Presented at the International Bohlen-Pierce Symposium, 7-9 March 2010, organized by
the Boston Microtonal Society in partnership with Goethe Institute Boston,
Berklee College of Music, Northeastern University, and the
New England Conservatory of Music.

Composing *Purity*

Curtis Roads

Media Arts and Technology, joint appointment in Music

University of California

Santa Barbara CA 93106-6065 USA

Point of origin

Many lecturers at this symposium will address the Bohlen-Pierce scale from an analytical, theoretical, and technical perspective. By contrast, this talk is an illustrated story about a notable time in my life as a composer of a work using the Bohlen-Pierce scale.

The point of origin of the composition *Clang-tint* can be traced to the sunny afternoon of 9 December 1990. I was a 39-year old Visiting Professor of Composition at the Oberlin Conservatory in Ohio, and I had heard on the radio a *New York Times* art critic praise an installation of photographic works by the Starn twins at the nearby Akron Museum of Art.

Figure 1. *Horse and Rider.* The Starn Brothers.

These large-scale works (Figures 1 and 2 depict works that are at least two meters in width), combined prints and large transparencies with wood, tape, metal, and other media to create three-dimensional sculptures (Grundberg 1990). Several aspects of this work struck me. These young artists integrated "sampled" (photographed) imagery with unusual materials and innovative methods of construction (tape, clear lacquer, pipes and clamps). Image quality was treated as a parameter that could be varied from high to low within a single piece. The unconventional bending, cutting, and framing techniques projected the works one meter into the room, effectively spatializing their two-dimensional photography in three dimensions.

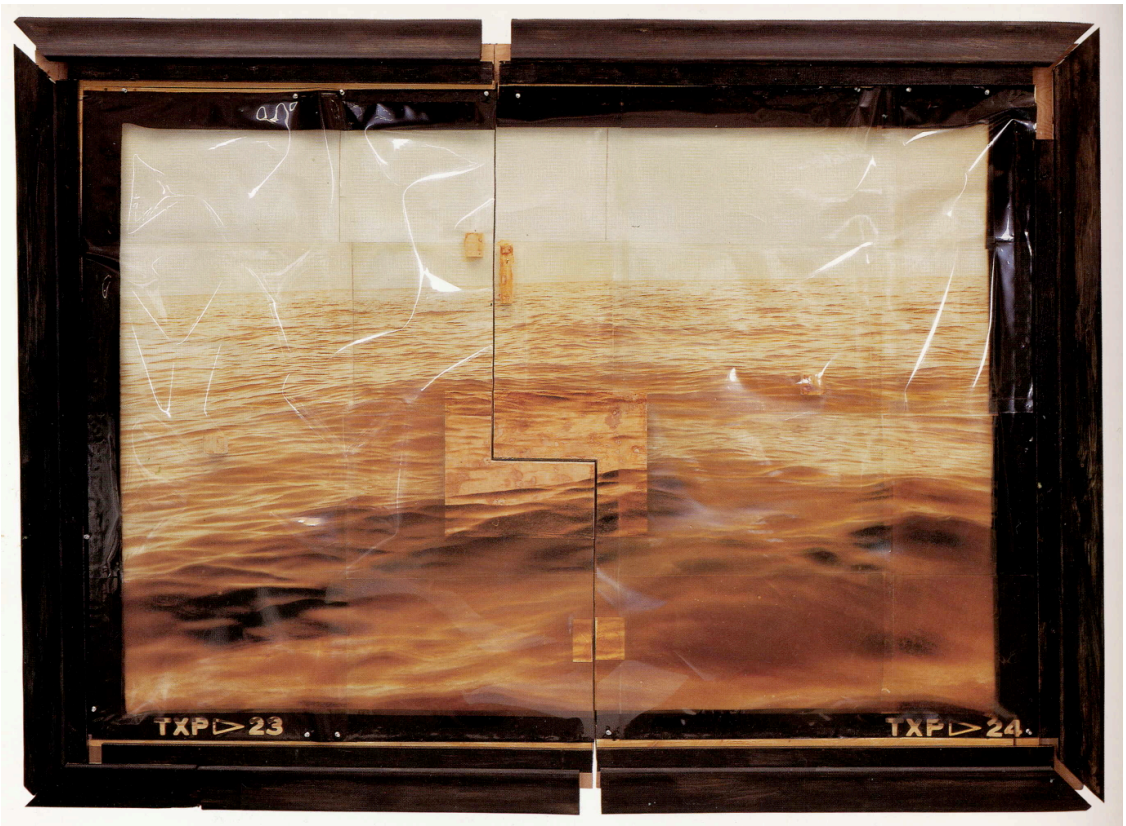
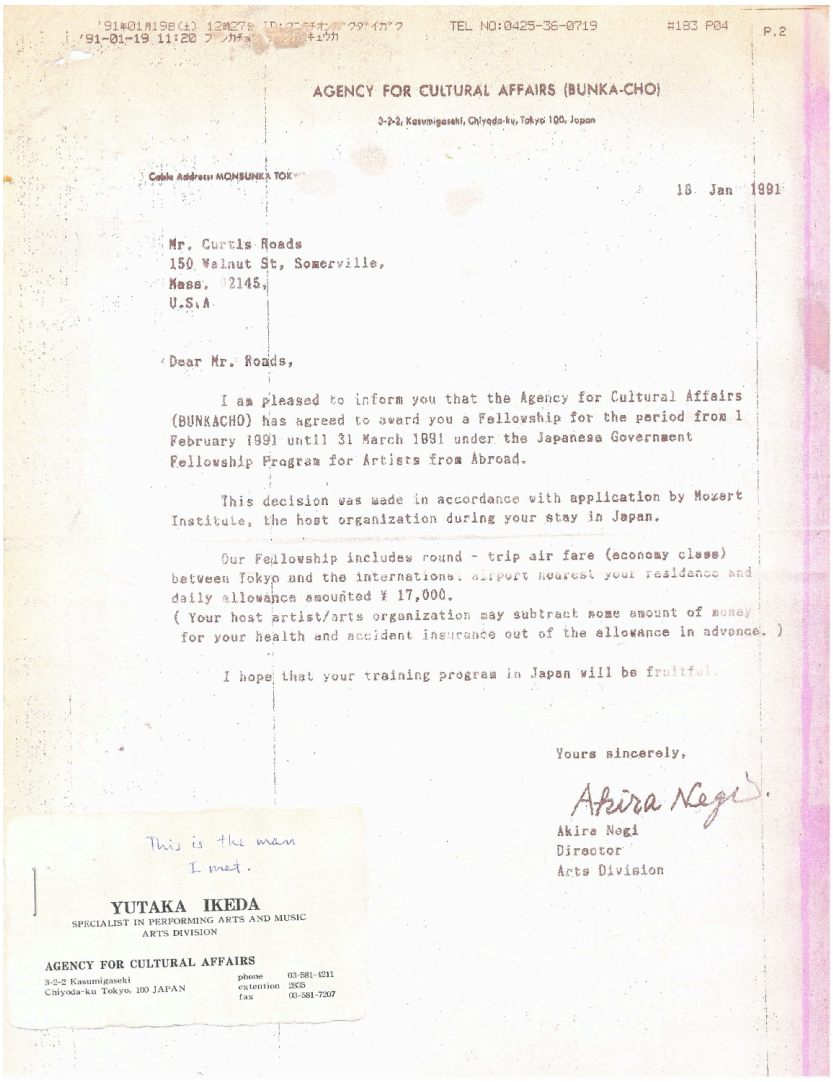


Figure 2. *Yellow seascape with film and woodblock.* The Starn Brothers.

I found this work fresh and inspiring. In the hour following my emergence from the gallery, I conceived a detailed design for a new composition. It would apply some of the same aesthetic concepts that I experienced in the gallery to the realm of sound. The primary source material for the composition would be sonic "photographs" or sampled sounds, as well as synthetically-generated tones. The piece would exploit the contrast between pristine sounds and noisy signals. The spatial architecture of the work would be intimately bound with its inner form. The piece would be organized in four contrasting movements, each concerned with a specific theme, and each organized around its own sound materials.

Shortly after this experience, I received an important fax message from Tokyo.



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AGENCY FOR CULTURAL AFFAIRS (BUNKA-CHO)

3-2-2, Kasumigaseki, Chiyoda-ku, Tokyo 100, Japan

Cable Address: MONBUNKA TOK

18 Jan 1991

Mr. Curtis Roads
150 Walnut St, Somerville,
Mass. 2145,
U.S.A

Dear Mr. Roads,

I am pleased to inform you that the Agency for Cultural Affairs (BUNKACHO) has agreed to award you a Fellowship for the period from 1 February 1991 until 31 March 1991 under the Japanese Government Fellowship Program for Artists from Abroad.

This decision was made in accordance with application by Mozart Institute, the host organization during your stay in Japan.

Our Fellowship includes round - trip air fare (economy class) between Tokyo and the international airport nearest your residence and daily allowance amounted ¥ 17,000.
(Your host artist/arts organization may subtract some amount of money for your health and accident insurance out of the allowance in advance.)

I hope that your training program in Japan will be fruitful.

Yours sincerely,

Akira Negi

Akira Negi
Director
Arts Division

This is the man I met.

YUTAKA IKEDA
SPECIALIST IN PERFORMING ARTS AND MUSIC
ARTS DIVISION

AGENCY FOR CULTURAL AFFAIRS
3-2-2 Kasumigaseki
Chiyoda-ku Tokyo, 100 JAPAN
phone 03-581-4211
extention 2855
fax 03-581-7207

This was an artistic fellowship from the Bunka-Cho (Japanese Ministry of Culture) in support of a commission from the Kunitachi Ongaku Daigaku (Kunitachi College of Music). I decided that the realization of *Clang-tint* would be an ideal project for the commission. The title derives from a book by John Tyndall (1875) that I discovered at Oberlin, in which he proposed the term “clang-tint” (sound color) as an English language alternative to the French “timbre” and the German “Klangfarben.”

国立市 Kunitachi residency 1991

This commission was a once-in-a-lifetime opportunity. It was prepared by a 1989 visit to Tokyo along with David Wessel, F. Richard Moore, and Cort Lippe to consult on the redesign of the Kunitachi computer music studios. With the remodeling done, in January 1991, I was flown business class from Boston to Tokyo on a new Japan Airlines jet, met by chauffeur, and housed in a luxury seven-room apartment in the Tokyo district of Kunitachi.

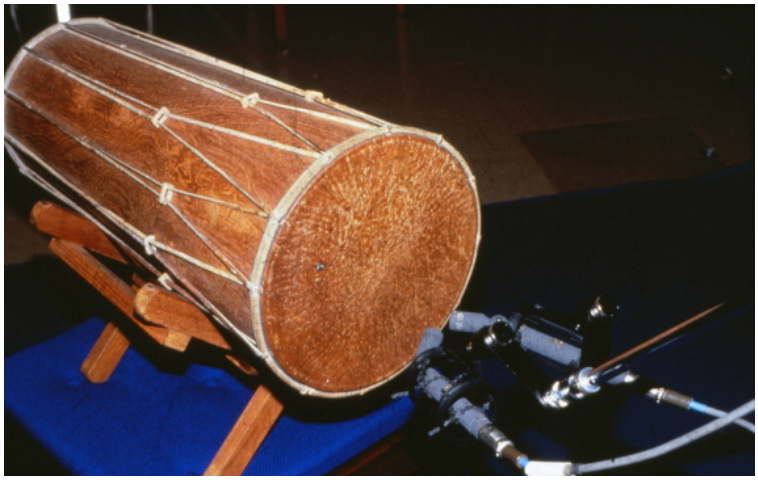
The author at Sensoji temple, Asakusa, Tokyo 1991.

The commission for *Clang-tint* involved an initial residency in Tokyo in the newly renovated studios of the Kunitachi conservatory for a period of three months, from January to March 1991. Besides the well-appointed computer music studios, I was particularly interested in an extraordinary facility at Kunitachi, the Gakkigaku Shirôkan (musical instrument museum, or Institute of Organology). Thanks to Professor Sumi Gunji, Director of the Institute, I was granted sole access to the facility for a period of five days so that I could record the instruments.

Courtyard at Kunitachi outside the electronic music studios.

I imported my own recording equipment to Kunitachi. This consisted of a matched pair of Schoeps condenser microphones with cardioid capsules, a two-channel Sontec microphone preamplifier, the oversampling analog-to-digital converters of a Lexicon 300 digital signal processor connected via SPDIF digital interface to a Panasonic DAT (digital audio tape) transport. I played the instruments myself, since no instrumentalists were available at that time. Over five days, I recorded 45 instruments, some dating back to 500 BC, and some as modern as a 1960 Ondes Martenot–an analog electronic instrument. The instruments came from Zaire, India, Iran, Syria, Japan, France,

Indonesia, England, Scotland, Germany, Switzerland, Burma, Papua New Guinea, Russia, Czechoslovakia, China, and the USA. The sessions resulted in a database of ten hours of sound stored on DAT.






Instrument recordings at Kunitachi, 1991.

Sectional organization of *Clang-tint*

I conceived *Clang-tint* in four highly contrasting movements, separated by silence. Each movement would express a specific theme or metaphor: *Purity* and its opposite *Filth, Organic* and its opposite *Robotic.* Although each movement represents an extreme tendency in composition, my idea was that they would counterbalance each other.

Just as building materials such as bamboo, wood, concrete, fiberglass, or steel have a strong influence on architectural design, so contrasting sound materials imply different methods of musical organization. Each section of *Clang-tint* deploys its own specific set of sound materials, and each is organized in an appropriate way.

The theme of "purity" supplied a metaphor for the choice of its sound materials and organization of the work. What is purity in sound? High-fidelity sinusoidal waveforms come to mind, and they dominate the sound palette of this work. The organization of *Purity* is biased toward melodic, harmonic, pulsating, and slow glissandi and rippling modulations.

Research agenda

The realization of *Clang-tint* took several years (1991-1994), merging musical and technical research with composition itself. Among the research projects undertaken in the course of the composition were the following:

• *Exploration of microtonal pitch organization*–specifically focusing on the Bohlen-Pierce (BP) scale; constructing melodic and harmonic structures based on the BP scale; exploration of the continuum between harmony and timbre in the mixture of equal-tempered and microtonal scales. (See the description of Part III of *Purity* below.)

• *Editing on a micro time scale*–microfiltration, transient wavewriting, micro-spatialization, microvariations in phase and delay. This research was enabled by high-quality sound editors with graphical user interfaces, which had just become available (Studer MacMix, DigiDesign SoundDesigner, Studer MultiMix). Today we zoom in and out of time scales effortlessly. This seemingly simple capability–which now seems so obvious and intuitive–changed the nature of music composition, as it offered direct and immediate access to all musical time scales.

• *Development of new techniques of distortion*–techniques for distorting signals without making them sound harsh, through dynamic range compression. These techniques were used in the making of *Purity's* opposite, *Filth.*

• *Composition with granular synthesis*–exploring musical applications of new sound materials such as clouds of sonic grains (Gabor 1946, 1947; Xenakis 1960; Roads 1978). I developed software for generating synthetic grains and for granulating multiple soundfiles. In this period, only two composers had used granular synthesis: Barry Truax in Canada and me.

• *Composition with pulsar synthesis*–realizing a new approach to sound particle synthesis; applications of pulsar synthesis with convolution. I developed new software to realize this technique (Roads 2001, 2002).

• *New approaches to rhythmic structure*–simultaneous polyrhythms; exploration of the continuum between metric and ametric rhythms. Exploration of Varèse's idea of multiple ametric simultaneous rhythms with points of synchronization. (These experiments were intended for the final movement of *Clang-tint, Purity*, which I did not complete.)

In this paper, I focus exclusively on part one: *Purity.* The metaphor of *Purity* suggested high fidelity pure tones in a tonal context.

The Bohlen-Pierce scale

The striking and characteristic moods of many tuning systems will become the most powerful and compelling reason for exploring beyond 12-tone equal temperament. …These moods were a complete surprise to me–almost a shock. Subtle differences one might expect–but these are astonishing differences…I could explain here that the seventeen-tone system turns certain common rules of harmony upside-down: major thirds are dissonances which resolve into fourths instead of the other way round:

certain other intervals resolve into major seconds; the pentatonic scale takes on a very exciting mood when mapped onto the 17 equally-spaced tones, and so on; but I can't expect you to believe me until you hear all this yourself. – Ivor Darreg (1975)

We seek new pitch schemes for their expressive potential. I chose the BP scale not because of its numerological properties, but because of its intriguing sound, which I heard previously in a 1990 composition by Richard Boulanger, *I Know of No Geometry*. With its combination of intervals that were sweeter than 12 ET, together with others that were more sour, I heard strong potential for expressive melodic and harmonic structures. At the same time, I wanted to take BP intonation from the familiar instruments into the cosmos of electronic music, by projecting it with sine waves, glissandi, intermodulations, and echoes in the manner of the classic electronic masterpiece *Forbidden Planet* (1956) by Louis and Bebe Barron.

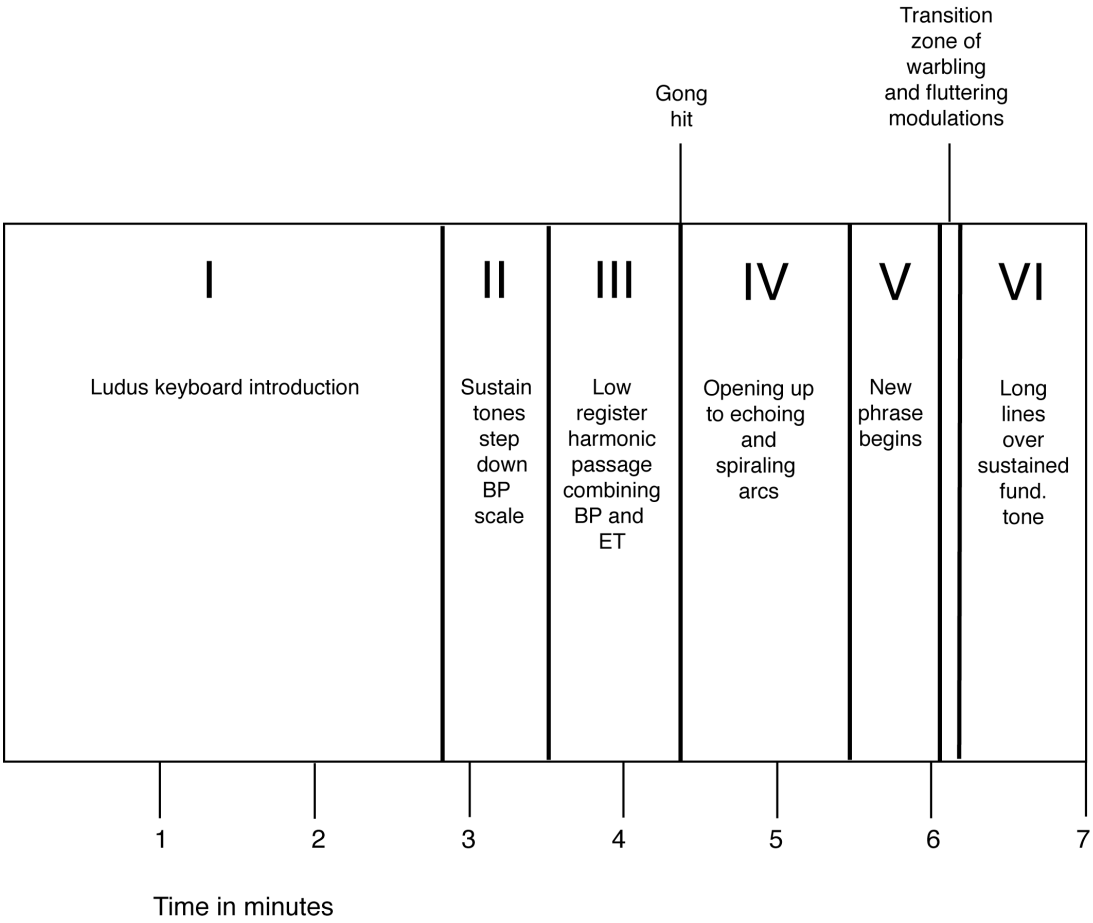
One can summarize the most basic facts about the BP scale by observing that the BP (equal-tempered version) step of 1.08818 is a quarter tone broader than a major second. This makes it very dissonant when combined with the tonic. By contrast, several BP ET steps are close approximations to just or pure 3^{rd}, 5^{th}, 7^{th} ratios, among others. Pierce (1999) viewed BP as a 9-tone scale (using steps 0, 1, 3, 4, 6, 7, 9, 10, and 12) beginning on any of the 13 chromatic steps, yielding 13 keys. Mathews and Pierce (1989) analyzed the harmony of the scale and showed its possibilities for quasi major and minor chords. My work, however, exploited the total equal-tempered chromatic range (all intonation steps).

In 1990, I programmed the BP scale on a Korg M1 synthesizer. The Korg M1 was tunable in cents, but was limited by its octave-based tuning system. This meant that retuning the middle C key (for example) also retuned all other C keys in higher and lower registers. Thus I had to divide the BP scale into two parts, BP I (the first nine steps of the scale) and BP II (the remaining steps). The M1 keyboard let me switch between them but I could not play them simultaneously except by overdubbing, so this was the strategy I followed.

I learned the harmonic flavor of the BP scale by ear, a process of familiarization that took many months. The presentation of BP intonation is simple only in the first section of the piece. Later on, the BP intonation is embedded in a broader context of sonic phenomena, including glissandi, general modulations, combinations with 12-note equal temperament, and temporal effects as reverberation and echo. (See the next section.)

Sectional organization of *Purity*

The overall form of *Purity* is strongly sectional, proceeding from a simple organ-like introduction and evolving into a "cosmic" glissando texture, made larger by deep echo and reverberation effects. On the final note, *Purity* returns to its organ-sound origins. *Purity* divides into six sections, separated by transitions.



I. 0-2:49 *Ludus*

The first section *Ludus* (Latin for play) derived from a seven-minute keyboard performance on BP I, realized 24 January 1994 in Paris. It uses a sinusoidal voice ("Pur_Jan") that I programmed on the Korg M1 synthesizer. The material divided into discrete two-voice phrases up to 2:14, then became more free. At four minutes the phrases play in the bass, and at 5:30, pitch bends entered in. I selected different parts of this performance, edited them, and spliced them into the opening of *Purity.*

II. 2:49-3:33 *Sustained tones*

Long sustained notes (> 10 sec), bathed in reverberation from the Lexicon 300. The texture simultaneously steps up and down the BP scale, reaching a single sustained tone in the high register.

III. 3:33-4:20 *Polyscalar*

A warm harmonic section in the lower registers combines notes from both 12-note ET (at a reduced amplitude) and BP to create a hybrid harmonic progression, the temporal details of which are deliberately blurred by reverberation.

IV. 4:21-5:35 *Cosmic opening*

Opens with a large gong sound recorded at Kunitachi College of Music. At 4:42 I introduce notes that spiral upward in frequency while also echoing, reminiscent of the radiosonic modulations of *Forbidden Planet*. Steady background tones maintain a tonal center leading to a resolution at the end.

V. 5:35-6:04 *Bridge phrase*

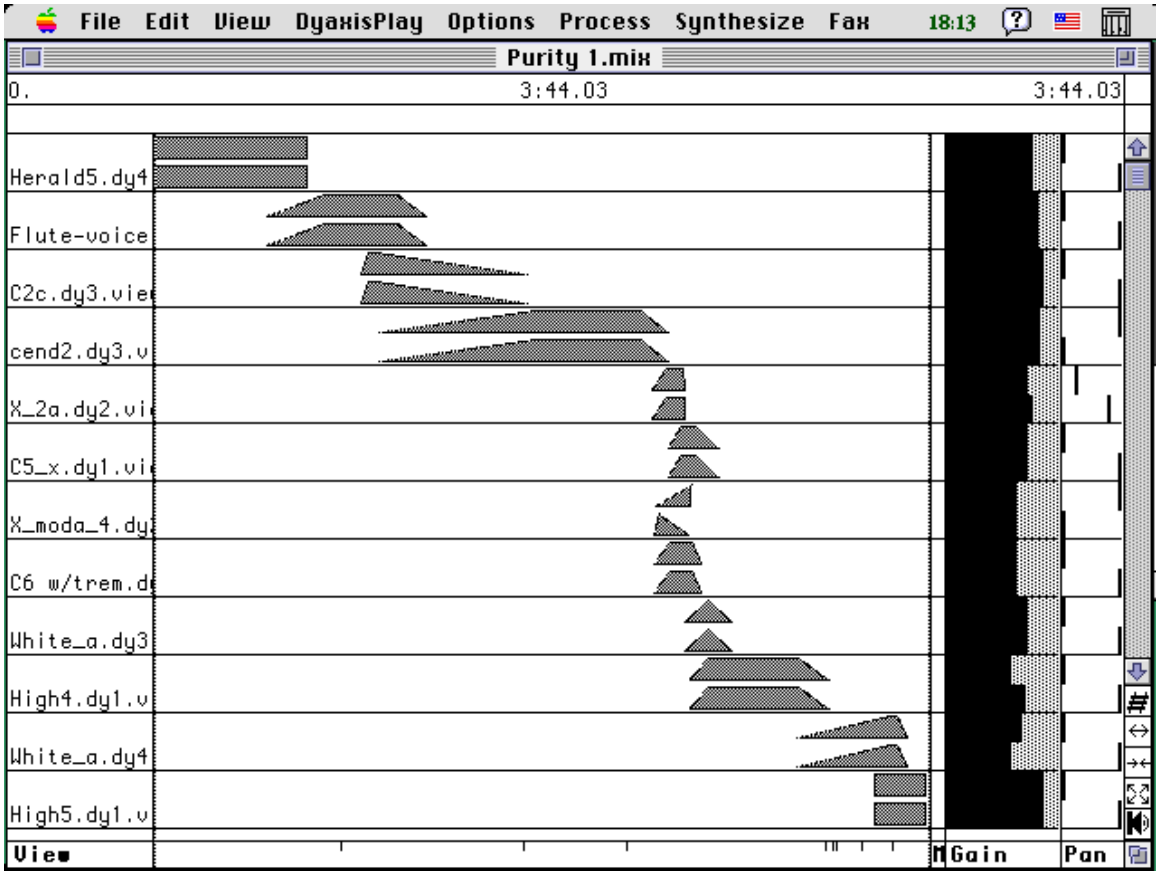
A new bridge phrase begins after a cadence that resolves near to a pure tritone away from the tonal center.

VI. 6:04-7:14 *Transition and Finale*

Warbling modulated tones signal a transition from the bridge phrase to the finale. The finale converges toward resolution at C, the tonal center of the piece. The last note is a positive organ sample that I recorded at the Kunitachi Institute of Organology.

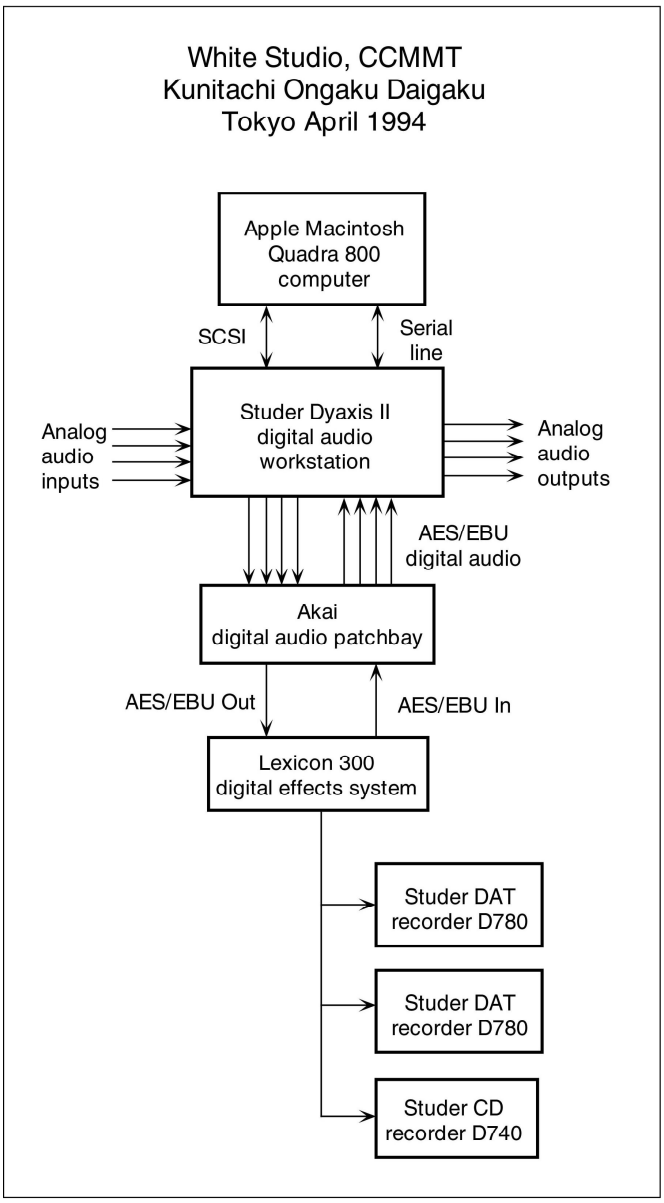
Technical means

Purity was assembled with state-of-the art-technology at the time. In my home studio, I used an Apple Macintosh Quadra with a 40 MHz processor running System 7.1. The main mixing software was Adrian Freed's MacMix, running on the Studer Dyaxis hardware.



One of many MacMix submixes, 24 January 1994.

In at the Kunitachi School in Tokyo, I used a more powerful system, shown in the diagram below.



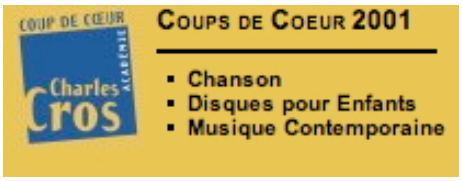
The Studer Dyaxis II had the impressive capability of being able to mix an unlimited number of tracks in real time. It did this by rendering a hardware-assisted submix of all overlapping regions at the instant that one repositioned any sound region on the time line. Working in the background, it was always ready for real-time playback.

Outcomes

The piece premiered at the Kunitachi school in April 1994. The French premiere took place in December of that year at the Olivier Messiaen Auditorium of Radio France using 48 loudspeakers of the Acousmonium sound projection system designed by the Groupe de Recherches Musicale (GRM).

Purity appeared on a compact disc entitled *CCMIX Paris: Xenakis, UPIC, Continuum* on the New York-based MODE Records label.

This set won the "Coups de Coeur" award from the Académie Charles Cros in Paris and was named "One of the Top Five of 2001" by *WIRE* magazine in the UK.



Reflections

The new composers have not abandoned melody. – Edgard Varèse (1923)

Clang-tint was a milestone in my compositional process. I had never before based a work on conceptual metaphors (purity, filth, organic, robotic). It turned out to be an interesting exercise to foster intuition. I set technical goals at the beginning with the explicit aim of expanding my composition technique. One of these goals was to investigate BP intonation, both melodically and harmonically. This was a rewarding process. I remain pleased with *Purity* and want to work again in BP intonation. In general, as the 2010 International Bohlen-Pierce Symposium demonstrated, the time is right to explore alternative tunings–a wide open territory. Let a thousand flowers bloom.

From a personal standpoint, the period during which I composed *Clang-tint* involved many changes in my life, from a temporary teaching position at Oberlin (1990), to a brief return to my home studio in Boston (1991), four months in Tokyo (1991, return in 1994), and a move to Paris (1991-1996). Except for the Tokyo visits, I had job obligations and was also completing my textbook *The Computer Music Tutorial*, which partially explains the long gestation of *Clang-tint.*

Viewed as a cultural artifact, *Clang-tint* can be seen as a product of the early 1990s in Japan–an era of great economic prosperity. In contrast with the 1970s, when production of electronic music instruments was a cottage industry, by the 1980s Japanese corporations had industrialized production of electronic instruments. Synthesizers by Yamaha, Korg, and Roland were sold by the hundreds of thousands. In the early 1990s, the Japanese electronic music scene was somewhat isolated, with little international visibility or contact. This extraordinary series of commissions (several other composers also received support) from Kunitachi and the Bunka-cho was a sign of emergence of Japan as an international cultural force in the field of electronic music. Since that time there has been much more exchange, with Japanese artists becoming known internationally, and non-Japanese artists becoming better known in Japan.

The technological context of this work is also significant from an historical point of view. This was the first piece that I realized with graphical editing and digital multitrack mixing techniques, as opposed to analog tape editing and mixing. The simple ability to view

waveforms and edit on a micro time scale was a revelation. This capability enabled a compositional process of *multiscale planning* (Roads Forthcoming). Whereas the emphasis in computer music in the 1980s was on programming and synthesis techniques, the 1990s was an era in which interactive editing moved into the forefront of our working methods.

Acknowledgments

The realization of *Clang-tint* was enabled by many kind people. I extend my thanks first of all to Bin Ebisawa, who was President of the Kunitachi College of Music (Kunitachi Ongaku Daigaku), and to the late Cornelia Colyer, then Director of the Center for Computer Music and Music Technology at Kunitachi for their sponsorship of this project in the 1990s. I also express my appreciation to the Japanese Ministry of Culture (Bunka-cho) for providing the fellowship that brought me to Tokyo in 1991 and 1994. I thank the composer Kuzika Kuryama for his assistance in Tokyo. Professor Sumi Gunji and her staff at the Gakkigaku Shirôkan kindly allowed me access to their fine museum of instruments. In Paris, I was encouraged by my colleagues Gérard Pape and Brigitte Robindoré at the Centre de Création Musicale Iannis Xenakis (CCMIX). Finally, I would like to thank Conrad Cummings and Gary Nelson for inviting me to teach at the Oberlin Conservatory, where *Clang-tint* was conceived. Switching back to 2010, I thank Clarence Barlow, Yutaka Makino, and Chris Jette for their helpful comments on this text.

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