

61

Transcriber's Notes: Interview begins at 68. Words that I couldn't understand are marked with a question mark and followed by their numerical place on the tape.

I would like to know when you were in that situation with KQED or associated with people around KQED. Could you describe that kind of interaction with your musical instruments. They had Jung's(? 73) instrument but you also knew tempertone (? 73) and that group of people there. Probably Roherty and Phyllis Llano (Yano?) and Warner Jepsen. Could you connect some of that scene? Because I know you ended with some equipment in your possession that you originally developed there. Steina brought some of the boxes from you.

There was a lot equipment at one time abandoned by KQED and the people who were working with it because it was incredibly obsolete and in fact they gave me the original console for safekeeping that, well, you know the people who developed that better than I do.

So you ended with it by default.

Yes, I had enough space to stash it and I said, "Okay, you can store it with me."

So let's go with a basic chronology. We are interested in this article about the systems, how people think about the system rather than about need of music. According to Subotnick, he commissioned you to develop the instrument. Is this true?

Yes, I think that's one way of looking at it.

Did he put an ad in the newspaper?

No, my original contact with Mort was timidly requesting that I be allowed to use his tape recorders because I had only one tape recorder, a single channel Wollensack and I wanted to do some dubbing. My music at that time was collage and I needed more than one tape recorder to do effective tape collage. I was very impressed by the fact that Mort had access to a three-track recorder. It was an Ampex three-track recorder.

How did it come about that you actually developed the instrument?

Well, Mort allowed me use the studio and I just looked around the studio and was amazed to find that people were using war surplus equipment to make electronic music, test equipment, oscillators developed for the physics lab and things like that. So I suggested that we design an intentional instrument for electronic music rather than borrowing from instruments intended for other purposes. Mort agreed and suggested that that was a fine idea. I was unaware of the work going on east coast at RCA or Robert

Moog's work and Max Matthews at Bell Telephone.

Who was using the war surplus equipment?

The San Francisco Tape Music Center.

Which composers?

Pauline Oliveros, Ramon Sender and Morton Subotnick were the key people there. Others came in here and there.

What year was that?

Around '63-'64.

What was the Subotnick commission about? Did he know what he wanted?

We talked a lot about the design and I suggested a modular system so that we could start with singular modules and Mort came up with a budget of \$500 and I went and built the first synthesizer on a budget of \$500.

What did it look like? What did it do?

It's about two three by three boxes and they did many of the things that we do now in synthesizers. We had voltage controlled amplitude devices, voltage controlled oscillators, voltage controlled filters, sequencers, resistance operated touch plates for keyboards and gradually added more modules dealing a lot with uncertainty and randomness and noise.

What was your concept of voltage control? Was it inherited from the industrial domain? Since it was so skillfully used for composing I would guess it would not be. How did that develop? Was it your idea or was it the only idea of doing it?

It was my idea for establishing a way of controlling parameters of sound and conveying information at the structural level. It wasn't uniquely my idea. It's surprising that Moog was working on voltage controlled equipment at the same time I was with a much different approach but nevertheless voltage control.

What was the difference?

I would say that philosophically the prime difference in our approaches was that I separated sound and structure and he didn't. An example would be the application of the voltage controlled amplifier in the Moog system would also be the remodulator. Control voltages were interchangeable with audio. The advantage of that is he required only one kind of connector and that modules could serve more than one purpose. There were several drawbacks to that kind of general approach and one of them would be that a module designed to work in the structural

domain at the same time as the audio domain made compromises. DC offset doesn't make any difference in the sound domain but it makes a big difference in the structural domain whereas harmonic distortion makes very little difference in the control areas but it can be very significant in the audio areas. You also have a matter of just being able to discern what's happening in a system by looking at it, by observation. If you have a very complex patch it's nice to be able to tell what aspect of the patch is the structural part of the music versus what is the signal path and so on. Another factor is that perceptually we hear quite differently than we assess things. An example would be if you have an input device on a control device you want to deal with attenuation in a linear fashion and you might even want to turn it upside down because phase is an important difference in terms of how something is controlled. Whether the pitch is going up or down is important to us but in an audio device we hear things exponentially. So if you're dealing with pitch and volume, you want to deal with exponential functions. So there's a big difference in whether you deal with linear versus exponential functions at the control sound level and that was a very inhibiting factor in Moog's more general approach.

Could you talk a little about your interest in randomness because to me that was one of the big advantages of your system? Compositionally, that capability is what interested me. It informed a lot of the structural basis of Mort's work as in "Silver Apples" and a lot of these pieces. What was your rationale behind that?

Uncertainty is the basis for a lot of my work. One of the important dichotomies of music to me is predictability versus uncertainty. One always operates somewhere between the totally predictable and the totally unpredictable and to me the source of uncertainty, as we called it, was a way of aiding the composer. It's not fair to say that it's totally random because we allowed constraints. We could say the deviations from one event to another in terms of the parameters we were dealing with would be constrained to a small number or the choices from a, say a group of pitches would be restrained to these pitches rather than just a random walk. The predictabilities could be highly defined. You could have a sequence of totally random numbers but you could have a sequence in which the numbers were only allowed to change by a certain range or interval. We had voltage control of the randomness and voltage control of the rate of change so one could randomize the rate of change. In this way you could make patterns that were of more interest than patterns that are totally random. So we got quite involved in randomness. An interesting story I could tell now is that Yusochevsky bought three identical systems from us very early in the game, in '65 or so, to outfit the Columbia/Princeton electronic music studios. He was very disturbed by the random module and taped them over. He didn't actually disassemble them but in the two graduate studios he taped them over. In his own studio he allowed the randomness to be used but he did not want to assess compositions made with the

random voltage generator.

Did you have something against the keyboard in the early days?

No, that's a myth. In the late 60s Rolling Stone published something that said I hate keyboards and hate keyboard players. I countered by pointing out that some of my best friends were keyboard players. It's often concluded that because I don't happen to choose to build keyboards into my instruments that I'm somehow against them and that's not true. I even studied keyboard myself but I don't choose to adapt the organ keyboard to a means of control of electronic vocabularies. I'm not saying there's anything wrong with that at all. It's simply that others are doing it and I'm not here to duplicate other people's work. To me the alternatives are much more interesting.

In the beginning you didn't know there were others. There weren't others.

No, but that's a funny one. In the beginning we were all dealing with monophonic structures. I did actually build a very early keyboard and decided this is not very interesting. To me, as a keyboard player, the concept of a monophonic keyboard was very strange. I never even thought of it. When I built my first keyboard it was polyphonic. It four-voiced polyphonic and then later on Arp came into the game much, much later and said, "We have the first polyphonic keyboard." Then I said, "I never thought of a monophonic keyboard." Then I got acquainted with Moog's equipment and realized that people were building keyboards with which you could only play one note at a time. To me that was absolutely preposterous. The only virtue of a keyboard is that you can simultaneously access a number of notes. I used a keyboard in some of my larger systems. In fact, very expensive hybrid systems that came out about '70-71 and found in my own work that the keyboard just was too dictating. I'd look at it and it shouted "twelve tone" back at me. I couldn't deal with it in an abstract way. I actually wrote pieces and more often adapted others. I remember a Daniel Lenz piece that was thought to be impossible to play, because it involved modifications to four strings and a voice. It might have been called "Sermon." It had a beautiful graphic score which I photographed and projected and put the entire score on the keyboard and then called a pianist and said, "Here, play this." Well, we wound up with five people having to simultaneously play the keyboard because it was impossible to do otherwise. I used the natural groupings of the keyboard. I would use the three black keys for different ring modulations and four of this for reverberation and two of this for switching on and off some other function. It was a five octave keyboard with one octave devoted to the control of each instrument. So there's my experience with keyboards. It's a one dimensional system for throwing hammers at strings and getting things into vibration and it's very good for that and very good for a particular kind of music but not so much for the aesthetic that Mort was into and numerous other composers on the west coast

were into.

Did you know Bill Hearn or Steve Reich?

Yes, I knew both of them.

Did you see Bill's early work on video? Did you follow that?

Yes, a little bit.

Were you in any communication?

Not very much. I experimented with the idea of getting into video myself, video synthesis and in fact Bill built me a monitor, a modified voltage controlled monitor which I used for years.

What do you mean voltage controlled monitor?

It was a x/y three color monitor. I shouldn't say voltage controlled but it displayed control voltages. In other words, it had random access. It was like an oscilloscope only it was color.

That's basically your medium isn't it? (not sure if this is correct 282) Do you still have it?

I think I do.

Do you have any other devices from that period? Did you actually develop some sort of a visual device?

I developed a very extensive video synthesizer that nobody knows about. I was very aware that Etra (? 286) was doing at the time and Hearn and so on.

Does that exist?

No. I think it's all disappeared.

What did you have in mind for a video synthesizer? What was it like?

It's been a long time but I recall an oscillator that I could switch between multiples of the horizontal versus the vertical frequencies. It was a two-range oscillator and it kind of depended on which way you were working, with a number of wave shapes and the possibility of phasing or not phasing. In other words, you could phase lock it to generate patterns. I may still have the final colorizer which was a voltage controlled device that restored the color to the whole scene at the end of it all. That was quite exotic. It was an interesting approach to it.

Did you use a commercial processor or did you build one?

At that time there were some interesting Fairchild and National

chips coming out and I knew a lot about that sort of thing because I was abreast of the field.

Would you modulate the width of those divisions?

It's extremely flexible. As I say I was aware of everybody else's work and I had a lot more experience in synthesis than any of these people did and to me video synthesis was an interesting extension of sound synthesis. It was completely interchangeable with all of my analog stuff.

Did you have a video input?

Yes, I did and a stripper and everything. I took composite video and I tore it down even in those days.

Did you also have a King involved? (? 334)

Yes I did. I did have King keyboards. Threshold converters and so on.

What year was this?

About '66-67.

That's much before everyone else.

Yes. That was when I first started conceiving of it. By '69 it was completely finished and much of it fabricated. Because it came before the CBS sale which was in '69.

Why didn't you try it?

For a number of reasons. One was that I was so busy with other projects. And then I wasn't excited about the size of the visual field believe or not, compared to the size of the audio field. The fact that I could command 100% of my acoustic perceptions and only 3% of my visual field. Kind of limited me as a composer in some weird way. I didn't want to compose for the TV frame. I admired you at that very early point. In fact, I remember one of your early pieces but it just didn't excite me as an artist to work in the context of video.

If you could find some document from this time it would be very important.

I'll look for it if you're interested. I don't know the exact dates.

You seem to have incorporated generated image by the division of the oscillator (? 367) they could be drifting or locked. You had a live video in.

And the wave shapes were very flexible too.

And they were controllable by voltage. I mean the whole system was probably controllable by voltage. . . was it a voltage controlled system?

Yes.

So you could mix, you could key (? 374) and keep it colorized.

Absolutely.

Woody: What it means you have incorporated except scan processing which is the right (? 375) and you have incorporated all the early design. Or what we trace as early which is Siegel who started it but Beck started actually later but Beck, of course, claims that (? 380) so we have to analyze this and see as far as the system who actually incorporated then later Sandean (? 383) used the same principle as you say in early audio, he would use the signal as the control also.

Stein: No, Sandean (?) studied Buchla. He was very impressed with the Buchla audio synthesizer. This is in the interview we have with (? 387).

Other interlocutor: But that's what this sounds like. It sounds like it was the first comprehensive system as a logical extension from the modular approach to the audio synthesis.

Woody: In that case it's very critical in our introductory sequencing. In the chronology.

Steina: Do you have a synch generator? How did you generate the synch?

Buchla: There was a master synch and I don't recall.

Like a clock.

I might have extracted it from an incoming signal or I could have generated it. I think I had the alternative.

So you could either generate like a camera and (? 397) then at the end how did you reestablish the (? 398) signal at the end?

I don't remember how I finally came out of it. But all the in between steps were done with strictly separated signals. There were numerous ways then of generating a composite signal from the output and it wasn't of great concern to me.

Do you have any photos of that machine?

I might have the actual stuff. I don't even know.

Were there artifacts generated?

Yes, the final colorizer was actually built.

But as far as video recordings?

No, the synthesizer was never completed. I believe that the input and output modules were. We did have video signals and we could do certain things with them but the oscillator was never built for instance. Although all this stuff was designed. I had very complete designs.

Can we find the designs?

I'll look for it. I have no idea whether any of it exists at all. I just disposed of all of the art work for hundreds and hundreds of modules that I'd been saving for a long time because I finally decided that nothing would ever be done with it. And I thought that maybe I'd make some Rauschenberg-like thing consisting of layers of this what I regarded as beautiful art work. A woman doing historical research at the New York Public Library called me up and said, "Do you have any documentation on this and this and this and this?" a week after I'd thrown it into the garbage can.

What year was that?

No, that documentation covered everything, that documentation that I'd disposed of.

What that after you moved out of that house?

No, I carried it into my house and then a friend of mine moved in with me and I had to clear out a room and so I . . .

Because we would also have been interested.

Well, you'll have to speak up. I still have an enormous amount of stuff.

Now we are speaking up.

I have a show that I put together six or seven years ago that has been since expanded with more recent things and I've found other people to complete the collection. So I now have a very complete collection of my instruments going back a long ways some of it belonging to other people that are willing to lend it to the show. I've found absolutely nobody interested in it. It had three showings here and there's was a Dutch museum that wants to purchase the whole thing but they're having difficulty financing it. Not financing my end of it, that's almost free but the cost of mounting an exhibition. So that sits there. I'm just telling you that it's there and that eventually it will just disappear and fall apart but it includes maybe thirty large framed things of all the graphics that I've done over the years. Compositions and catalogs and descriptions and I've commissioned the Andrew

Joyim Press to do a catalog which is like way, way overkill but at that time I didn't realize that what I was doing was fairly exotic I just thought well, that's the way you do something. You find a very skilled typographer to do the catalog layout. So these things are kind of interesting in retrospect. Then I have interactive instruments that are on the wall and then we borrowed the first system from Mills College and I think I can now talk them out of it in terms of gaining access, trade them a whitening(? 466) for it or something like that.

The first system is put together?

Yes the first system exists. It's quite intact and still used occasionally.

You see these people that we are working for would probably want to buy all the video equipment but I think that would be an offshoot because what we are suggesting is no way of looking at video only because it had that audio system.

I can't promise you I can find anything. It could be just scrapped out.

We still have to hope because this is essential. This is the only record we have so far. That was your major brush with video, so to speak. Do you have any direct knowledge of Steve Beggs (? 489) influence?

No, there wasn't any influence there.

But you must have been hobnobbing a bit with Hearn. He refers to you in this interview.

A little bit, yes.

He has great respect for you by the way. Do you recall any other video device that you would be inspired by when you were building your instrument or did you start in mid air? Was there any reference in your mind to what video synthesis could hold, what video synthesis could be like? There must be some predecessor to your thinking somewhere. Or no?

I'm afraid not. No I strive for a great deal of generality as much as I did in the sound stuff.

Nobody in the Bay Area would have any box that you would be entertained by?

No. What little I was aware of I found not terribly interesting to me partly because I wanted to interact very strongly with the sound and some of these systems did not have what I regarded as voltage control. I definitely wanted that kind of interaction.

The major contribution is the way things are controlled so again,

the voltage control system developed in sort of a parallel to what you're doing or were you educated apriori about voltage control systems? Did you understand that term before your approach (? 525)

I understood the concept but I didn't understand the term. The term didn't exist.

So you actually couldn't predict how it would be used. You knew it must be used but how it would serve in the way of composing, you must have had some idea but not . . .

Oh many ideas.

So how did you call the material? You earlier referred to texture . . .

Well, I looked at my own needs as a composer. I looked at Mort's needs and I was aware of other people's needs at the time. At the Columbia/Princeton laboratories if one wanted to make a sequence you took a half inch of tape from a G and half inch of tape from a B flat and three inches of a tape from a C and splice them together and that was a sequence and I said "Well, maybe we could build a little thing that controlled an oscillator in such a way that we could have these three pitches sequenced without having to splice tapes." So they would make a whole reel of tape that consisted of nothing but an A and my idea was to do a little sequence and that's originally what the sequencer was about. It was perhaps with the influence of Terry Riley that people that started using the sequencer as almost a loop machine, as a way of generating a cyclical function. But my original concept was that we could save sixteen tape splices here, we'll just have sixteen pitches in a row and we'll set them up for duration and pitch.

Why sixteen?

It was a convenient binary number. I don't know why sixteen.

Was it binary in (? 559)

It didn't make much difference because we weren't dealing with computers but I was enough of a scientist to respect the binary system. I myself was dealing with very early computers.

Did you do the first sequencer?

Yes, I did the first sequencer.

(? 566) It was part of the Buchla system.

It was certainly an important component and then later on when we introduced the 200 series system it got ridiculously flexible in terms of what one can do with it. Of course, I've been sued for infringement of some Canadian patent on sequencer but the guy was

about five years too late.

Really? Who was that?

I forget his name. I get this a lot.

How did you refer, what was the terminology that was used?

I called it the sequential voltage source initially. Model 123.

The thing that I recall that was unique about the 200 series was the interaction control voltages so you could do things like with the random voltage generator and create these extraordinarily complex patterns.

Yes, the sequencer had random access to it so you could take a voltage control that in turn controlled the stage you were on in the sequence and you could take pulses which could then direct things and so you could get into loops inside of loops and all kinds of stuff and there were logical conditions. There was another one that came out later that you might not be familiar with affectionately known as the "MARF" which stood for Multiple Arbitrary Function Generator and that was essentially a sequencer in which each of the outputs was on a different time base. It was quite elaborate and they all drew from the same data. The data bank consisted of up to 32 pots controlling voltages and paralleled with 32 pots controlling times. One output could be looking at any segment of this and then there was a lot of things that said what range you were in and gave you the potential for looping within loops. Each output section had a tempo control and start/stop pulse input and things like that. You could do an enormous range of things with it. I'm not even on touching on the capacity of it. It was our first system based on a new logic form just introduced by RCA called C-MOSS(? 615) and it operated at that time at 15 volts and it had some built-in failure mechanisms that RCA never solved. We used hundreds of C-MOSS chips in the MARF and our failure rate was incredibly high and it was simply the introduction of a technology that should never have been introduced. I know of no functional MARFS to this day and we were pulling our hair out trying to keep the thing going. It was the year before the introduction of the microcomputer. The MARF was rapidly obsoleted by the microcomputer which could do all that it could do given good programming which took a few years for us to get together but eventually it replaced the MARF.

Tell me some of the terminologies, you had also a module that conditioned the input microphone. We still have here on the shelf. What was the name, how did you call . . . Tell me the components of your system. Original names that you put on them.

I'm not sure what you're referring to there. We had a microphone pre-amplifier but that wasn't much at conditioning.

There was some filtering there but how did you call oscillators.

Did you call them oscillators away from generators? What was the terminologies you used? Frequency sources or was there anything that's unusual that's now (? 647)

Terminology? I referred earlier to the Source of Uncertainty. A lot of people liked that and one of our touch controlled keyboards was called the Kinesthetic Input Port. So we had funny little names like that occasionally. I tried to be accurate with the names and not borrow too much from extant terminology when it wasn't directly applicable. We weren't trying to be cute. We were trying to be differentiated at the same time as accurate.

And that was the only known language, how would you call, you referred to Mort's need for textures. What was the language when he would commission you to make an instrument? What would he ask for? What was the need?

Well, Mort was certainly concerned about timbre as I was too. The language of timbre, interestingly enough, borrowed from the visual language at that time because electronic music was born out of technical devices so we have the term sawtooth wave and square wave and sine wave, those are visual analogies. We don't listen to a sawtooth and say, ah that sounds like a saw. It looks like a saw if portray it on an oscilloscope. I had and Moog has had extensive discussions with Theramin (? 687) and we were both impressed with the fact that this guy pre-dated oscilloscopes so he doesn't have any of this visual terminology and yet his instrument, the theramin (?) has incredibly complex timbral changes over the range of it. When you talk to him you realize that he was using a totally different language. Certainly a timbral language and he had to make analogies with extant instruments rather than visual analogies like we do. Nor could he be concerned about whether something looked like a good sawtooth or a good square wave. He had no way of ascertaining that. Nor was of it interest. Perceptually, it's certainly not of interest to me to make square waves and indeed my later systems didn't bother with it when I had timbre control I used a much different harmonic structure than simply varying between sine and sawtooth.

Were there any other terms?

Of what?

(? 708)

All I'm saying is that he made analogies to . . .

But did he name it? Did he say violin-like timbre?

It was very difficult to follow when we got into discussions like that. And as I say Moog did much more extensive interviewing with Theramin than I did. I talked to him on a couple of occasions but Moog was equally impressed with what he had to say, with his scientific method if you call it that in terms of his

experimentation.

How did you set up your shop? It took off somehow as you mentioned, the Buchla Synthesizers. So you had manufacturing in the loft?

No, I never manufactured extensively.

I visited you in the loft. It was in Berkeley I think. Early, but you don't remember.

Was it in a trainyard?

A large building with large windows. Do you recall more about this?

Oh, that was Reusesay (? 738) and Chaco's. I shared it with them on 4th Street in a fairly dingey studio actually.

About '71 or so?

Yes. Let's see. Dates I have a difficult time with. In '71 I think I was still in the. . . I don't recall.

END OF SIDE ONE

BEGINNING OF SIDE TWO (Set counter to zero)

I was just curious about what the role and history in terms of the tape center and Mort's participation in that. What was the participation of Ramone and Pauline's? And did you have much interaction with them? Did they influence the designs or anything at that point?

Only peripherally. I would say no, not a strong influence.

What was the most influential in this interaction between the artist, so to speak, and the engineer? Or were there others that would be more profoundly involved in this?

No, I sought ideas and interaction from wherever I could find such things but the truth is that I knew my own artistic needs and knew my technological resources. I was involved a little bit with the Billy Kluver experiments, the seven evenings in New York, maybe you know the dates of that. I don't. But I saw the failures then of collaboration between artist and technology if anything and then I realized that I was very fortunate in having a technical background with which to implement my artistic needs. Everything was in the same head, rather than two heads trying to collaborate.

Were you there actually physically at that event or in preparation?

Yes, in preparation at the last minute. Unfortunately, I was too late to help them out very much.

Was it David Tudor?

David Tudor was involved.

There was a film that we know about that I often show.

Really?

Absolutely. There is Cage and Tudor in presentation. So you are involved with both Cage and Tudor?

I was peripherally involved in a lot of experiments at that time.

Because Tudor was going strong but he had these boxes. Remember, he had these little mini-boxes.

Well, Tudor was one of my first customers. Cage and Tudor visited me at my studio in Berkeley and I remember that occasion. My studio at that time was ten feet wide and I worked out on the sidewalk. It was so crowded in there we hauled the workbench out on the sidewalk on good days and set up my oscilloscope and worked out there. Cage came by and for voltage control I had

hooked up my keyboard to an FM module that I'd built, a little module that was an FM receiver and I could play stations on it because I had one of the first veractor tuned FMs. Cage, as you can imagine was, just enormously interested in the fact that I could tune each key to a station and then proceeded to play the radio. I had already met Cage while putting together some of his pieces that involved perhaps multiple radios, phonographs and so on. At that time, in fact the first instrument that he encountered that I had built was a device that gave you a pitch according to where you were along the sound beam. And it was a guidance device for the blind. At that time I was working a lot with prosthetics for the blind and Cage played it as a musical instrument in this piece and then later on saw my voltage control tuner. He didn't actually purchase one. I'm not sure that I was offering it for sale in fact. But David Tudor came along with him and commissioned a sound locator that was based on a very beautiful Aztec-looking design. Four circular motifs in which you played a five-channel sound system. Four speakers in the corners of the room and a fifth directly overhead. That was my way of making a equal interval polyhedron. Not taking care of the bottom but certainly the top and Cage bought that and the rather complex voltage controlled amplifier that it controlled to distribute sounds and he used in a number of pieces. I believed he used it in a early version of the Rain Forest Piece.

Do you recall the date of that?

I have a hard time with years to tell you the truth.

The 60s of course?

Oh early or mid sixties.

What was the war doing?

This was early 100 series stuff. By '69 I had abandoned the 100 series so it would be around '66.

Have you ever met Paik?

Oh, Nam June. Of course. He shared a studio in New York with a video artist that was a good friend and I don't remember where I first encountered Paik. Oh, well he was associated with the California Institute of the Arts and I was the first technical director of the C.I.A. as we called it. The right C.I.A. And Gene Youngblood was there in fact. That's where I met Gene.

Those (? 73), like you say the sequence or so you got the idea when you realized that they were doing those loops. Can you remember any other ways of how you derived the idea of what became a module. Obviously there was a need, right and it came out of just a dumb idea or from . . . ?

Well, I was very much into processing instruments and many of my

later modules were things like spectral transformations, vo-coding, and these were very valuable for dealing with voice as well as instruments. Pitch shifting those kind of transformations, severe kinds of filtering often coupled with other processes. Later on all this stuff became rather commonplace but were talking about '70-71. Fairly exotic stuff then.

I've never heard about your vo-coder.

It's a module that I was selling for a very large amount because it was very complex and now it's in great demand. People still want it and collectors are paying rather large amounts for it and we didn't call it that. We called it the spectral processor but it was 16 channels of analysis based on equal bark intervals. In other words, not 3 channels per octave but broken up according to the perceptions or perceptual band width. In 16 channels you could do what it would take a conventional filter to do in almost twice as many channels to get the same resolution at the mid-band. Then you could edit (? 97) amp loop detection on each channel and with decay times that were variable according to whether you were trying to voice or music and which were also spread out according to how high in pitch the channel was so that the amp loop (? 99) detectors were tailored to the channels. You could do cross correlations by throwing a switch in which case the alternate channels became analysis channels with the synthesis channels or you could patch on the front panel to make more absurd relationships. The cross correlation was quite effective and people like to use that a lot. It had built-in reference oscillators and stuff like that. It's still a very useful module and one that I use a lot.

That was in the 70s?

That was about '73-'74. It was one of the later 200 series module. I was experienced only at that time with the work of the EMS guy in England. What's his name?

Zinoviev?

Zinoviev, yes. Much earlier than he had done some similar interesting work.

We have documentation on vo-coders done in the '30s and '40s.

Oh, vo-coding is an old technique.

Yes, also Boldon developed one.

I didn't even call it a vo-coder. I didn't think of it as a vo-coder. I wasn't that familiar at that time with the work done by Bell Labs.

It goes way back because it was the German who did the Voder

device which was a speech synthesis device and that's where the vo-coder came out of. It was the second half of the resynthesizing device for these. That was in the 30s.

It had a lot to do with attempts at reducing the information band with telephone channel and it had no application whatsoever to music.

Well, that's what Bell Labs interest was, wasn't it?

Yes, of course. Absolutely.

Tell me about access to components, that time it became cheap enough to actually build things because the components became packaged correctly.

What sort of components are you thinking of?

You know, you have to have some ways of building things. What I presume because Cage in the sixties. . . I came from this old technological culture that did not have this particular technology, the operation of (? 130) and the . . .

Oh no, this came along before op-amps. We were dealing with discrete transistors.

I see. So you started in the transistor era.

Oh, yeah.

When did the cans come?

When did TI introduce the . . . Our 100 series stuff was entirely discrete up through the late 60s. We started using integrated circuits in the 70s. With the early discrete transistors you had to be very careful how many you used. I remember one of my devices called the Buchla Box which was a name later attached to my synthesizers, was actually a device for connecting between your hi-fi output and your power amplifier. By not even very careful adjustment it would differentiate between speech and music. I called it the speech/music discriminator and it would turn off commercials and it would also somehow assess the tone of voice and decide whether or not it was announcing music which you may not want to cut out versus trying to hype something. It worked rather well. It was quite impressive. It was never marketable because it seems that I couldn't find anyplace that would advertise it. The center of the story is that it used three transistors for which I paid \$22.00 a piece. The CK722, I think. I may be wrong about the numbers but the transistor was in the 20s. They weren't very good. They were called point-junction transistors.

For \$22.00 they'd better work.

They did. But not for very long. They were quite noisy but the switching, the audio path didn't use any transistors in this case. It used a saturated-diode bridge, a concept which was well-understood even at the time.

Tell me, do you think that there was some kind of a problem with those kind of components in building video circuits? Did you find this a problem? What I'm driving at is why would video come so late after audio?

Because of the band width involved. The early transistors weren't capable of handling videos.

So you are saying it would not become a popular medium until the components would appear that would handle that kind of band.

Yes, in terms of video processing. I said earlier that it was in the late sixties, I'm not so certain when I did the video synthesis. I'll have to look at that because I'm not sure where it all fits in in terms of when I designed that system. ICs were available at the time I was doing it, there were the first ICs that came out for video and I can almost remember some of the numbers but they were the first ICs dedicated to video and that would put them in around '70 or so. That may have been when I was doing it. I did a lot of video compositions when I first had access to cameras and tapes and video technology and those go back a long ways and the first two of those compositions at that time could not be implemented. They were conceptual pieces that have never been performed but could now be done. I'm anxious to do them one of these days.

Going back to the colorizing part. Does it still exist as equipment?

As I say I don't know whether it was scrapped out. I'll have to look at the stuff in my studio and see what's there. I have boxes of stuff and I don't even know what exists in the way of notes and schematics but I think probably a large part of that exists.

Could you briefly summarize how you view, at least during that period through the sixties and early seventies, the designs that you were doing and instrument building, how you would differentiate the major features from a lot of the other work that was going on. What was the major focus that would have differentiated it say from Moog or Arp or from Zinoviev or from the different centers for synthesizer systems building?

I would say that I was interested in providing very exotic functionality that served my needs and those of the people around me that I associated with. To a great extent my instruments have always been very personal. I think that a strong impetus behind a company like Arp was to serve the needs of the marketplace and maybe they created the need. In a way that doesn't matter. To commercial companies there's nothing wrong that. It's the way

capitalism works. The larger the market the more you sell and the happier the stockholders are. I was never interested in that. If you want to manufacture and successfully market a soft drink, you'll probably reach the largest market by making it as much like Coca Cola as you can. I was much more interested in the knish market, much more interested in the composers working in the avant garde area. I often thought that if people started beating a path to my door I would run. I would say something is wrong with this picture. My instruments have been referred to as the Maserati or Rolls Royce of instruments and indeed I put that kind of effort into it in terms of their expense. There was a concern about the real musical needs that they're serving and being involved in music quite a bit myself I have this lack of duality that a lot of people have. An example is at the moment I'm concerned a great deal with the user interface that we see on systems of the day. A good term for the nature of the interfaces that we see is "user-hostile" as opposed to "user-friendly." The reason for that is that the languages are designed by the programmers and in my area there's a lot of confusion between what a program is and what a language is. To me they're quite different. I have the advantage in one respect of not knowing anything about programming. That's not quite true but I do not program and initially when I started designing interactive languages I didn't know how a computer worked. When people looked at my descriptions of the language, they said, "But a computer is a sequential device. How can you have all these things in parallel?" I'm saying a musical instrument is a parallel device and I don't care how you do it. You figure it out. I had to have very talented programmers. I think I wasted ten programmers before I finally found a couple guys that actually cut it. It's really an advantage to be designing from the outside in. But the engineering approach as well as the programming approach to language design, the engineering approach to instrument design is "well, here's a circuit that does some neat things. We'll put some knobs on it, and make it work." My approach has always been to take knobs and say, "this is what I want this knob to do, what the technology behind it is, whatever is most efficient at this time." I don't care whether it's transistors or ICs or infrared or whatever. The function comes first and then the technology. By using that approach I believe I've built instruments that are not easily technologically obsoleted. It may be that next year it'd be better to use a different IC to implement the function but the function was musically correct in the first place and didn't depend on the technology. If a bigger memory chip comes around next year it's not going to obsolete the 700 or something like that. I think that's an important difference in my philosophical approach to instruments.