This is an abbreviated version of the presentation I made at the University of Hamburg at the opening of the Ligeti Center, director Georg Hadju, May 5, 2023, celebrating György Ligeti's centennial birth year. It also includes a newly found 1985 letter to me from Ligeti.

Ligeti Center
Hamburg Conservatory for Music and Theater

MAY 5, 2023
HAMBURG, GERMANY

John Chowning *jc@ccrma.stanford.edu*

György Ligeti: his visionary abstraction becomes concrete

Invited by Stanford University's Department of Music, Gyørgy Ligeti arrived in the winter of 1972 with Vera and Lukas, their young son, accepting the invitation to find a calm atmosphere to "catch up on his commissions," far away from the pressures of Europe. He was unaware of the system colleagues and I had built at the Stanford Artificial Intelligence Laboratory beginning in 1964. But Ligeti's very nature was engagement, and he asked to visit the A.I. Lab for a demonstration of our work.

Over the next five months, he made several visits to our lab, always probing us for knowledge about our work and how computers work, and he learned of the allure of their intrinsic abstraction. He also visited the University of California in San Diego and the California Institute of the Arts in Los Angeles. But he was most impressed with what was happening at Stanford's A.I. Lab,
"I am very much interested in coming back after one or two years to learn more about this." And he did!

But how did this advanced computer music system come to be? It was unknown in the analog studios of Europe that Ligeti knew very well.

Paris, 1959 -1962

My First Experience Hearing Music Composed For Loudspeakers

While studying music in Paris from 1959-1962, I heard for the first time, music composed for loudspeakers. I was naïve. Studying with Nadia Boulanger, a famous teacher at the time, I had no background in technology.

I attended many concerts while in Paris, the Domaine Musical series by Pierre Boulez and concerts by Pierre Schaeffer's Groupe de Recherches Musicales.

LE GROUPE DE RECHERCHES MUSICALE (GRM), 1959.

LE GROUPE DE RECHERCHES MUSICALES
de la Radiodiffusion-Télévision Française
présente
CINQ MANIFESTATIONS
de
MUSIQUE EXPÉRIMENTALE

★

1er et 30 Juin - *Concerts* - Salle Gaveau, 45, Rue La Boétie, à 21 heures
MUSIQUE CONCRÈTE - ELECTRONIQUE - EXOTIQUE
Berio, Boucourechliev, Ferrari, Ligeti, Mâche, Maderna, Mayuzumi, Philippot, Pousseur, Sauguet
Schaeffer, Varèse, Xenakis

16 et 26 Juin - *Expériences Musicales* - Salle Guimet, Place d'Iéna, à 21 heures
"LES IDÉES ET L'OBJET"
"L'IMAGINATION ET L'INSTRUMENT"
projections sonores commentées par Pierre Schaeffer

23 Juin - *Image et Mouvement* - Salle Guimet, Place d'Iéna, à 21 heures
Films de : Alexeieff, Bourguignon, Brisset, Fulchignoni, Grémillon, Hirsch, Lalou, Le Corbusier
Max de Haas, Patris, Sarrut, Schwab et Gout, etc...
avec les musiques de : Ferrari, Henry, Mâche, Philippot, Schaeffer, Varèse, Xenakis
et la compagnie de Mime Jacques Lecoq
avec la participation des studios :
Fonologia di Milano - Apelac de Bruxelles - Westdeutscher Rundfunk de Cologne

★

LOCATION : R.T.F. 18, rue François-1er, - ELY. 57-50
SALLE GAVEAU, 45, rue de la Boétie - BAL. 29-14
Chez DURAND, 4, place de la Madeleine, dans les Agences et par téléphone à S.V.P.
Prix des places : 400 - 500 - 600 - 800 - 1.000 - *Tarifs réduits : J.M.F. - A.M.J. - Etudiants*
organisation de concert : M. DANDELOT

The composers at GRM were *dedicated* to creating music for loudspeakers. It was there that I heard a performance of *Kontakte**. I was struck by the motion of sounds moving in the space. I had a desire to create more complicated motion as a bird flies in curvilinear paths.

* November 27th, 1961, at Salle Gaveau

In 1962, I entered the graduate program in music composition at Stanford University. I was disappointed to find no interest in creating music where loudspeakers are the intended source.

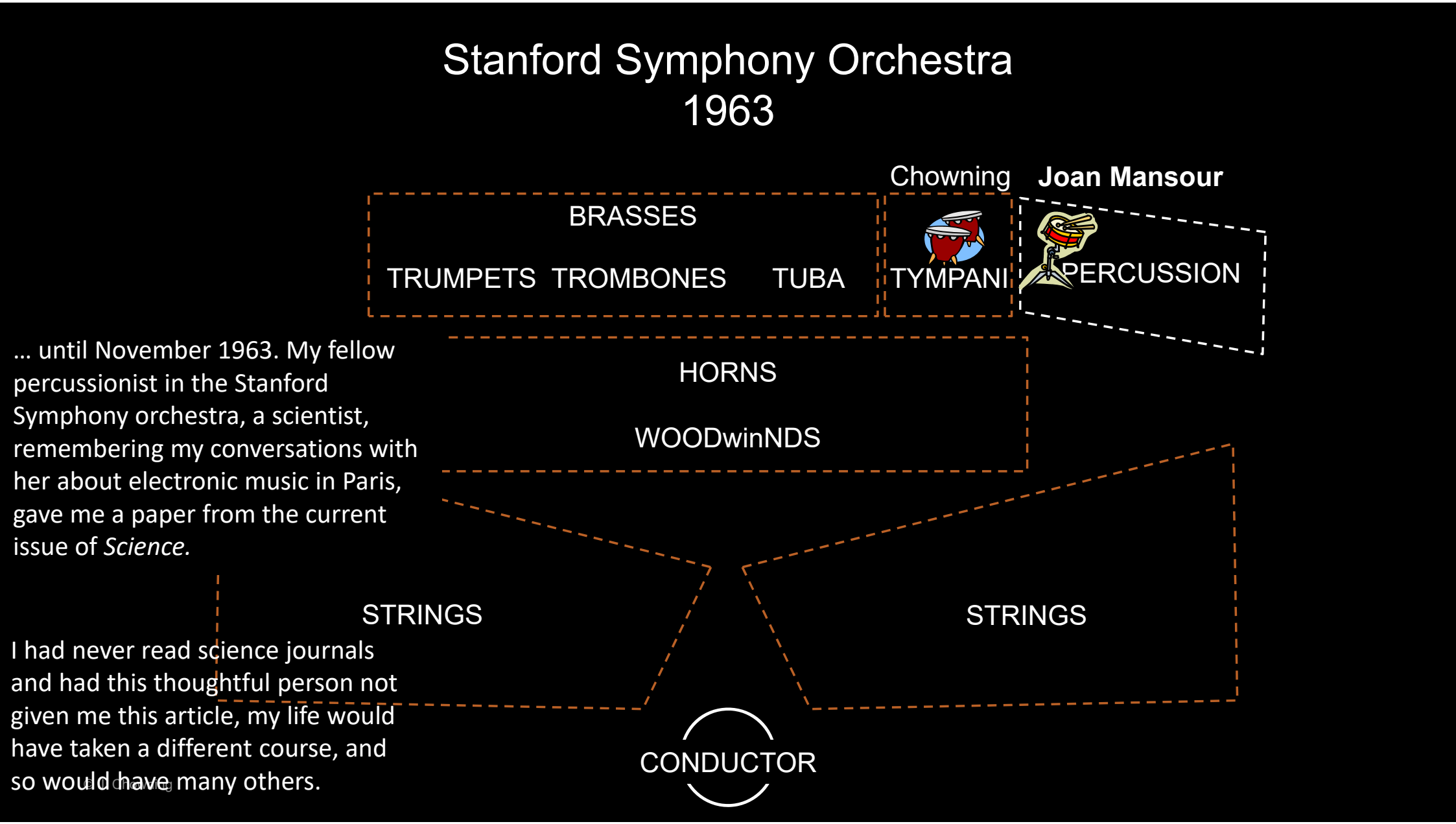
I listened to Stockhausen's *Gesang der Jünglinge* (1955/1956). I was struck by the sensation of being in a large space, while sitting in a small room. I imagined composing sounds that could move freely in large spaces as I had heard in *Kontakte*.

Karlheinz Stockhausen
Electronic Music Studio
West German Radio, Cologne, Germany

I discovered how he had created the rotational movement of sounds by fixing 4 mics at the corner of a square table and rotating a loudspeaker as he played a tape of a synthesized sound source

- Composing sounds that could move in more complicated paths remained a dream…

Stanford Symphony Orchestra
1963



… until November 1963. My fellow percussionist in the Stanford Symphony orchestra, a scientist, remembering my conversations with her about electronic music in Paris, gave me a paper from the current issue of *Science.*

I had never read science journals and had this thoughtful person not given me this article, my life would have taken a different course, and so would have many others.

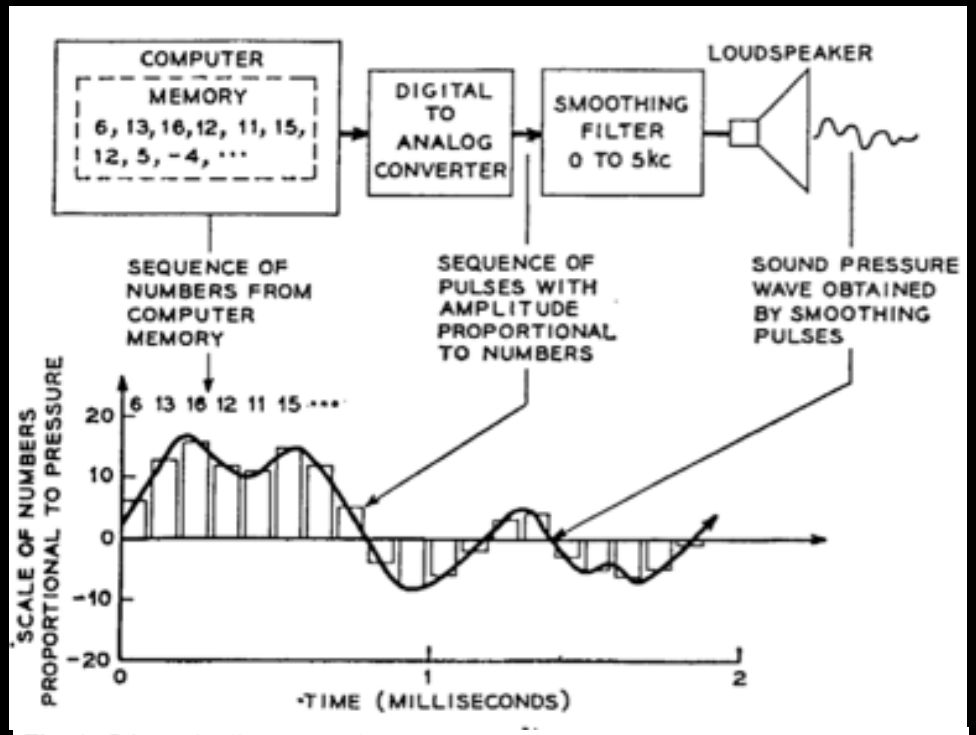


Fig. 1. Schematic diagram depicting the conversion of a sequence of numbers stored in a computer memory to a sound pressure wave form. The sampling rate is 10,000 numbers per second to yield a bandwidth of 5000 cycles per second for the sound wave.

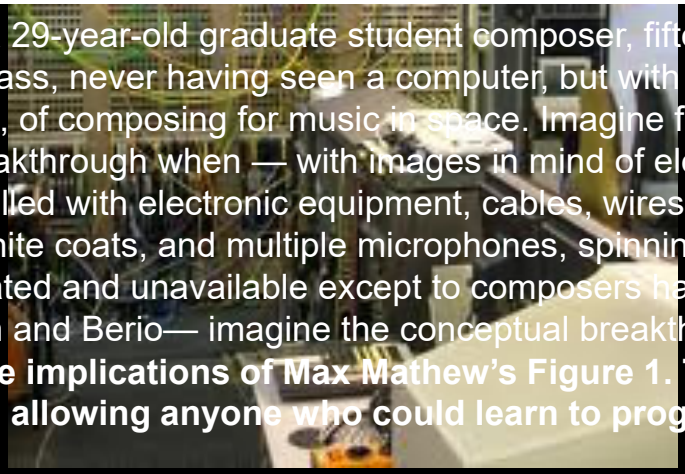
M.V. Mathews, "The Digital Computer as a Musical Instrument," Science, Vol. 142, No. 3592, pp. 553-557, 1963

example, by running our computer at a rate of 30,000 numbers per second, we can generate sound waves with frequencies from 0 to 15,000 cycles per

Sound from Numbers

How can the numbers with which a computer deals be converted into sounds the ear can hear? The most general conversion is based upon the use of the numbers as samples of the sound pressure wave. A schematic diagram of this process is shown in Fig. 1. Here a sequence of numbers from the computer is put into an analog-to-digital converter, which generates a sequence of electric pulses whose amplitudes are proportional to the numbers. These pulses are smoothed with a filter and then converted to a sound wave by means of an ordinary loudspeaker. Intuitively, we feel that if a high enough pulse rate is used and the amplitudes of the pulses are generated with sufficient precision, then any sound wave can be closely approximated by this process. Mathematically, it has been established (*1*) that this conclusion is correct. A sound wave with fre-

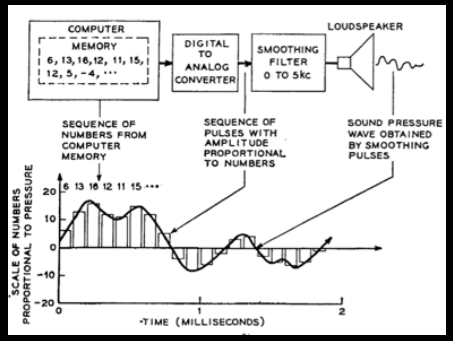
Electronic Music Studio
West German Radio, Cologne, Germany



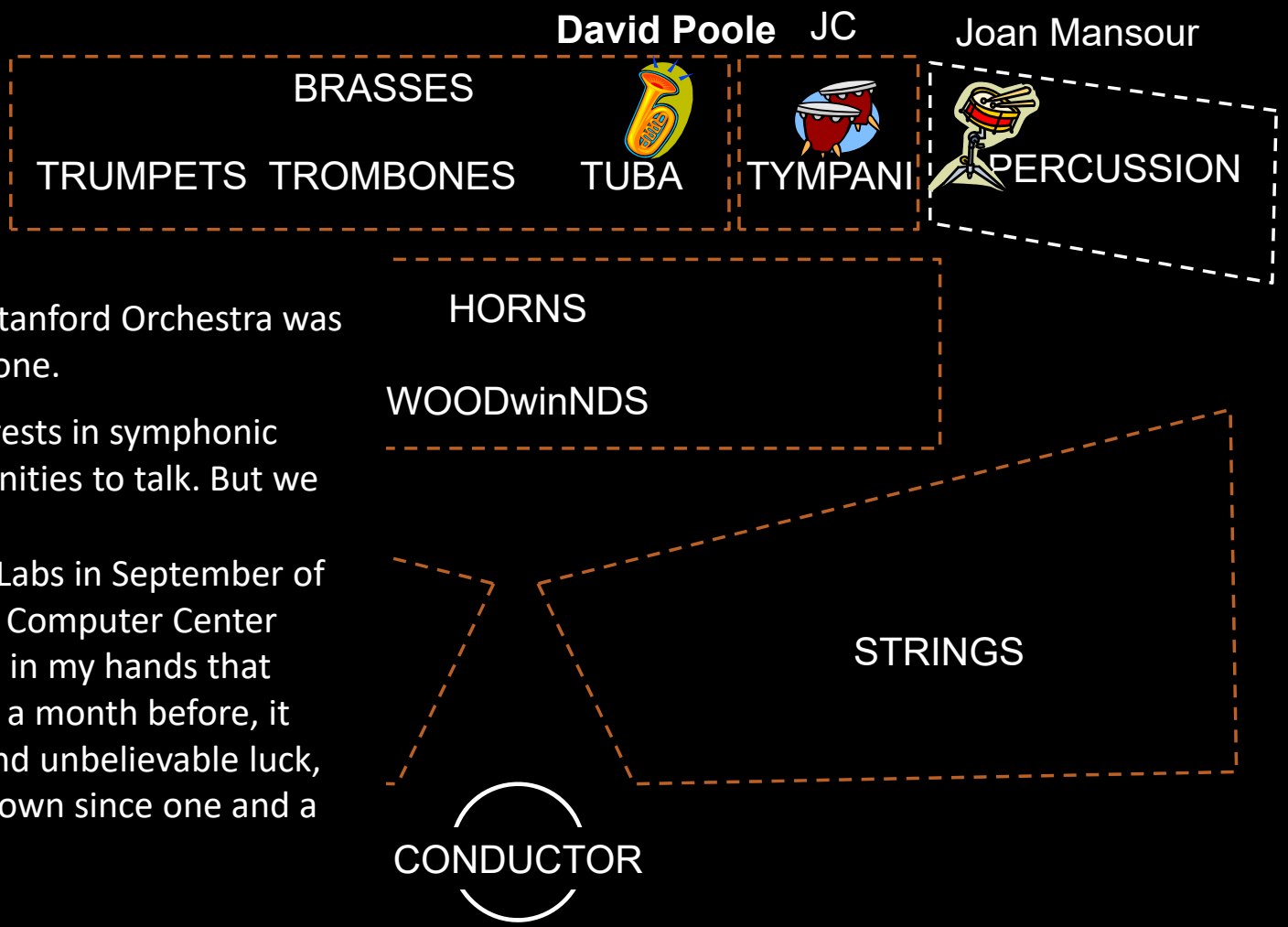
Now, imagine a 29-year-old graduate student composer, fifteen years from my last math class, never having seen a computer, but with vivid imaginings, however vague, of composing for music in space. Imagine further, the conceptual breakthrough when — with images in mind of electroacoustic music studios filled with electronic equipment, cables, wires, stern-looking engineers in white coats, and multiple microphones, spinning loudspeakers, all too complicated and unavailable except to composers having the stature of Stockhausen and Berio— imagine the conceptual breakthrough when **I understood the implications of Max Mathew's Figure 1. The beauty of its abstraction allowing anyone who could learn to program to engage**

Karlheinz Stockhausen
4 ch sound rotation for *Kontakte* 1958
West German Radio, Cologne

Electronic Music Studio
RAI, Milan, Italy



Stanford Symphony Orchestra
1964



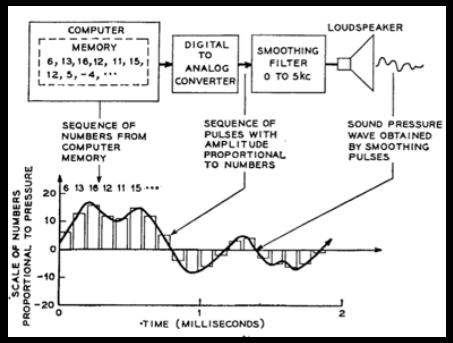
Now, to my other side in the Stanford Orchestra was the tuba player—a very good one.

Tuba players also have lots of rests in symphonic music so we, too, had opportunities to talk. But we did not talk about computers.

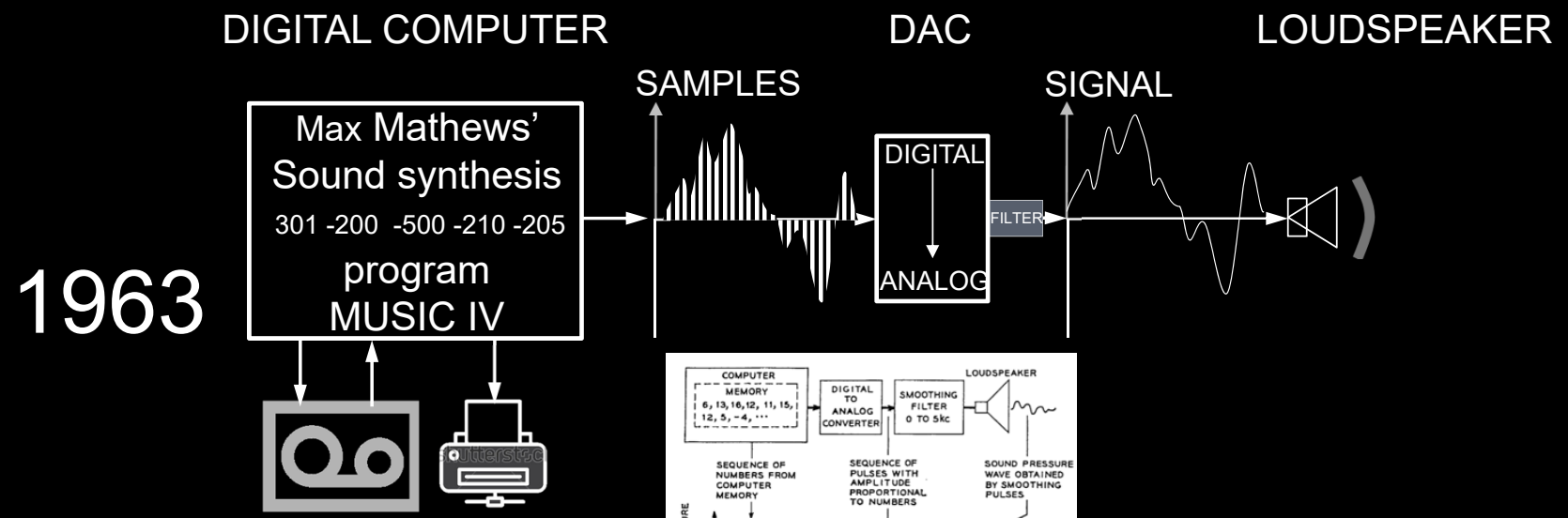
So, when I returned from Bell Labs in September of 1964, standing in the Stanford Computer Center with the box of punched cards in my hands that Max had given me at Bell Labs a month before, it was a great surprise and my and unbelievable luck, to meet David, whom I had known since one and a half years as a tuba player.

Dave Poole was my angel!

David knew a lot about computers. He thought for a day or so about Max's article and figured out that it was possible to implement Max's music synthesis system. And he did it.



This is the online system, implemented by David Poole, that Ligeti saw in 1972 on a DEC PDP-10

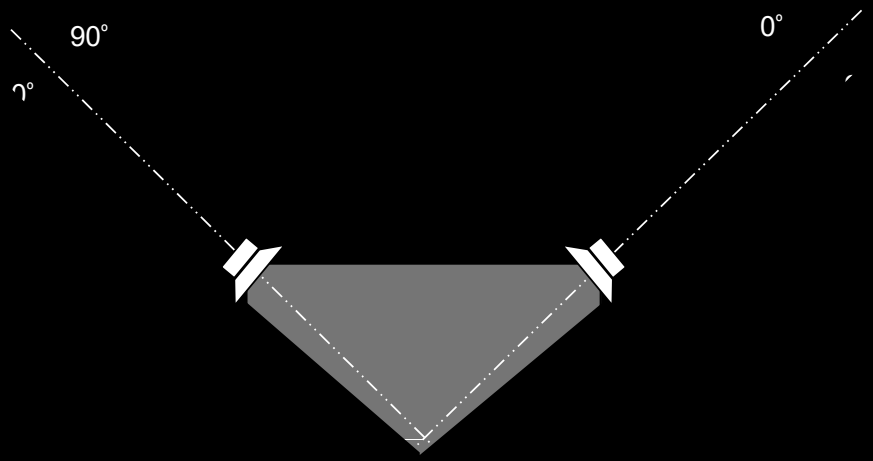


This diagram presented a face of Claude Shannon's sampling theorem, which was inspiring—even poetic in that it showed a path to musical expression that was direct, an abstraction that would allow the composition of any perceivable sound.

Music IV was a program to create the samples that would drive loudspeakers bringing musical creation directly to our perception.

From the very beginning of my work in 1964 at the AI Lab, I worked on the simulation of moving sound sources as auditory illusions, realizing my dream.

In the next slide I will describe the graphic spatialization program that was fully implemented when Ligeti arrived at Stanford.

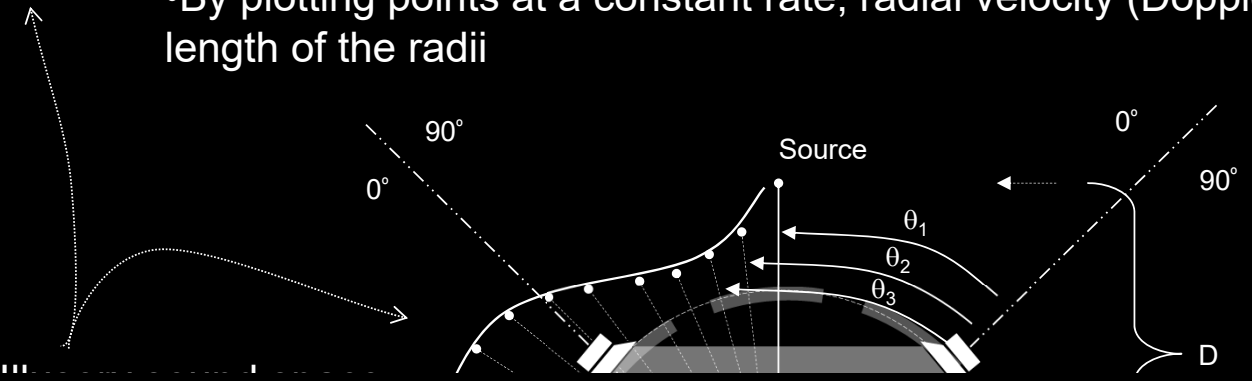


By 1969, with a 4-ch DAC, and my experiments were extended from stereo *to* quadraphonic.

•programming made it possible for me to find by graphic means, the trajectory and velocity for a moving sound source

At this time, I did not understand the equation for Doppler shift.

•By plotting points at a constant rate, radial velocity (Doppler) is captured in the changing length of the radii

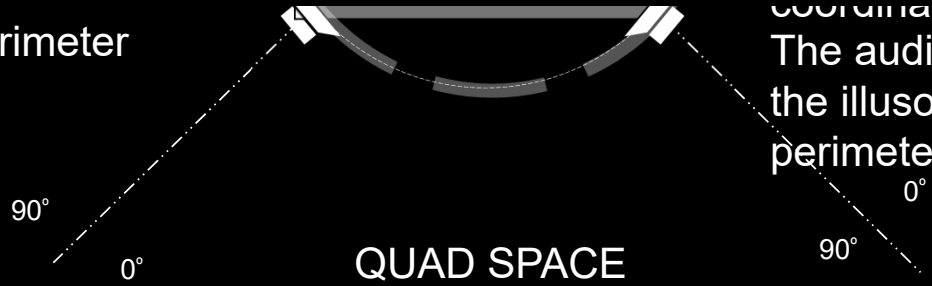


distance

The intensity of the direct signal decreases with increase in distance, but the intensity of the reverberation remains constant

This is the spatialization program that I had vaguely imagined from the very beginning. And in searching for the distance cue, I discovered FM Synthesis in 1967.

the speaker perimeter



The audience is within the listener space and the illusory sound space is beyond its perimeter.

j. chowning

This is the spatialization program that I had vaguely imagined from the very beginning. And in searcing for the distance cue, I discovered FM Synthesis in 1967.

But, beyond the AI Lab and Max Mathews and Jean-Claude Risset and colleagues at Bell Labs, no one knew of the work that we had accomplished at Stanford.

That was about to change following Ligeti's presence at Stanford.

The full text is available at https://ccrma.stanford.edu/people/john-chowning

The first page of a ten-page contemporaneous conversation between Ligeti and Louis Christensen in 1972 at Stanford. The entire document is available on my website

Conversation with Ligeti at Stanford

presented in Monk Mink Pink Punk #9

contents next page

Interview by Louis Christensen, California, 1972
first published in Numus-West, No.2, 1972
prepared for the web by Josh Ronsen, February 2003

LOUIS CHRISTENSEN: Now that you have been here for a quarter at Stanford, how would you assess the differences between the new music atmosphere here on the West Coast compared to Central Europe?

GYORGY LIGETI: I think it's not a musical question; it's a general culture question. I don't know the East Coast. This the first time I have been to America, and I have come directly to the West Coast. If instead of San Francisco I had come to the East Coast, perhaps it would not be so different from Europe; but here the situation is very different.

The full text is available at https://ccrma.stanford.edu/people/john-chowning

Before, I present in detail Ligeti and Christensen's thoughts about the work they observed at Stanford, I want to be very clear about their reference to "John Chowning."

I was the "face" of the work at Stanford, but without the support of an intellectually rich and generous environment at the AI Lab, I would not have succeeded in pursuing my dream.

By 1972, I was joined by colleagues (James A. Moorer, John Grey, Loren Rush, and Leland Smith) in the Computer Music Project. We were, in a sense, students, who found in these AI Lab colleagues, patient teachers who willingly answered our questions as they watched us build a new means for making and representing music.

With that context in mind, please understand Christianson and Ligeti's reference to "John Chowning."

The full text is available at https://ccrma.stanford.edu/people/john-chowning

Ligeti's 1972 conversation with Louis Christensen (LC)

My comments are in yellow

LIGETI: I think coming to America has given me very interesting experiences. The most interesting thing for me was the work of John Chowning with the computers right here at Stanford because I think the real computer music begins with this…
I think Chowning is the first who puts the two things together and composes directly with the computer and composes music which is entirely based on the thinking possibilities... (not of the computer; the computer is doing what you want it to)... but on this feedback effect that the use of computers has on the thinking of the composers.
So, I think this is so important that you can compare it with the situation at the Cologne electronic studio in 1952-53, the beginning of a new thing. I had no information of it in Europe. Nobody in Europe, I think, has information of just what is going on here at Stanford.

The full text is available at https://ccrma.stanford.edu/people/john-chowning

Ligeti's 1972 conversation with Louis Christensen (cont.)

LC: But they'll have it now, through NUMUS-WEST

LIGETI: Yes, now, it begins...

LC: Well, then, if we may turn to Ligeti the composer. Have you had a chance to get acquainted with synthesizers?

LIGETI: Yes, but I personally am more interested in the possibilities of doing work with computers. Have you heard John Chowning's pieces?

LC: Yes, and I think it was one of the most "mind-expanding" experiences I've had, because the illusion of the motion in space is more real than one that's real, through this perfect calculation of what becomes strong Doppler effect The one drawback, of course, that every time you use electronic sound you are losing something that nature has...

The full text is available at https://ccrma.stanford.edu/people/john-chowning

Ligeti's 1972 conversation with Louis Christensen (cont.)

LIGETI: Yes, exactly. You can produce reverberance electronically, but not the same. It's not the same…

LC: They may get there.

LIGETI: Yes. Everything...

LC: They're just not perfected enough.

LIGETI: Yes, but it will be. And then, something which is fantastically new... *not to buy instruments but to build programs*. [My emphasis]

LC: Of the mind.

LIGETI: Yes, the abstract instruments. [Ligeti understood, absolutely]

The full text is available at https://ccrma.stanford.edu/people/john-chowning

Ligeti's 1972 conversation with Louis Christensen (cont.)

"Yes, the abstract instruments."

Which began with Max Mathews in 1957

The full text is available at https://ccrma.stanford.edu/people/john-chowning

Ligeti's 1972 conversation with Louis Christensen (cont.)

Referring to his commission for an orchestral piece from the San Francisco Symphony, the conversation ends with this exchange:

LC: So, given this, that makes so much stronger the possibility that you will be back here on the West Coast...

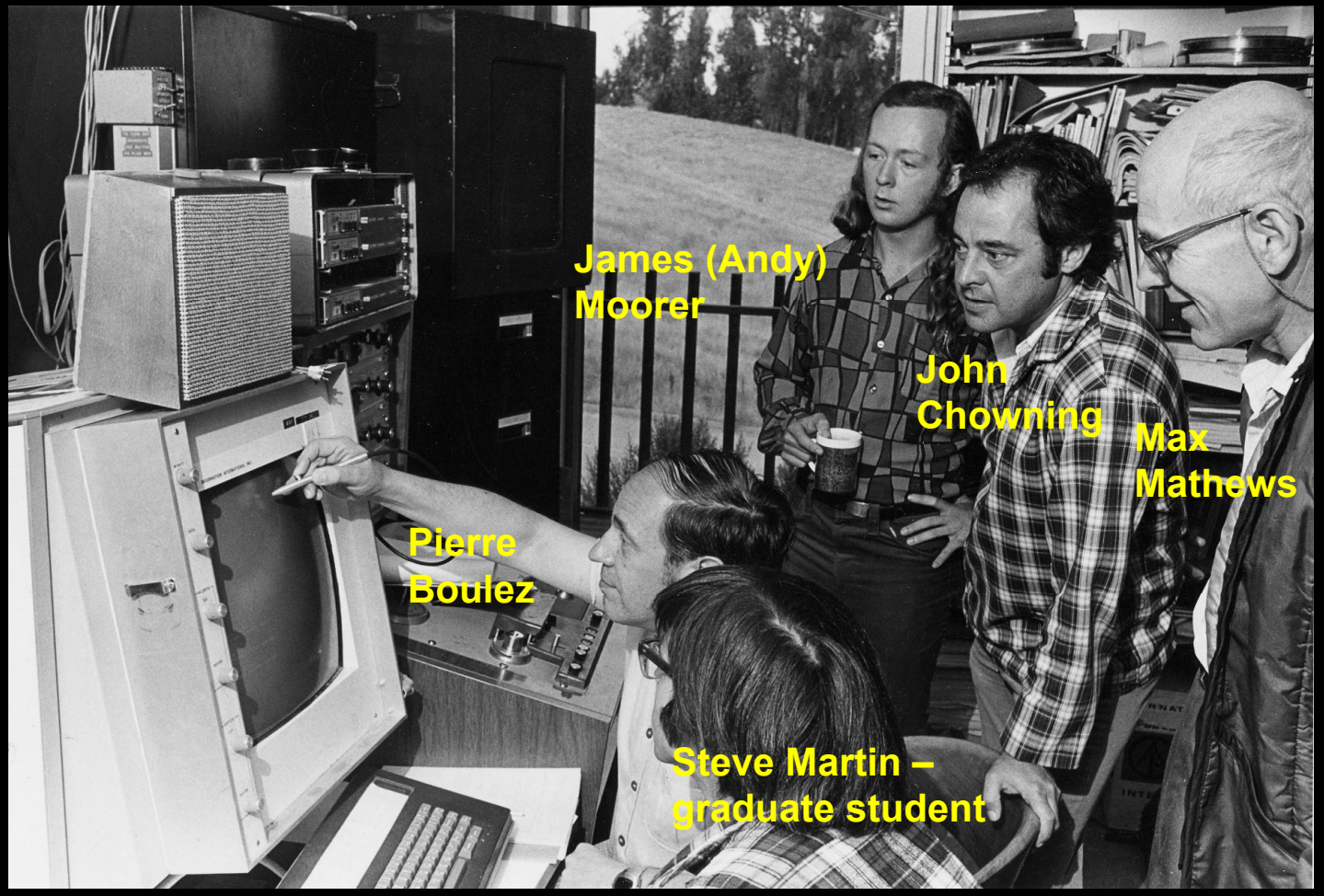
LIGETI: Oh, yes, I will surely come… I'm not sure of the exact date. And independently, I hope to come back here [Stanford] for six months or so in order to compose pieces with computers.

Returning to Austria with Vera and Lukas, then to Germany, he was caught-up in performances and commissions, it never happened. But he did not hesitate in pursuing his vision of a Stanford/Hamburg mirrored system, where advances at each would be shared immediately with the other as a unique network.

On returning to Germany after his five months at Stanford, he told Boulez to “pay attention to what is going on at Stanford.” Boulez did, advice having great consequence for the future of IRCAM, which opened in 1977 with a PDP-10 computer running the CCRMA/AI Lab software/operating system. One of the Paris newspapers headlined

“Stanford sur Seine!”

1975- Pierre Boulez brings IRCAM team to CCRMA at the AI Lab for two-week course in computer music



Forming and advancing his vision

Ligeti not only informed Boulez of our work at Stanford, but he also invited me to join him to give a presentation on the first day of his Darmstadt lectures.

I explained in full detail my spatialization program, my discovery of FM Synthesis, its theory based in the frequency domain. Ligeti then presented *Turenas* in 4-channel surround, which he had heard in April, four months before, at its first performance at Stanford. Completely unaware of computer music, the frequency domain and time-varying spectra, the students were stunned by what they had learned, some of whom came to study at Stanford — Johannes Goebel, for example.

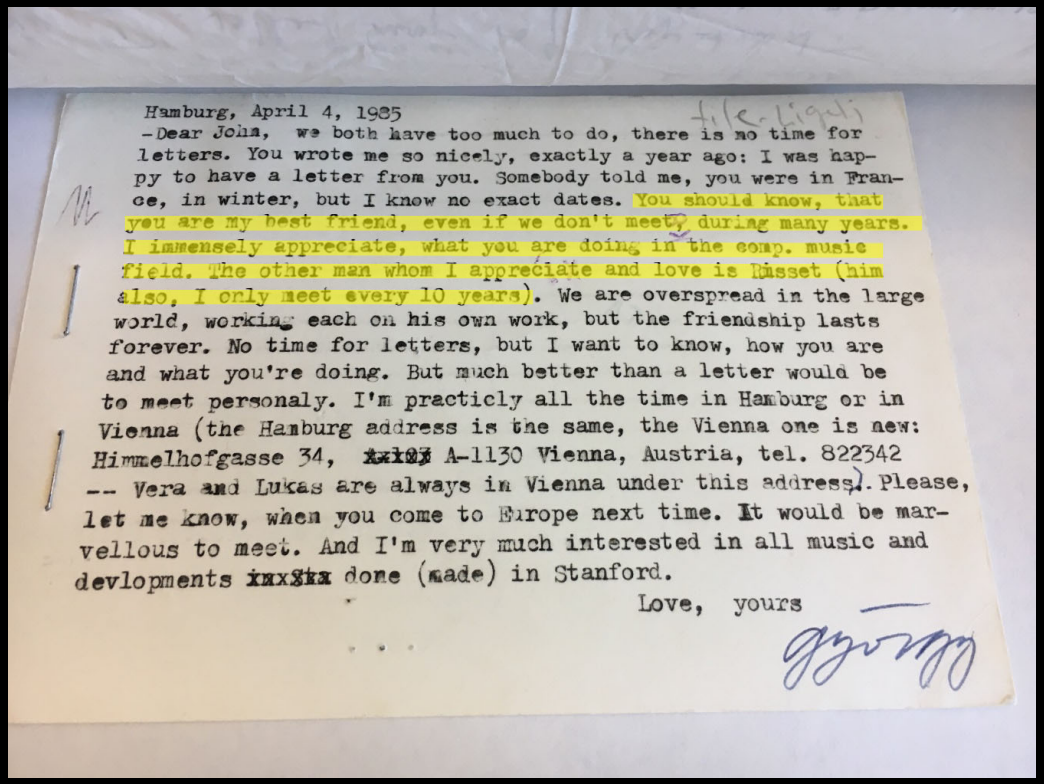
Forming and advancing his vision

Ligeti invited James A. Moorer and me to Hamburg only two or three years later to help him set up a mirror system between Computer Science at the University of Hamburg and the Hochschule für Musik, where he had just accepted the Professorship of Composition.

Then in 1980, he arranged for a grant to permit his brilliant student, Manfred Stahnke, to come to Stanford as a visiting scholar.

Ligeti vigorously pursued his vision until, for some reason, the entire project was blocked because of the withdrawal of support from the City of Hamburg. He was greatly disappointed, of course, forced to give up *his* dream. But we remained in close contact in the years following.

Following, is a letter he wrote to me in 1985, affirming his continued interest in computer music and friendship with Jean-Claude Risset and me.



Hamburg, April 4, 1985
-Dear John, we both have too much to do, there is no time for letters. You wrote me so nicely, exactly a year ago: I was happy to have a letter from you. Somebody told me, you were in France, in winter, but I know no exact dates. You should know, that you are my best friend, even if we don't meet during many years. I immensely appreciate, what you are doing in the comp. music field. The other man whom I appreciate and love is Risset (him also, I only meet every 10 years). We are overspread in the large world, working each on his own work, but the friendship lasts forever. No time for letters, but I want to know, how you are and what you're doing. But much better than a letter would be to meet personaly. I'm practicly all the time in Hamburg or in Vienna (the Hamburg address is the same, the Vienna one is new: Himmelhofgasse 34, A-1130 Vienna, Austria, tel. 822342 -- Vera and Lukas are always in Vienna under this address). Please, let me know, when you come to Europe next time. It would be marvellous to meet. And I'm very much interested in all music and devlopments done (made) in Stanford.

Love, yours

He continued to learn, reading about scientific subjects, especially about computers. On a visit to Stanford in the early 1990s, he said to Jean-Claude Risset and me,

Hamburg, April 4, 1985

— Dear John, we both have too much to do, there is no time for letters. You wrote me so nicely, exactly a year ago: I was happy to have a letter from you. Somebody told me you were in France, in winter, but I have no exact dates. You should know, that you are my best friend, even if we don't meet during many years. I immensely appreciate, what you are doing in the comp. music field. The other man whom I appreciate and love, is Risset (him also, I only see meet every 10 years). We are overspread in the large world, working each on his own work, but the friendship lasts forever. No time for letters, but I want to know, how you are and what you are doing. But much better than a letter would be to meet personaly. I'm practically all the time in Hamburg or in Vienna (the Hamburg address is the same, the Vienna one is new: Himelhofegasse 34, Ax1o3 A-1130 Vienna, Austria, tel. 822342 – – Vera and Lukas are always in Vienna under this address). Please, let me know, when you come to Europe next time. It would be marvelous to meet. And I'm very much interested in all music and developments ixxSxx done (made) in Stanford.

Love, yours

(signature)

“I compose computer music, but I don’t use computers.”

Ligeti, Chowning, Sylvia Fomina and Risset at Stanford's CCRMA.

Realizing his vision

In addition to his music, Ligeti's legacy was his vision of a prominent computer music center in Hamburg, a noble imperative.

Professor Georg Hajdu, whom I have known since he was a graduate student at U.C. Berkeley, having a broad background in so many aspects of computers and music — and open and transparent by nature— directs the center.

In fulfilling Ligeti's vision, he will lead and guide his colleagues in the years ahead in their commitment to educate, to teach, communicate, and create music and direct research. And we must not forget, with an infrastructure of dynamic, supportive people.

Hajdu will often reset this complicated clock-like system of institutions with so many interacting parts, for it must be, because the parts will connect in new ways with new ideas.

He will refine and teach the use of highly sophisticated code, equipment, and concepts, to the men and women agents, and then they, from their thoughts in the silence of abstraction, will reach to the very edge of their imaginations.

Ligeti's vision and energy did not disappear with his death— for now, fifty years later,

he succeeds!

Thank you