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Mortuos Plango, Vivos Voco: A Realization at IRCAM

Introduction

Mortuos Plango, Vivos Voco for eight-track tape was commissioned by the Centre George Pompidou in Paris and was realized at the Institut de Recherche et Coordination Acoustique/Musique (IRCAM) with the technical assistance of Stanley Haynes. It is a very personal piece in that the two sound sources are the voice of my son and that of the great tenor bell at Winchester Cathedral, England. I have written much music for the choir there, in which my son was a treble chorister, and have often listened to the choir practicing against a background of the distant tolling of this enormous black bell. The text for the voice is the text written on the bell: *Horas Avolantes Numero, Mortuos Plango: Vivos ad Preces Voco* (I count the fleeing hours, I lament the dead: the living I call to prayer). In the piece the dead voice of the bell is contrasted against the living voice of the boy.

Analysis of the Bell

The spectrum of the bell was analyzed with the fast Fourier transform (FFT) program at IRCAM, part of the interactive sound analysis package S imported from Stanford University. The analysis commenced ½ sec after the initiation of the sound. The spectrum is shown in musical notation in Fig. 1.

This typical moment, when the spectrum was at its fullest, forms the structural basis of *Mortuos Plango, Vivos Voco*. I added to the analyzed spectrum one of the most, to me, supernatural attributes of this extraordinary sound, a clearly audible, slow-decaying partial at 347 Hz with a beating component in it. It is a resultant of the various F harmonic series partials that can be clearly seen in the spectrum (5, [6], 7, 9, 11, 13, 17, etc.) beside the C-related partials. Such "unanalyzable" secondary strike notes are quite common in bells.

The eight sections of the work, with their central pitches, are structured around the partials shown in Fig. 2.

Techniques Using the Bell Sound

The synthesis and mixing work was done with the IRCAM version of Music V (Mathews 1969). This version was greatly expanded by John Gardner (prior to 1977) and Jean-Louis Richer (after 1977). (See Haynes's 1980 article for a description of some of its features.)

I first synthesized the bell spectrum shown in Fig. 1. Then, using Music V (IRCAM) I could give the partials any envelope I chose, for instance I could turn the bell inside out by making the low partials, which normally decay slowly, decay quickly. The normally fast-decaying high partials could be made to decay slowly or even reach crescendo over varying durations. Modulations from one bell transposition to another were achieved by sine-tone glissandi. To avoid banal parallelism, I chose different slices of the spectrum as beginning and end sounds, and the current central note was the "pivot" of the modulation (Fig. 3).

Thus subsidiary "bell-tonics" are set up in hierarchies analogous to (but distinct from) the traditional western tonal system. Each of the eight sections is announced by and based on a bell transposed to the pitches indicated in Fig. 2, with all its structural implications of secondary pitches. The straight digitized recording of the Winchester bell in various transpositions was read by the computer in different ways.

The sound file reading modules in the IRCAM version of Music V are able to read files forward or

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Fig. 1. Spectrum of the bell tone shown in musical notation.

Fig. 2. The eight sections of the composition set around eight pitches from the bell's spectrum.

Fig. 3. Transformations from one bell sound to another made as glissandi pivot through a center tone.

Figure 1

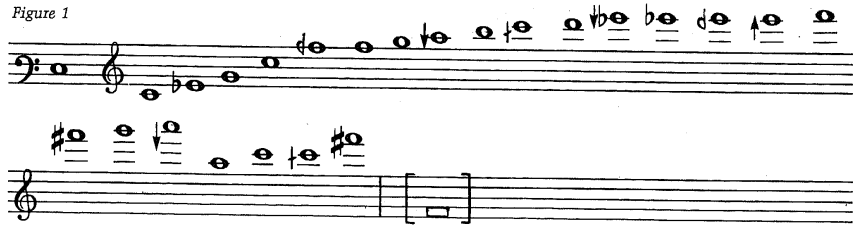


Figure 2

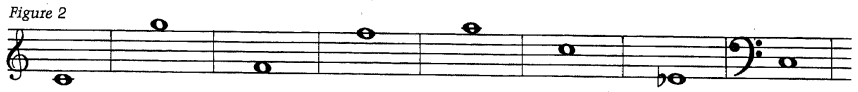
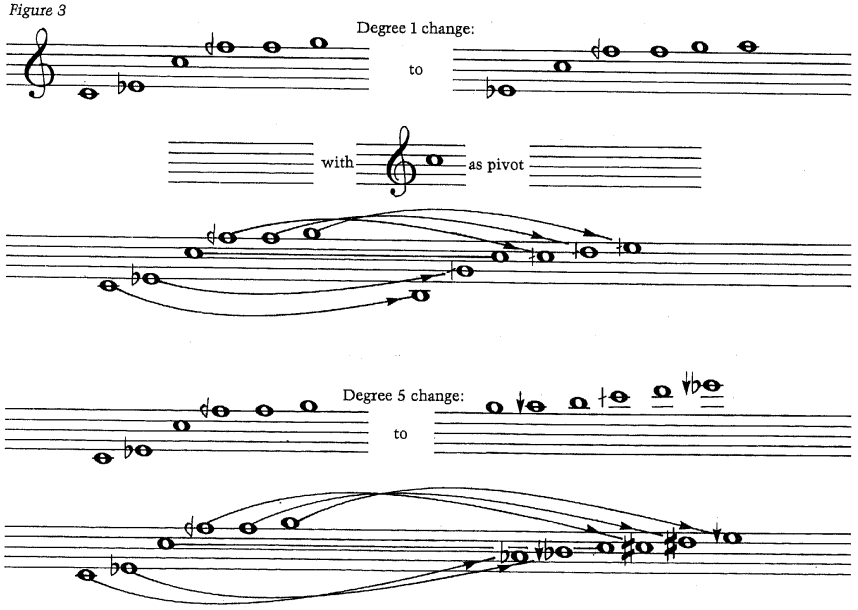


Figure 3



backward, with the option of continuously varying the speed. Often a rapidly oscillating forward/backward reading was made that gave a decrescendo/crescendo of high partials as the attack was left or approached. Rhythmic patterns of great subtlety were easy to devise, sometimes in interplay with programmed spatial movement. Elsewhere the partials of the bell, or selections from them, were individually distributed around the eight speakers, giving the listener the curious sensation of being inside the bell.

Techniques Using the Boy's Voice

Recordings were made of the boy (1) chanting the Latin text on one partial-note, (2) singing all the phonemes of the text separately, and (3) singing a short melody based entirely on the spectrum pitches. I was able also to simulate these sounds using the singing synthesis program CHANT developed by Gerald Bennett and Xavier Rodet, though getting the degree of random fluctuation and rudimentary vibrato right for the pure treble voice was a problem at first. I often disguised the beginning of the synthetic transformations with a "real" voice fragment. In another technique, recordings of vowels sung by the boy were digitized. The digitized files were then read by the sound-input modules, looped, and given pitch and amplitude contours analogous to those applied to the sinusoidal components in the synthetic bell spectra. The boy's synthetic voice sang on the bell partials instead of sine tones, and modulations as described previously were effected. Bell-like envelopes were given to some of these "bell sounds composed of boy's voice." Transformations were also applied to the spectra of the boy's vowels, which could be made into pitch and amplitude glissandi to the nearest bell equivalents in a bell spectrum. Such a file could again be read backward and forward, giving rapid oscillations of "boyness' with "bellness" in varied rhythms.

Conclusion

The computer's ability to read a recorded concrete file, to analyze it, to isolate the minutest fragment, and then to reproduce it rapidly in all sorts of patterns and multiplications (mixed or unmixed with synthetic material) comprises its most intriguing potential. The technology of programs like Music V (IRCAM) and CHANT at last make possible the precision whose lack made *concrète* work so conceptually problematic in the past.

Acknowledgment

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References

Haynes, S. 1980. "The Musician-machine Interface in Digital Sound Synthesis." *Computer Music Journal* 4(4):23–44.

Mathews, M. 1969. *The Technology of Computer Music.* Cambridge, Massachusetts: MIT Press.