December 9, 1988

TO: John Chowning
Larry Lollar
Niels Reimers
Richard Stearns

FR: Anna Ranieri *aR*

RE: Yamaha Proposal

Dear Colleagues:

Please review the enclosed draft proposal to Yamaha Corporation. My plan is to send it out with the enclosed materials about CCRMA, the Music Communications lab, and the Industrial Affiliates Programs.

Please feel free to give me your candid feedback on the proposal and especially its appropriateness for Yamaha as a Stanford friend and a Japanese corporation.

I greatly appreciate your help on this!

Telephone: 5-4291
EM address: CT.AMR

DRAFT

December , 1988

Mr. Hiroshi Kawakami
Yamaha Corporation
10-1 Nakazawa-cho
Hamamatsu, 430
JAPAN

Dear Mr. Kawakami:

I respectfully submit to you a proposal for support for the Center for Computer Research in Music and Acoustics (CCRMA) at Stanford University. Specifically, we ask that Yamaha Corporation consider giving to Stanford an endowed professorship for the directorship of CCRMA, a position currently held by Professor John Chowning. This endowment would fund the position in perpetuity and would carry the name of the Yamaha Corporation, the Kawakami family, or whatsoever other name you would designate. We also ask that you consider additional support to establish the Yamaha Music Communications Laboratory, a state of the art facility at CCRMA, for the use of distinguished researchers and students.

The expense to Yamaha for these projects would be $1,750,000. This consists of $1.2 million for the endowed professorship, an amount to be matched by $400,000 of Stanford University funds to reach the total cost of $1,600,000; and $550,000 toward the total cost of $1 million for the development of the music communications laboratory. We propose that Yamaha make a five-year pledge of this amount, paying $350,000 per year. The professorship would be formally acknowledged and named when $400,000 has been paid toward its establishment.

You may find that such a gift, made through your U.S. subsidiary, could be tax-deductible in this country. This was the case for Hitachi America, the donor of the Hitachi America professorship. Our university counsel would be available to work with you on investigating the U. S. tax laws regarding such a gift, should that be helpful to you.

We would also like to use this opportunity to further the interactions between Yamaha and Stanford. We propose that this arrangement would allow for Yamaha to send, at its expense, a visiting scholar to CCRMA for all or part of each year in order to perform research and to have the opportunity (with the permission of the instructor) to audit Stanford courses in the areas of his interest. We would offer such a researcher office space and technical support. You may also be aware of the Industrial Affiliates programs at Stanford that might be of interest to you under this arrangement. Yamaha is already a member of the affiliates program at CCRMA. Other programs are described in the booklet enclosed with this letter.

I have included some general information about CCRMA, a premiere research entity in its field, and one with which you already have many interactions. We are very proud to have this respected institution here at Stanford, where the renown of John Chowning and his colleagues brings us honor. We would be most delighted to have the Yamaha name further associated with CCRMA's endeavors.

I am also sending information about the music communications laboratory and the importance of the exciting new work to be performed there. We would be very pleased to involve Yamaha in this venture, which is crucial to the development of new knowledge in the field.

I would like to invite you and your colleagues to talk further with me, Stanford President Donald Kennedy, and others at Stanford about this idea.

Please accept our invitation to visit with us here at your earliest convenience. We would like to show you more of our programs, to talk about your interests, and to host you in playing golf on our fine course.

If such a visit would not be convenient for you, please let me know whether we might confer with you in Japan. I hope that I will have the pleasure of talking with you again in the near future. Thank you for your willingness to consider this proposal and for your friendship and interest toward us at Stanford University.

Sincerely,

James F. Gibbons

bcc: John Chowning
Anna Ranieri
Lollar/Hay/Meredith/ODF: Yamaha Corporation

Should I give a
Copy to each -
MVM, CC, EDS ?

Photo

JC

MUSIC COMMUNICATIONS LABORATORY

Music technology, computer technology, and IC technology have become so powerful that it is no longer hubris to claim that we can, but for the following problems, make any sound or timbre or sequence of sounds that is of interest. The most important and interesting unsolved problems lie in the human communications area and concern how we hear and perceive music and how we can control our new musical resources to communicate our musical thoughts in an expressive and powerful way. We propose to set up a new laboratory, the YAMAHA MUSIC COMMUNICATIONS LABORATORY, to study these problems. We expect that the most important progress in the science and technology of new music in the next decade will come from the focus of this laboratory.

The work of the laboratory naturally divides into two parts; one concerned with control of music and musical instruments by musicians, the other concerned with the perception of music. However, the two areas fit together in that they both involve the same disciplines which include psychology and human performance in addition to music and engineering.

MUSICAL CONTROL

The least satisfactory part of most synthesizers is the control mechanism. Synthesizer keyboards, even those with touch sensitivity and carefully designed mechanical parts, don't "feel right" to the best keyboard performers. They are unable to express themselves subtly and powerfully no matter how they push the keys. Even more frustrating is the fact that although synthesizers can now make many excellent non-keyboard timbres, for example, string, woodwind, and brass timbres, no way has been found to perform on a keyboard with the articulation and phrasing of these other instruments. We cannot achieve the control of a violinist's bow with a keyboard. We believe that better understanding of the performance of music and of human control of musical devices may be the most important next line of progress.

Some of the initial problems we propose to investigate in the control area include:

1. Improvements of synthesizer keyboards and particularly the feel of these keyboards. We are particularly interested in active keys which have integrated circuit controlled forces fed back to the key to improve its feel and to allow radical changes in the feel of the key by changing the feedback algorithm.

2. Adding sensors to traditional musical instruments to produce synthesizer control signals. This problem is important both because traditional instruments have been highly developed over many centuries and because performers on these instruments are highly trained and have studied for many years. By capturing signals describing the movements and forces of the violinist's bow or the brass player's lips and using these signals to control synthesizers, we hope to take advantage of much important and hard won existing knowledge to achieve a whole new level of expressitivity in synthesizer control.

3. Control of intra- and inter- note variables. In the past, most of the control of both computer music and synthesizers has been at the note level. That is to say, the parameters for a given note are specified, the note is started by some trigger, and thereafter the sound is produced without further intervention on the part of the musician. At most, a note-off signal stops the sound, and a small family of continuous control signals slightly modify the sound during the course of the note. The phrase structure, which is well known to be important in all music, is not directly expressible by control information. Instead phrase effects must be translated into modifications of individual notes. At the intra-note level, we would seek a control mechanism as flexible as that of the violinist's bow in modifying the sound of the violin. At the phrase level, we would seek a mechanism for capturing sweeping gestures made by the musician in some appropriate modality--perhaps broad arm or body movements and translating this information into appropriate modifications of each note in the phrase.

4. Radical new sensors. Although sensors for traditional instruments are probably the most important in the near future, it would be a great mistake not to seek completely new ways of controlling music. Most of these ways center about new communication techniques between the human brain and machines. For fast control, we believe there is no alternative to sensing gestures of the fingers and articulators. These are by far the fastest and most precise coupling to the human brain that exists. For slower and more global control, movements of other parts of the body may be useful. The direct use of EEG and other electric signals from the human body does not seem promising to us as these signals are of very low bandwidth and not under direct conscious control.

Many of our plans for new sensors focus on general and uninhibiting ways of capturing gestures. An example is a new three-dimensional drum controller. This is a device that can continuously track the trajectories of drum sticks as they are moved in the vicinity of the surface of an electronic drum. Thus the drum sticks can either be used as a generalized percussive sensor which sends information about when and where they hit the surface of the drum or they can be used as continuous three dimensional "Theramin" type sensors for control of timbre and phrasing of other continuous aspects of music.

5. Developing appropriate control philosophies and programs. The advantages of most new sensors cannot be fully realized with existing instruments and synthesizers. In fact, a new sensor can only be truly evaluated when coupled to a complete music system that is designed for the sensor. So, concurrently with our experiments on new sensors, we plan to write new music control programs to couple the sensors to sound synthesizers. This domain is closely connected with human performance abilities and limitations. Musical performance is very demanding. The human ear can hear, differentiate and appreciate musical events and subtlety that are almost impossible to perform. The pianist, playing a tough piece, is subject to information overload. One attack on this problem is to try to separate music into the parts that are predetermined in advance of the performance by the composer and the parts that are to be interpreted by the performer. As much as possible, the predetermined parts are automatically provided by the control program. As much as possible, the sensors and control program allow the performer to focus his attention on the expressive aspects of the music and to control these aspects with strength and facility.

Perception of Music

1. Masking. One area that has been explored extensively in general but scarcely touched in music perception is masking. What, for example, are the signal-to-noise ratios set by good solo performers (or conductors)? One suspects that by physical standards they will be very poor, yet our impression is that the solo instrument is heard with nearly unmasked quality. How is this possible? And what does it tell us about the preferred level of a "voice" that should be dominant in electronic music? Recent work by Leek et al. indicates that identifiable vowel color can be created for the listener by beginning with a series of equal-level harmonic partials and emphasizing the 2 partials found at the center of the vowel 1st and 2nd formant by only one to two dB. This is astoundingly small! Has it a musical parallel? How far must a clarinet (say) be above the level of the accompanying orchestra to be heard with recognizable timbre? Such information would be helpful to computer-oriented composers and to the eventual standardization of mixing techniques. A large body of data exists on perception of spectral profiles, but virtually none of it has been related to musical implications. To what extent does constant spectral profile imply constant timbre? Do minimum recognizable profiles of familiar instruments stand out from the orchestra in solo passages or in analytical listening to the orchestral timbre? If so, how much do they stand out in dB? How much does this tell us about the secret of hearing individuals in ensembles?

2. Timbre. Can timbre sequences be successfully utilized as a major factor in composition? Are there desirable timbre patterns that function almost as melodic patterns do in most compositions? Can synthesized timbres be made to follow an identifiable auditory progression that is more than trivial? A beginning experimental attack on this problem has already been made at CCRMA, but further progress requires much more flexible psychoacoustic facilities.

3. Microtiming and musical preference. What auditory principles govern the addition of inter-period variation for natural sounding sustained electronic tones? Under what circumstances are different envelopes preferable on different partials or in different frequency regions? How do envelope rates and spectral shape interact for auditory synchrony? This would be an extension of the work of Gordon and Grey at CCRMA.

Related to this is the nature of those small frequency and timing departures from regularity that are employed by skillful performers for artistic enhancement. These have been known in general terms for years, but are now becoming comparatively easily measurable. Investigation might take the form of attempting to understand their auditory raison d'etre from the standpoint of music recognition or an analysis and evaluation of individual performance.

4. Musical exploration of auditory space.

New electronic instruments are dependent upon loudspeakers as transducers. Loudspeakers are point sources and even in very complicated applications loudspeakers do not produce the spatial richness that occurs in natural performance spaces where the sound sources are at a variety of angles and distances relative to the listeners. Surprising little research has been done in trying to uncover the correlation between the physical attributes of sounds and the spaces in which they occur and the perceptual/cognitive attributes. While work is already being done in this area the proposed communications laboratory would greatly accelerate the research.