The Role of the Computer in Academic Contemporary Music
~Focusing Mainly on IRCAM and Its Surroundings~
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Abstract
For centuries, composers have tried to discover new forms of musical expression. After Western music evolved from its use of a modal to a tonal organizational system, tonality eventually gave way to bitonality and polytonality in the second half of nineteenth century, and subsequently atonality in the first half of twentieth century. During the twentieth century, composers paid attention to forms of media that can not be written in staff notation. For example musique concrete, the expression of timbre and complicated calculations became possible with the development of the computer.

This paper first describes how the computer became connected to academic contemporary music in the stream of music history. I will also explain how composers of today have developed their creations (compositions) with computers by examining the case at IRCAM in Paris.

1. Introduction
To begin, let us take a look at the case of the late Gerard Grisey (1946-1998) who had a very important effect on the next generation of composers including myself. And next, I will consider the case of Philippe Hurel (1955), one of the most remarkable composers who has been spreading Grisey’s ideas with his creative activities with the computer, and in the last paragraph, I would like to touch on my own works.

2. Gerard Grisey (1946-1998) and his works
“We are the musicians, and our model is the sound, never the literature, but the sound. Neither the mathematics, nor the theatre, nor the plastic arts, nor the quantum theory, nor the geology, nor the astrolgy, nor the acupuncture.’”[1]

These are the words of Gerard Grisey, one of the most important contemporary French composers, and in the successive generation of composers following Pierre Boulez (1925), Karlheinz Stockhausen (1928), Luciano Berio (1925), and others. He released the composers of our time from past spells with his new theory on musical creation, namely, from the rule such as the 'total serial' in which the music is controlled by complex operations applied to the notes, or by a continuation of the early twentieth-century stream, which attempted to adopt ideas from other branches of arts into musical expression. As mentioned in the above quote by Grisey, he said that the music is essentially the sound, neither the literature nor the mathematics, namely, it is the expression of the sound. Such philosophy of Grisey is an extremely important pillar of musical creation for many composers in the following generation who were greatly influenced by him.

For the purpose of developing his theory, Grisey had studied acoustics with Emile Leipp at the Pierre & Marie Curie University (UPMC, Paris VI) during 1974 to 75, by which time he had established his own new creative method. Here is a trombone sound on the tone 'E', which includes many overtones, but some overtones are able to be heard, but others are not through the usual auditory sense. However, after the computer disposition of the sound, i.e.: frequency analysis, he made all of them perceivable tones and used them as material in a musical composition. “Periodes”[2] was written using the method and is part of one of his early and important works entitled “Les Espaces Acoustiques”[3] - cycle in six pieces (1974-85).

A similar case is recognized in his “Transitoires”[4] which is also part of the same cycle of pieces. In this piece, the doublebass sound on the lowest tone 'E' was disposed. The figure depicts sonogram of doublebass.

3. Philippe Hurel (1955-) and his case
Philippe Hurel is one of the remarkable French composers within this generation who has been greatly affected by Grisey. He made the overtones analysis of the doublebass sound on a tone 'E' and used it as material in a composition commissioned by IRCAM. Hurel's directions for using these materials was more developed than in the case of “Periodes” by Grisey. This was used in his piece entitled “Lecon de choses” (1993)[6][7], which has a closer connection with technology. The instrumentation was written for an ensemble of ten...
players and computer using the IRCAM Signal Processing Workstation.

For example, the spectral structure of an E sound on a contrabass is modified according to how partials are collected. As a result, in each repetition of its appearance, the phenomenon occurs such that the timbre of the contrabass is varied. This is because the mechanism produces a kind of filter function. As we see, each partial is emitted from groups of orchestral instruments as if it is generated from the reference contrabass.

There are three types of electronic sounds used in this piece: 1) Synthesis sound 2) Modification 3) Non-processed instrumental sampled sound. He made these processes have a structured function that directly merges with each acoustic sound. For example, in “Objet A”, the filtered reverberation is performed by the computer, while a spectrum of a sound is performed by the orchestra. Moreover, as another example: for all of the first section of the piece, the analysis results of the tape sound is modified by the composer himself.

As we can see, the role of the computer here is more closely related to the music compositions than those by Grisey. Computer sound does not sound electronic to all listeners. It is rather used as in the position of orchestral sound for example as a base and its extension by filtering sound.


A trial was made to create a new space using sound modification, which was made possible using only computer. “Consistency of timbre and its modification” is the theme of the piece, and all the sound material is from shakuhachi sounds. On the technological side, sound modification and editing were done using the sound synthesis system “Okinishi” developed by NTT CS Labs.[11] Various timbres were acquired from sounds restricted to shakuhachi modified using mainly granular synthesis and sinusoidal models implemented in “Okinishi”.

Granular synthesis is an analysis/synthesis model based on the idea that every sound is composed of grains, which are auditory units. New timbres are created by modifying the combination of grains. The Sinusoidal model is a representation that decomposes a sound into multiple sinusoids. By selecting some of the sinusoids and re-synthesizing, a filtering effect is expected.

In many cases of computer use, we are conscious about how powerful and fantastic the sounds are. This is fresh and stimulating to us. However, in my use of the computer, I attempted to achieve microscopic changes of timbre, which are only possible by using a computer. This is a paradoxical use for the macroscopic treatment of a computer or synthesizing a peculiar sound.

Specific examples from “le chant Vertical” are discussed. The piece starts with a computer part. All of the sounds are modifications and re-syntheses of a long tone from a shakuhachi by granular synthesis, and all are issued from the same material. All are heard as either the original shakuhachi sound or the repetition of the same sound. The sound is not exactly the same one, but the difference is very fine, so it is not clear from the auditory perception point of view whether it varies or not. However, as time goes on, the variation is clarified. How I represent this variation process is the central point of my composition method described in the previous section. This demonstrates an example of my creation on a computer using technology achievable only by computer.

5. Conclusions

This paper provides a survey of how the computer had been related to the development of serious contemporary music and how it has been used in the stream of vivid activities by professional composers. This survey was derived from my own experiences at IRCAM, and an examination of Grisey’s aesthetics, Hurel’s activities, and my own works. In the future, I plan to continue my careful study of works by contemporary composers, and in my own realizations, hope to continue inquiries concerning ideal ways of utilizing the computer in serious contemporary music.

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7. References