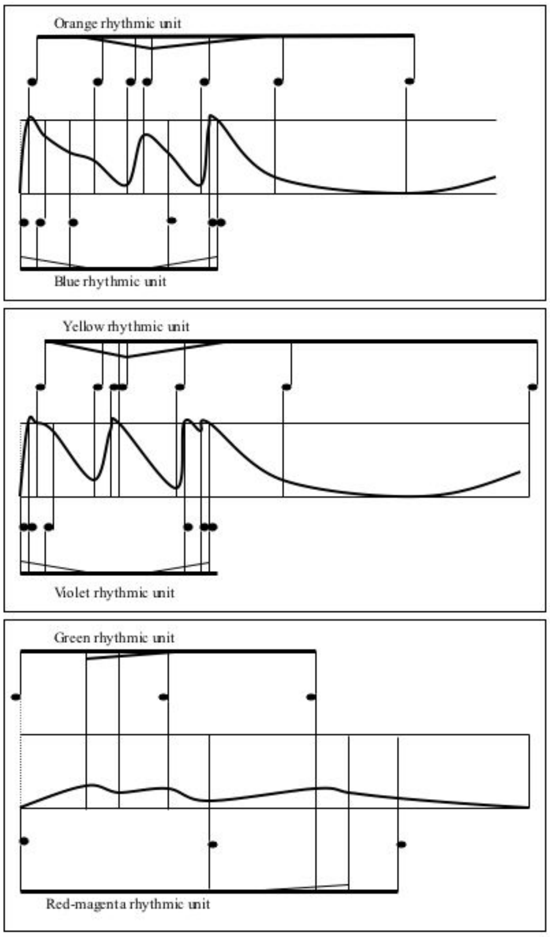

Figure 7. Basical rhythmic sequences.

From colour to pitch

In parallel to the colour-rhythm association, I developed a system of patches in OpenMusic that, for each colour, give an aggregate of pitches or "chords" consisting of a maximum of eight pitches and a minimum of one. It is the interval relationships that are important here; and somewhat less important, the absolute value of the frequencies. The role of these pitch-groups is to provide a strongly characteristic and differentiated harmonic colour, even in a monodical disposition, as is the case for *Strette*.

As the starting point for the computation of the chords I took the first 32 partials of a harmonic series whose fundamental pitch I altered several times in accordance with the formal structure devised for *Strette*. Thus, to the three continuous colorimetric indexes is added the fourth—external—parameter of a discrete and intrinsically musical nature (Figure 8).

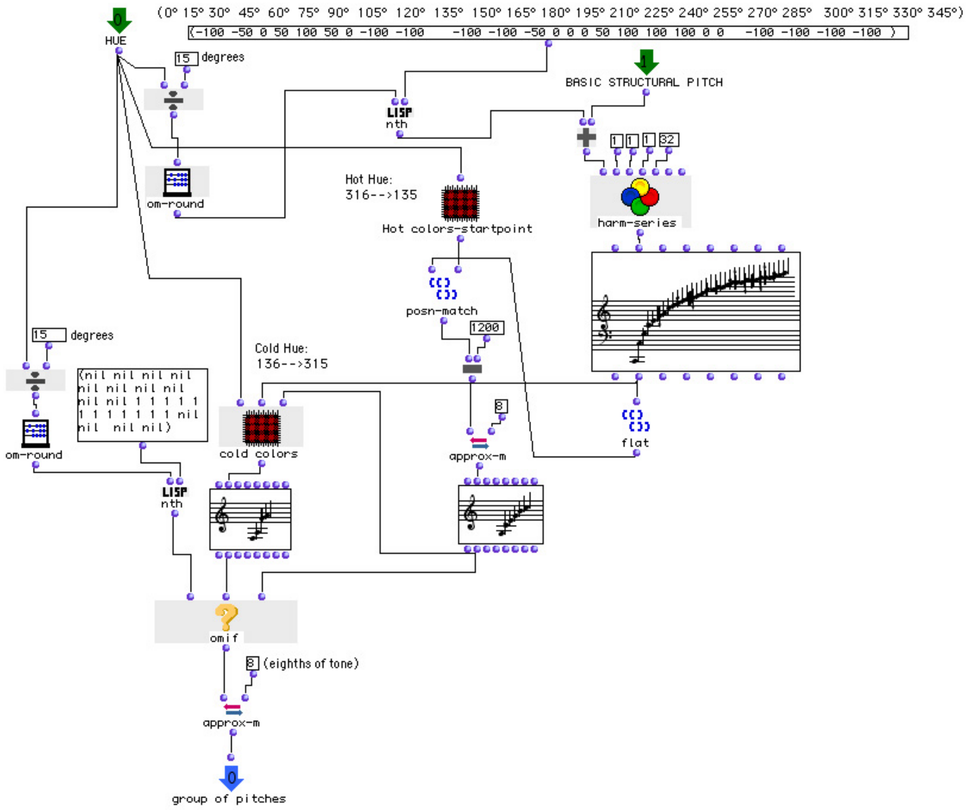

Figure 8. Patch for the pitch.

Again, as in the case of rhythm, it is the hue parameter that plays the dominant role in determining the idiosyncrasy of each pitch aggregate, defined at maximum saturation and intensity by means of the sub-patch represented in Figure 9.

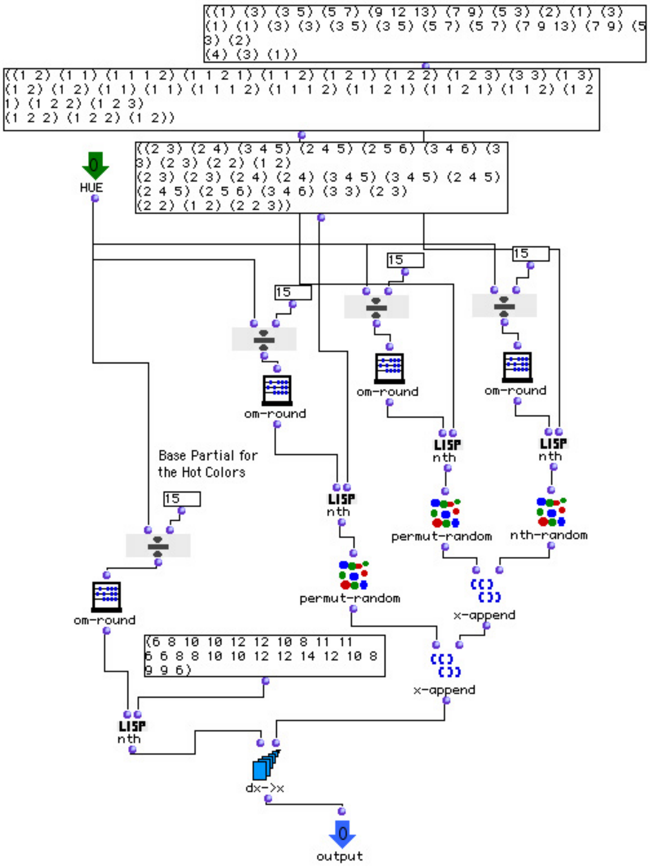

Figure 9. Sub-patch for the partials (hot colours).

Decreasing these parameters will modify the aggregate by reducing the number of elements and by homogenising the interval ratios. As we can see in the upper part of Figure 8, small displacements of the fundamental of the harmonic sequence are carried out in such a way that the colours close to the yellow-violet axis are raised a half-tone, while those close to the green-red axes are lowered by a half-tone. This simple procedure is an attempt to avoid pitches belonging to chromatically opposed spaces coinciding too often.

In Figure 10 we see how the two named functions "virtual-fundamental" and "best-frequency" belonging to the OpenMusic *Esquisse* library provide some of the pitches that will be used for a hot color and its complementary cold one. Together with other partials from the upper lines of this lower section, the "cold colour" aggregates will attract and acoustically complement those that correspond to the complementary "hot colours".

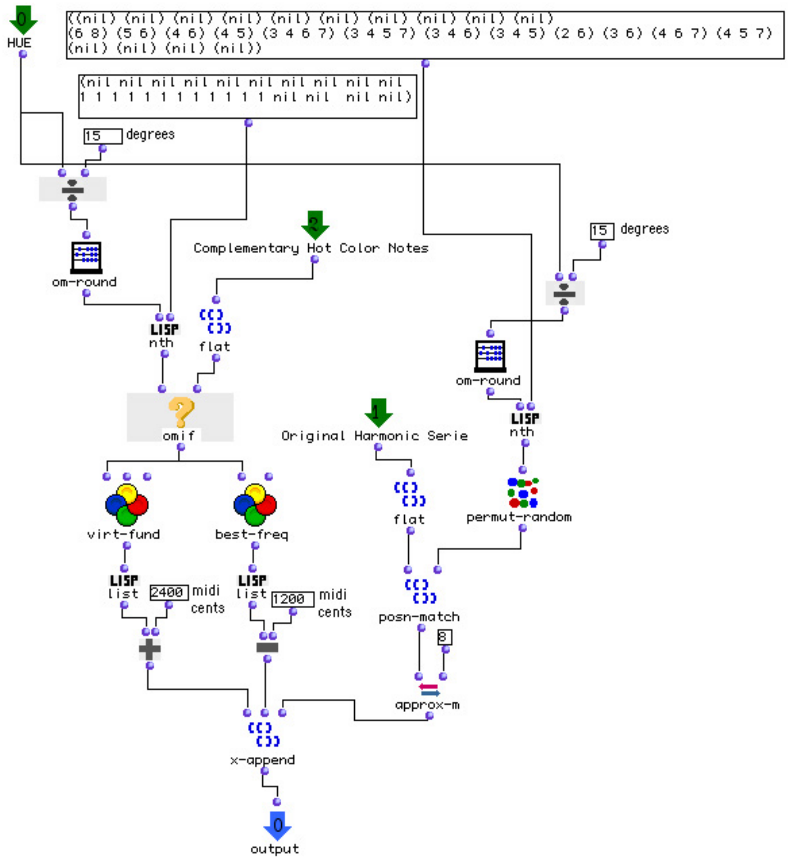

Figure 10. Sub-patch for the partials (cold colours).

As saturation decreases the pitch aggregates lose notes until they are reduced to a single tone for saturation values lower than 20. The "frequency-distortion" function of *Esquisse* generates a reduction or compactification of the original range of the spectrum. It transforms the original irregular intervals defined in eighths of a tone at saturation 100 into regular interval progressions. For saturation between 50 and 75 the resolution is reduced to quarter tones and to half tones for saturation values below 50%.

To sum up, the progressive loss of saturation that describes the progression to gray is made to correspond to a process of homogeneization by reduction of the elements that characterize the idiosyncrasy of the initial chords. In Figure 10 this process is represented for Hue = 60º , Intensity = 100 and Saturation values of 100, 75, 60, 50 and 20.

Finally, the decrease in the intensity parameter also reduces the number of notes as well as the range of the spectrum. However, in this case concentration does not take place around the central pitch of the chord, but rather in the higher frequencies in the case of the hot colours, and in the lower frequencies in the case of the complementary cold ones.

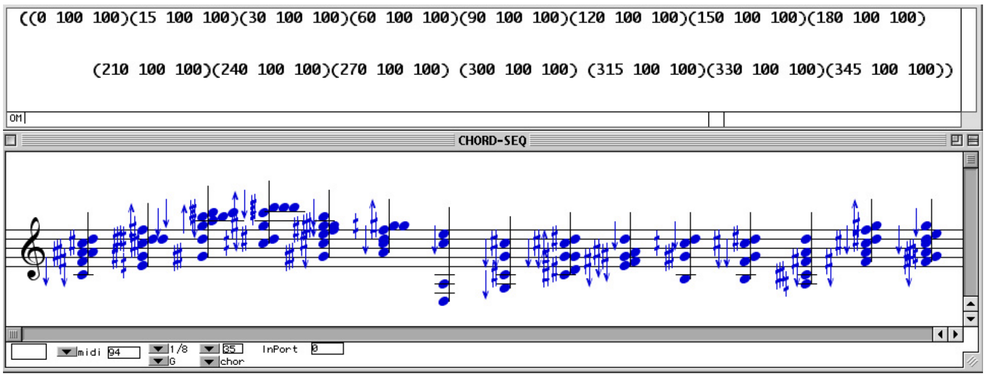

Figure 11. Chords corresponding to successive changes of 15° in Hue, at the maximum level of Saturation and Intensity.

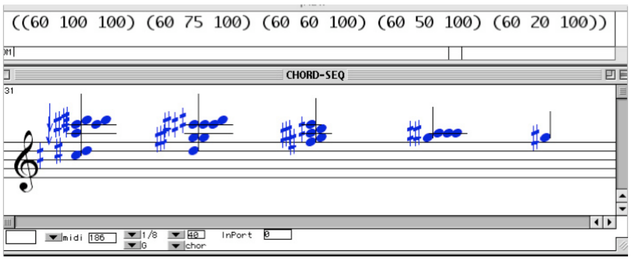

Figure 12. Progressive decrease of the saturation for Hue=60 and Intensity=100.

2.3 Final steps towards the score

The maquette

For each visual phrase of my aesthetic perception of Cézanne's *Château Noir* I constructed a *maquette* timeline along which I laid out the small rhythmic units corresponding to each colour present. Each maquette covers a 10 to 30 second timespan. The particular spatial layout of the different rhythmic units is inspired by the functions played by the corresponding colours, as mentioned above.

On the right side of Figure 13 can be seen the rhythmic patch analyzed above, integrated into the maquette, as well as the list of colours that constitute its input. I think this procedure is sufficient to accommodate a strong and flexible interaction between the output of the OpenMusic patches and the composer's musical requirements.

After transferring the maquette contents to the OpenMusic multi-sequence MIDI editor I carried out simultaneous filtering of the sequence to suppress all those attacks that seemed to me musically uninteresting, and also to implement the pitch corresponding to each colour in what was in fact the pre-composition of the vocal line. This work was done at the same time as the first manuscript drafts of the score and while thinking about the best means of processing the text.

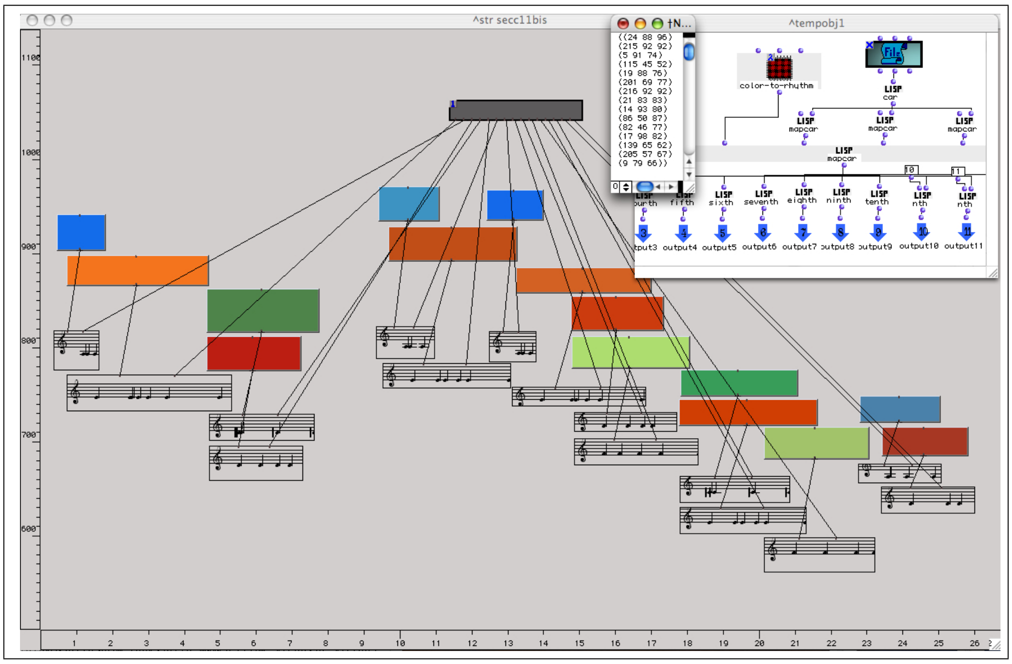

Figure 13. Maquette corresponding to the first 30 seconds of *Strette*.

The process of rhythmic quantification

The quantification of the musical phrases was carried out using the rhythmic quantifier provided by the *OMKant* library .[3] The Figure 14 illustrates the three stages of this process:

1) Marking the sequence at those points where I want to start a measure or place a strong beat;

2) Triggering the quantification process, using the tempo I consider most appropriate at this point of the piece and which, at the same time, offers a quantification rather closer to that of the original sequence;

3) Displaying the result in the form of actual rhythms, with a fixed tempo applied to certain measures.

It is necessary to stress that the specific characteristics of each phrase make this process different each time. There is no routine automatic processing. For instance, although I used the *OMKant* object to force the choice of rhythms that satisfied me more than those resulting from the quantification process of certain beats, I nevertheless strove to adhere to the derived material.

[3]The *OMKant* library was conceived and programmed by Benoit Meudic.

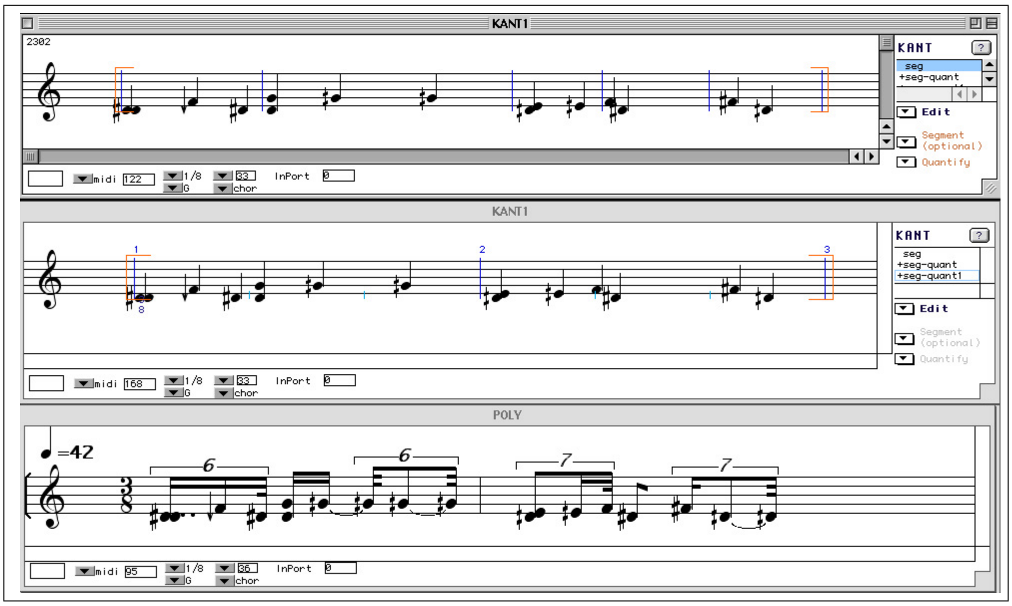

Figure 14. Quantification with the *OMKant* library.

The final creation of the fragment quantified in Figure 14 is shown in Figure 15. It is obvious that certain of the rhythmic characteristics proposed by *OMKant* have been transcribed. In general their gesturality has been stressed and adapted to the text by combining various dynamic progressions and structured silences. In other places, e.g. the last part of the second measure, the entry point of the second articulation was considerably modified.

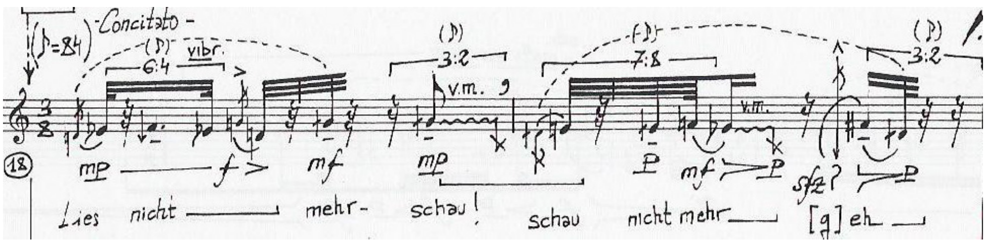

Figure 15. Exemple from the score (mm. 18 and 19 of *Strette*).

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