Using the computer in a search for new aspects of timbre organisation and composition.

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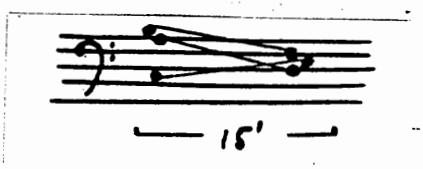
I would like to discuss three different pieces of mine and some compositional ideas for which I used, and which were inspired by the computer:
- VERS LE BLANC (1982), a computer tape piece realized at IRCAM with the CHANT program
- VERBLENDUNGEN (1982-83) for orchestra and computer-tape realized at GRMs digital studio in Paris, and
- a work in progress, which I have been working on at the EMS computer studio in Stockholm with the CHANT program.

VERS LE BLANC ("Towards White")is my first piece for computer and was realized quite soon after my first contact with this medium. It is a kind of manifestation of those ideas the computer wakened in my mind. Coming from instrumental music writing, I wanted to realize with the computer those kind of musical ideas which are, on the one hand, idiomatic to the computer medium, and on the other hand, impossible to realize with traditional instruments.
My goal here was also to combine form and content into one, inseparable unity. I rejected the traditional western approach with such musical elements as melody and phrasing, and aimed at replacing these elements with slow processes on different musical parameters.
The basis for the piece is the changing of a six-voice chord into another chord so slowly that the pitch changes are not audible as such. The six glissandi - which last the length of the piece - produce continually changing harmonic structures when gliding in different directions at different speeds (example 1). The harmony is a continuous stream and cannot be heard as a series of changing chords. One only notices from time to time that the harmonic situation has changed.
ex 1



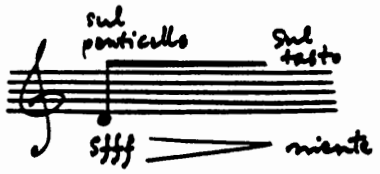
Technically, the long glissandi for the piece were very easy in principle to realize: as the piece is worked out with the CHANT program - the basic principal is probably familiar to most of you - the pitch parameter can be described as a simple function of time.

ex 2
F01= /I
220. 0.
220. 40.
214.77 120.
209.54 180;

The piece was realized so that every one of the six voices was calculated in it's whole length, that is, fifteen minutes in one run. This working process followed my vision for the piece as being an unreal choir singing for fifteen minutes without any pause, with one single breath.
The rhythmic pulsation was worked out for the continuous voices. An algorithm was defined for the modulation of the overall amplitude of each voice.
The timbral transformations were created in two ways:
1) by controlling the center frequencies for the formant regions with functions of time, and
2) by using the user subroutines for creating changes between different speech phonemes.
In the case of timbre, the goal here is to create an image of an eternal, everlasting "human" singing voice, which at times looses it's reference to a physical model. This loss of reference occurs when the voice is dimmed, thinned or mystified by gradually changing the values for such parameters like the amount of random modulation of formant center frequencies or formants banwidths, and the coefficients for formant center frequencies and formant amplitudes. The two last manipulations change the frequency and amplitude relations away from the formants of a normal voice.
Generally speaking, with the parameters named above, all available in CHANT program's user subroutines, one can add different kinds of noises and shadings to the sound.
Here these parameters were controlled with functions of time, which slowly changed the values away from the default values and then, as slowly, back again. These kind of symmetrical wedge-like functions of different parameters and different voices were overlapping with each other.
(sound examples: two tests which were made before the final calculation of the piece)

In my orchestra-tape piece VERBLENDUNGEN the tape part is worked out by GRMs digital tools for manipulating and transforming concrete sound material. Part of the programs are written directly in Fortran or in Macro-Assembler The other part uses Music V as a sound processor.
My basic material consists of two violin sounds, a sforzato stroke and a pizzicato (example 3).

ex 3



From these two sounds I have built a quasi-string orchestra with a very wide pitch range. The timbres were very homogeneous because of the single reference spectrum.
(sound example: the sforzato)
The previous example was realized with a program which is made for accumulating the musical material by superimposing it on itself. When changing the pitch, the duration is automaticly changed, the basic idea being the same as in the classical variable speed tape machine.

In the next example I have used the same program after editing the phrase to include the dynamic and rhythmic aspects I desired. As a result there is a rich canon in many layers.
(sound example: a wide chord)
As the tape is mostly mixed with an orchestra in performance, I am using it often as an end point in the transformation from heterogeneous orchestral timbre into homogeneous string tone. This string tone is then slowly transformed into manipulated string sounds on the tape, these being drawn away from the original physical image.
The total plan for the use of timbre in the piece is based on slow transformations in the orchestra and on the tape, which are moving in opposite directions with respect to timbre. The piece starts with a thick orchestral tutti, which is first hidden and then shaded by the noise on the tape. During the piece the orchestral colouring is transformed into instrumental noises, which, before withering away, cover up the quasi-string orchestra on the tape.
(next sound example)

In my most recent work, which is still in-progress, I have three different independent areas which I am trying to unify into one artistic totality. My three three points are
- new harmonic explorations
- new rhythmic explorations, and
- new organizations for timbre; researching the perception of timbre in three-dimensional auditory space.

Often when listening to computer music I am bothered by the fact that little attention is payed to the fundamental musical elements, and when it is, the solutions are often banal. The consequence is that what is heard is,in this respect, musically conventional even though the composer has focused his ambition on extremely complex algorithms or other ways of carrying out his sound synthesis and compositional process.
From a harmonic point of view I am interested in shaking the western pitch experience. I am well aware of the interesting results that have been obtained from physical models and compositions based on or inspired by spectral analysis. But I want to approach the question of harmony also from the other point of view, e.g. by redividing the octave and creating new scales. This releases us from the harmonic tensions that are so familiar, but builds perhaps new kinds of hierarchies.
In contrast to this, when building continua between different parameters, like harmony and timbre, which interests me very much, or gliding gradually from tone to noise, we are operating with harmonics and formants. These two ways of approaching the pitch structures, on the one hand neglecting the existing physical model and on the other hand operating on it, are, of course, in clearly contradictory positions. It may seem unwise to disperse a compositional focus so much that both approaches are incorporated. But as a matter of fact, concerning my work-in-progress, I would like to expressly combine these approaches, so that I can make transformations simultanuously from conventional tuning into new tunings and, at the micro- level, inside the sound, transformations from the physical model into abstract sound objects without recognizable identity. I will try to find solutions for such transformations, where the internal frequency structure of the sound would be derived from the harmonic solution or, which is of course a more common idea, where the harmony is derived from internal frequency structures of a sound.
The ideas mentioned above are, of course, totally inspired by the computer and

the work of such composers as Chowning and Risset, and could not be realized without the digital ability in creating arbitrary frequency structures at will.

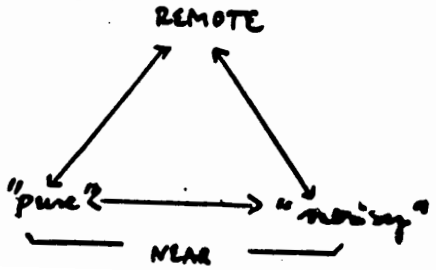
From a rhythmic point of view I am developing an idea used in the tape part of VERBLENDUNGEN: rhythmical models which are superimposed upon themselves. In this piece they are independent parameters and not consequences of the speed changes as in VERBLENDUNGEN. I am particularly interested in a kind of friction which appears when duplicating the models, so that the duration of each layer differs very slightly from each other layer. Depending on the number of layers and the density of the rhythm, the result is a vivid texture with different degrees of delay effect, or a change in the timbre.
Example 4: an eight-tone octave which is used in the next short sound examples. In both examples one rhythm is duplicated in several levels. The second example is a cluster of all the eight notes, which is combined with a rhythmic model in different durations - as shown bellow:

ex 4

Hz	dur
329.64	10"
359.464	9.8"
391.998	9.4"
427.477	9.6"
466.167	8.8"
508.359	8.6"
554.369	9.2"
604.544	9"

(sound examples)
I have not yet found musically meaningful models for a complex compositonal organization of timbre. In my instrumental music writing I have already started to use the tone - noise axis as a timbre parameter in order to build musical form by regulating the degree of tension. In my mind the tone-noise axis replaces, to a certain degree, the concept of dissonance and consonance in it's abstract, non-tonal sense: generally speaking, the grainy, noisy texture is comparable to dissonant material, and clear, smooth texture to consonant. Noise is already, physically speaking, a developed version of dissonance. It is, indeed, a comparable listening experience to hear harmonical tension resolve into a tonic chord (or in the case of a less tonal context, into consonance)as to hear a progressively added noise changed into clear sounds again.
My work with the CHANT program took me concretely inside the sound, and influenced my instrumental writing where I have now adapted the ideas of continua between musical parameters. Further, I have started wondering, whether timbre would be organizable in a hierarchy, as, in the most developed case, tonal harmony is.
When analysing closer my experience of timbre perception I have run up against many unclear and hardly definable concepts, like the identity or recognisability of a sound object, space, and what I call an "aural perspective", meaning with the last named a space built with timbre.
My timbral ideas have started to include spatial elements, and a new kind of triangular network, seen in the picture (example 5), has started to take shape in my mind.

ex 5



To finish my talk I would like to sketch for you this starting point for finding a well controlled, but, before all, musically meaningful way of using the space. The three angles of my triangular network are "pure sound ", "noisy sound" and "remote sound". The first two aspects describe the different kinds of types for a sound which is near; the "pure" sound could be described with such examples taken from physical sounds like brass instruments or educated western singing voice. This kind of clear and bright sounds can be compared in visual art to the pure pigment. In my mind this aural pigment can fill the space in the same way than the real pigment can be spread on canvas. The pure colour is then shaped and regulated with white or grey. The musical equvalence for the white is silence, and for the grey noise, starting from the smallest instrumental mechanical sounds, like key-clicks in wind instruments, or the slightest noises of bow when playing string istruments.

The addition of noise weakens the purity of a sound, but at the same time, when moving away from the maximal brightness the sound is moving towards either the "remote" -corner or to the other aspect of nearness, the "noise" -corner, or both directions simultaneously.

The concept of noisy sound can be characterized by physical sounds like a sound of flute or a whisper, in other words airy, brittle and grained, sound. The decisive factors towards "remote" are the increasing reverb and, often, decreasing dynamics.

Following the sketch described above I intend to form a timbre-spatial aspect with different parameters, some of which were named in the context of VERS LE BLANC, in the CHANT -program.

The use of timbre is also in a close relation both with harmony- and rhythm parameters when aiming to create impressions of transitions from familiar sound images to new, unidentified and abstract sound objects. Also in the relation of the "aural perspective" these parameters can be used to strenghten or split the spatial experience built with timbre.