**Tones, Timbres, Technology: Japanese Heritage Instruments in the 21st Century**

workshop conducted by the Columbia University Computer Music Center
sponsored by the Toshiba International Foundation
Karuizawa/Tokyo: June 12 - June 21, 2015
directed by:
  - Brad Garton, Columbia University Professor of Music and Director, Computer Music Center
  - Douglas Repetto, Director, Sound Arts Program, Columbia University School of the Arts

Columbia-Japan Administrative Liaison:
  - Ken Aoki, Executive Director, IMJS: Japanese Cultural Heritage Initiatives

*special conceptual assistance from Professor Barbara Ruch, Columbia University*

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The purpose of this workshop will be to explore the materials used in and the technological enhancement of traditional Japanese musical instruments. The goal will be to endow the rich sonic heritage of Japanese music - in all its forms - with a contemporary relevance made possible by the creative deployment of the techniques and technologies of the new field of Sound Arts. An additional goal will be to introduce workshop participants to a Sound Arts perspective, particularly as it is being developed in the ground-breaking Columbia University Sound Arts MFA program.

- from the project proposal submitted to the Toshiba International Foundation

The workshop took place primarily at the Japanese National Informatics Institute's well-appointed "Seminar House for Advanced Studies" in Karuizawa, Nagano Prefecture. It spanned two weekends of intensive activity, with students developing projects in the intervening week. Along with the stated purpose of the workshop, we also considered this an experiment in pedagogy. A 'hidden' goal of the workshop was to ascertain if sophisticated technological innovation and creativity could be nurtured through an immersive "hands-on" environment.

The Karuizawa gathering was also enhanced by a workshop 'prequel', the *Koto Tones and Timbres Comparison Demo* presented at the Tokyo University of the Arts (GeiDai). This presentation featured demonstrations of various types of kotos being newly developed in Japan by performers and teachers to solve dilemmas in sound and use. The *Koto Tones* demo was organized primarily as a contribution and prelude to the Karuizawa workshop.
Presented by one of the Columbia 2014 "Tokyo Summit" leaders, Mr. Takafumi Tanaka, Hogaku Journal founder and editor-in-chief, and made possible in collaboration with the eminent performer and Tokyo GeiDai teacher of the koto, Professor Satomi Fukami (Kikkawa), it was invaluable to 'prime' the student workshop participants with the challenges of integrating digital technology design and Japanese Heritage instrument concepts.

As can be seen in the projects presented below, we succeeded in achieving both the overt goal of the workshop as well as demonstrating that a high level of creative accomplishment can be promoted through a direct material connection, even if the time-frame is quite limited. We are very proud of what the students produced!

We structured the workshop around the presentation of both advanced software and advanced hardware techniques. The students were very talented and motivated, but none of them had been heavily involved in this kind of development prior to the workshop. Professor Brad Garton, Director of the Columbia University Computer Music Center, handled most of the software-based instruction with Professor Douglas Repetto, Director of the new Columbia Sound Arts Graduate Program teaching the hardware aspects of the workshop.

Along with Profs. Garton and Repetto, two graduate students from the Columbia University Sound Arts Graduate Program, Alice Baird and Chatori Shimizu, were on-hand to assist students and collaborate in project development as well as lend their particular perspectives to the process.

Japanese student participants in the workshop were selected by our colleagues at the Kunitachi College of Music and Tamagawa University. The Kunitachi and Tamagawa students involved were:

- Ryosuke Horie
- Mamoru Takano
- Sayaka Ueda
- Danjo Yamauchi

All were advanced students pursuing studies in music composition.

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The Projects

The following are descriptions and short demonstrations of the projects completed by the students. The video used was recorded during the final presentations by the students.
Danjo Yamauchi and Chatori Shimizu

Yamauchi is a music composition student with a strong interest in the timbre of sound. Shimizu studies Shō performance as part of his musical education and routinely employs traditional Japanese methods in his Sound Art work. Shimizu and Yamauchi created a new composition together using the traditional Japanese Shō coupled with a laptop running state-of-the-art digital signal processing software. The audio signal from the Shō was processed in real-time through various transformative DSP (Digital Signal Processing -- techniques that allow digital machines to alter an audio signal) algorithms, resulting in an evocative piece that married the marvelous sound of the Shō (played by Shimizu) with the contemporary sound of computer processing.

Sayaka Ueda and Alice Baird

Ueda expressed an interest in investigating new ways for her as a composer to 'connect' with traditional Japanese instruments. Baird's work in Sound Art exhibits a broad-ranging interest in "interface", especially capabilities made possible by new technologies. They decided to use a set of basic EEG sensors to monitor the overall electrical output from an individual's brain. This global EEG signal was then used to control the synthesis of a traditional koto, mapping aspects of the EEG signal onto musical parameters (pitch, modulation, etc.) of the synthetic koto. In addition to this, Ueda and Baird built a simple hardware 'switch box' interface that allowed them to transform how the EEG was being interpreted as musical parameters controlling the koto synthesizer.

Ryosuke Horie and Brad Garton

In his initial presentation to the workshop, it was obvious that Horie was interested in the automatic generation of music by computer, known as 'algorithmic composition'. This is a particular specialty of Prof. Garton's work, so he and Horie worked together on building an algorithmic system. Horie was also intrigued by the possibility afforded through technology of 'moving outside the concert hall', deploying work that could interact in interesting ways in a multitude of contexts. The traditional concert hall setting is also not always suitable for Japanese Heritage presentations, so Horie's concepts may find direct application as we move forward with the next stage of heritage instrument/technology development.
Although Horie claimed "never to have done any programming before", by the end of the two weekends he had produced an application that responded to pitches detected in an environment and algorithmically generated harmonizations for those pitches. By learning the computer music research language RTcmix, he was able to translate his application from a general-purpose laptop computer and build it to run on mobile devices (an iPhone is shown in the video demo). This portability will allow him to imagine many possible ways to move 'outside the concert hall'.

Mamoru Takano and Douglas Repetto

Takano was also interested in working with a musical interface, but his focus was more on the physicality of an instrumental interface. He wanted to learn how to construct devices that could potentially work as performable instruments; things that he could design to meet his own particular musical needs. Prof. Repetto was an obvious choice for this work, and together they produced a system that could trigger various musical processes.

Takano also discovered that the data generated by the device could be used to control real-time graphics generation, as is shown in the video of his final presentation.

Prof. Brad Garton

Inspired by the outstanding work done by the workshop participants, Prof. Garton wanted to contribute to the final presentation in a direct way. Drawing from the work being done by the students and workshop staff, he built two simple 'demo' applications designed for use on mobile devices. The sound is generated by a synthesis technique called "physical modeling" in which the physics of existing instruments (in this case a koto and a hichiriki) are used to determine audio synthesis. Currently we are planning to use these ‘virtual instruments’ (along with other work developed at Karuizawa) in the annual Spring (2016) Gagaku/Hogaku concert at Columbia University.
Alice Baird and Chatori Shimizu

play_algorithm

The evening ended with a special presentation of an installation work done by Columbia graduate students Baird and Shimizu. One room of the 'seminar house' was converted into an interactive performance space, featuring real-time data collection, musical performance, and video/audio generation. This site-specific work was an ideal ending to the workshop, bringing together many of the themes that were explored over the two weekends.

Final presentations from the workshop were given to a distinguished panel of guests, including:

- Professor Cathy Cox (Tamagawa University and Kunitachi College of Music)
- Professor Shintaro Imai (Kunitachi College of Music)
- Professor Johnathan F. Lee (Tamagawa University)
- Professor Jill Lipoti (Rutgers University)
- Professor Yoshiaki Onishi (Toho Gakuen School of Music)
- Professor Barbara Ruch (Columbia University)

In addition to these distinguished guests, several other prominent figures in Japanese computer music were following the progress of the workshop. Though they were unable to participate directly in the workshop due to scheduling conflicts, they include:

- Professor Jarek Kapuscinski (Stanford University)
- Professor Naotoshi Osaka (Tokyo Denki University)
- Professor Takayuki Rai (Kunitachi College of Music)
- Professor Akira Takaoka (Tamagawa University and Tokyo University of the Arts)
We are looking forward to extending the initial groundwork accomplished at this workshop, and to expanding upon it in New York in 2016. We welcome any inquiries about the workshop and what we did; please write to garton-at-columbia.edu for additional information.

We want to give our sincere thanks and appreciation to the Toshiba International Foundation for the support that made this workshop possible, as well as to the staff of the Japanese National Informatics Institute, which made the superb resources of their Karuizawa ‘Seminar House’ available to us.