Date: 02 Apr 91 1106 PST
From: Patte Wood <PAT@ccrma-f4.Stanford.EDU>
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Mr. Norio Ohga, President
Sony Corporation
7-35 Kitashinagawa
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SHINAGAWA-KU
TOKYO 141, JAPAN
October 12, 1986

Dear Mr. Ohga:

I am writing to you with the hope of interesting the Sony Corporation in joining Stanford University in a long term research project on physical modeling of musical instruments with a special emphasis on the singing voice. This project is now being initiated at Stanford's Center for Computer Research in Music and Acoustics (CCRMA), a center dedicated to the application of computer technology to music/acoustic research and composition.

The singing voice interesting for a number of reasons from the point of view of acoustics, psychoacoustics (perception) and signal processing. For example, their is no better musical source than
the voice for the study of the perceptual importance of very small inadvertant fluctuations in the pitch and and intensity of a "constant" tone. While these fluctuations are present in all natural sounds they are little understood. With computer analysis we can now begin to quantify and characterize them.
In additon, the voice presents a special problem in regard to modeling: within any given voice type (e.g. soprano) there is an enormously wide range of voice qualities judged to be excellent when compared to any other musical source (e.g. violin). The model must be sufficiently robust to accomodate such a range.

Of all musical sources the modeling of the singing voice is perhaps the most complex and dependent upon advanced filter technology. Unlike most musical sources where the excitation function and the resonance system are relatively constant for a given note, in the case of
the singing voice (as in speech) both the excitation function and the resonance system can change rapidly and extremely in a continuous manner during the course of a note.

At CCRMA we have developed over the years great skill and insight in the analysis and simulation of complex musical sound with particular emphasis on its micro-structure. Some striking sound examples of the singing voice have already been produced which relate its micro-structure to perceived naturalness.
Based upon recent developments in digital filter technology by Dr. Julius Smith of the CCRMA staff, physical modeling of complex acoustic sources now seems attainable. Smith's development of digital "closed wave guide networks" provides for stability in the face of rapidly varying parameters (and for the elimination of

limit cycles).

In order to increase our understanding of, and to be able to begin to assign acoustic and psychoacoustic dimensions to voice quality, we must make use of advanced filter technology in modeling. We must also have as large a number as possible of recordings of excellent! voices (I emphasize excellent because much of the current research has been based upon less than excellent voices which results in less interesting conclusions). We want to make these recordings in a known and controlled environment at CCRMA. Profiting from Stanford University's proximity to the San Francisco Opera, I am making long term arrangements to invite the great singers of our age to CCRMA where we can make digital recordings of standard vocalises and repertory in CCRMA's newly constructed digital recording studio.

Having access to the great voices as well as an excellent recording studio we have need of an equally excellent digital recording system which is the reason that I write to you. Given Sony's leading position in this field, helping CCRMA define the recording system would be a most effective way for Sony to join with Stanford in this monumental project.

There is much for us to learn about the singing voice and the current technology offers us unprecedented means for discovery in signal processing, acoustics, psychoacoustics, and even vocal pedagogy. In addition,
the singing voice is the only "instrument" that is unique to a performer and therefore does not survive the performer. Of great importance then, this project will not only result in an archive of the great voices for comparative studies and analysis, but also in physical models which will allow their survival for all time.

In order that you might have some reference for our work, I might suggest Mr. Grant Smith, Executive Vice President, Sony Technology Center, Palo Alto.
Mr Smith and staff have been very helpful to us in some of our research and production projects in recent years.
There are two people in Japan who have a long acquaintance with our work and overall technical competence and with whom you can speak candidly about CCRMA. They are Mr. Kawakami Jr. and Mr. Mochida, President and Managing Director respectively of Nippon Gakki Co. (YAMAHA) in Hamamatsu, Japan. It is largely because of their early insight that YAMAHA successfully developed the FM synthesis technology which was discovered here at CCRMA. YAMAHA's participation in this project is in our acquisition of the digital recording studio, for which we not only received excellent advice from YAMAHA but the considerable funds for construction through their licensing agreement with Stanford University.

Would it be possible for me to visit your corporation to speak to you or members of your staff regarding this project.
I will be in Tokyo in early November and am free all of Monday, November 3rd.
I would be willing to make a
short presentation with synthesized examples of some of the work already accomplished in modeling the singing voice.

I look forward to your reply.

Respectively,

jc

include: telex and tel numbers

copies to: Mr. Grant Smith, Executive Vice President
Sony Technology Center, Palo Alto

Mr. M. Morizono, Directo of Research and Development
Sony, Japan

Mr. ? Kawakami, Jr., President
Nippon Gakki Co, Ltd.