Music at MIT Oral History Project

Barry Vercoe

Interviewed

by

Forrest Larson

with **Mark Ethier**

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Contributors

Barry Vercoe (b. 1937) is Professor Emeritus of Media Arts and Sciences at MIT. Since 1985 he has been at the MIT Media Lab. And from 1971 to 1985, was Professor of Music at MIT in the Department of Humanities. He is among the first generation of engineers in the field of computer music. His achievements include creation of the widely influential Csound software and development of technology for real-time interactivity between live performers and computers. He is also a composer of orchestral, choral, and chamber music as well as notable works combining computer generated sound and live acoustic instruments.

Mark Ethier is CEO of iZotope, Inc., an audio technology company he co-founded in 2001. He is a 2001 graduate of MIT with degrees in computer science and music.

Forrest Larson, Library Assistant at the Lewis Music Library, has attended training workshops in oral history methodology and practice at Simmons College and by the Society of American Archivists, and is a member of the Oral History Association. He is also an active composer and violist.

Interview conducted by Forrest Larson on August 19, 2011, in the MIT Academic Media Production Services studio. First of two interviews. Second interview April 23, 2012. Duration of the audio recording is 1:57:48.

Music at MIT Oral History Project

The Lewis Music Library's *Music at MIT Oral History Project* was established in 1999 to document the history of music at MIT. For over 100 years, music has been a vibrant part of the culture at the Massachusetts Institute of Technology. This history covers a wide variety of genres, including orchestral, chamber, and choral musical groups, as well as jazz, musical theater, popular and world music. Establishment of a formal music program in 1947 met the growing needs for professional leadership in many of the performing groups. Shortly thereafter, an academic course curriculum within the Division of Humanities was created. Over the years, the music faculty and alumni have included many distinguished performers, composers, and scholars.

Through in-depth recorded audio interviews with current and retired MIT music faculty, staff, former students, and visiting artists, the *Music at MIT Oral History Project* is preserving this valuable legacy for the historical record. These individuals provide a wealth of information about MIT. Furthermore, their professional lives and activities are often historically important to the world at large. Audio recordings of all interviews are available in the MIT Lewis Music Library.

1. Family and musical background (16)

LARSON: It is an honor and privilege to welcome Barry Vercoe, Professor Emeritus of Media Arts and Sciences at MIT. From 1971 to 1985, you were a Professor of Music at MIT in the Department of Humanities. And then from 1985 on, you've been at the Media Lab. And you're now Professor Emeritus, as I mentioned.

Also assisting me in this interview is Mark Ethier. He is CEO of iZotope, Incorporated, an audio technology company he co-founded in 2001. He is a 2000—and he's also a 2001 graduate of MIT with degrees in computer science and music.

So Barry, thank you very much for coming. And Mark, thank you for helping out as well. So Barry, tell me when and where you were born.

VERCOE: Well, I'm a Kiwi, that is to say, a New Zealander. And I was born to essentially a mining family, the long history of Cornish miners who, sort of, immigrated to New Zealand, and—

LARSON: What year was that?

VERCOE: In 1937 I was born. And in this—in the country area, so mining and eventually, then, in farming, dairy farming. So that was my background.

My dad was a self-taught musician. He was born in 1912. And as a self-taught musician, he played many instruments, and particularly had dance bands and things like that.

During the Depression, he did what many other people couldn't do. He, sort of, he had a very comfortable living because he was always asked to play. During the Depression, of course, people still want their fun and games, and so dances were still very popular. And that was a good profession to be in.

LARSON: So what were some of the instruments that he was playing?

VERCOE: Well, he was a pianist, a good jazz pianist. And then played saxophone and played a lot of brass instruments, and was in the Paeroa Brass Band. And then later on, at the start of the war, he then joined the brass band in the second NZDF. That's the expeditionary force that went to Europe. And he fought in Europe with one of the—in one of those theaters there, in Crete, mostly.

And then later on came back—back home, to New Zealand, of course. And then settled down in a place called Te Awamutu, where he built up a business in—as a cabinet maker and boat builder. But still kept up his teaching of piano and playing saxophone and so forth. So that's where I got my musical background, essentially, from—through him.

LARSON: Did he write any of the charts that he was playing?

VERCOE: He did a lot of arrangements. He wrote songs, you know, pop song kinds of things, and did a lot of arrangements and did shows and things like that. He was just a very active—he was also a cinematographer. He was president of the local cine club and did [laughs] a lot of things. He—sort of—early innovator in what—what you would call claymations, sort of making things move with still photography.

And so it was from him that I got my background. And when I was in high school, I was playing dances with him, and going out in shows and playing saxophone with him, and—

LARSON: You play saxophone?

VERCOE: Yes.

LARSON: Wow.

VERCOE: Yes.

LARSON: Are you also a pianist?

VERCOE: Vaguely. I mean, all of us are sort of frustrated pianists, I suppose. But—

LARSON: That was your primary instrument?

VERCOE: That was—to begin with, yes. But then once I was with my dad, I was playing saxophone out on the road. And that was, along with the brass—the brass band, was sort of my musical background.

The brass band movement in New Zealand was much like that in England. In fact, I got to know classical music through the brass band arrangements, I think, like the *1812 Overture* [Tchaikovsky], and the *Egmont* overture [Beethoven], and so forth. That's where I got to know the structure of the—of those musical pieces, and then later on was quite surprised when I heard the orchestral versions of those things. [laughs]

LARSON: So in the brass band, what did you play?

VERCOE: I played cornet, which had the... So I played that for a while, cornet, and also some other instruments in the brass band. But they're all, sort of, worked much the same way.

LARSON: So a saxophone, were you playing alto or tenor or both?

VERCOE: I was playing alto. So by the time I got to university in Auckland, I actually had a dance band that I started up in the Auckland city. And I was playing, at that time, a cool Paul Desmond sound. So we played all the Paul Desmond covers and that sort of thing out on the road. [laughs]

And that was—you know, my, my favorite people there were Paul Desmond and Chet Baker and people like that, and Gerry Mulligan. Those were my favorite musicians at the time. But of course, at university, I was studying classical music. And as I went through a very rigorous course in harmony and counterpoint and then graduated in music composition. And—

LARSON: I'll ask you some more about that in a bit. But—

ETHIER: Do you mind if I ask a question? I was going to say, was your father's filmmaking your first exposure to art and technology combined?

VERCOE: I suppose, in a way, yes. Although he wasn't—he wasn't involved in the technology of filmmaking. It was really as an artist or creator that he did these things.

ETHIER: You talked about the claymation. That sounds like an innovative application of that sort of thing.

VERCOE: It was at the time. Yeah, he was doing—I mean, claymations later on, became very common. But he was doing it rather early. And he just thought up this idea of how can we create toy models or something like that. That was what he—how he did that.

LARSON: So, tell me about your mother. Was she a musician as well?

VERCOE: Well, the whole family was sort of into music in a way. The brass band movement, there were four brothers. I had my dad and three other brothers who were all in the brass band.

And so the whole family was involved. My mother—my grandmother played piano, also. And so there was just music around the house the whole time, really.

LARSON: I didn't get your father's first name.

VERCOE: George, yes.

LARSON: And your mother's name?

VERCOE: Winifred.

LARSON: So it sounds like where you grew up, there was obviously a lot of music. Can you talk about the cultural scene of the town? Was the brass band and these jazz groups kind of—

VERCOE: That was—that was rather it. A small town—a small country town, didn't have very much going for it in the way of visiting symphony orchestra concerts or anything. And so the music at the time in the band, we would play in parades and at special functions and in the rotunda, you know, sort of Sunday afternoon concert kinds of things. And that's when I got a—got a lot of exposure to the whole act of performing.

And I, in some cases, actually did some arrangements for the brass band myself when I was in high school. I arranged the first movement of the Beethoven Fifth [Symphony], for instance, for the brass band. [laughs] It was okay. [laughs] But that was my first venture, I suppose, into writing something.

I wasn't yet composing for the brass band. Although as a youngster at the age of about, I suppose, from about 10 or 11, I had a book of pieces that I had composed, compositions for piano. And I don't know where that book is now.

But I was very religious about building up this little list of small compositions. I never had a composition teacher or anything. But I was just interested in creating things on my own.

LARSON: So your exposure to classical music, you mentioned that the brass band was one avenue. Did you hear it on the radio? What was your entry into the world of classical music?

VERCOE: Well, of course, there were radio performances, a radio broadcast of classical pieces. The act of—the musical life for me was playing, not so much just listening on

the radio or something. It was actually playing. And so this is—you know, when I had—

We had lots of scores at home, for instance. The score of the Beethoven Fifth—you know, my dad had a piano reduction of the Beethoven Fifth. And that's what I actually did my brass band arrangement from.

I suppose it was the case in the 19th century that people had piano reductions of classical pieces, and maybe two-piano things. And that was—that was how a lot of the music in the home happened in small, sort of isolated towns, if you're not living in a place like Vienna or whatever.

LARSON: Right. So your former wife, Elizabeth [Vercoe], is also a composer and pianist. And you had two kids. Are they musical, as well?

VERCOE: Oh yes, yeah. It's funny because Elizabeth and I decided that, of course, the children had to have musical education from the age of five or whatever. And—but we didn't—we thought, well, of course, we don't want these people to become professional musicians. I mean, that's no life for anybody. And of course, they are both professional musicians.

Andrea [Vercoe], my daughter, is a freelance violinist down in Washington, DC. I spent the last week with her down there. And it's a hard life, being a freelance musician. But, you know, she's—she's getting there. And then my son, Scott [Scotty Vercoe], is a jazz pianist and writing film scores and so forth.

LARSON: Where's he based?

VERCOE: He's based in Boston, here. He actually did go through a Master's degree in Media Arts and Technology at the Media Lab, and has also been working on the side for Echo Nest, which is a—sort of a music information retrieval company, you might call it that.

2. Formative Musical Experiences (10:46)

LARSON: Fantastic. Talk about some of the important musical experiences as a child that sent you on the direction of becoming a composer and professional musician.

VERCOE: Well, I felt that—I felt drawn to the intricacies of music. For instance, in church choirs and things, I wasn't particularly aligned to any particular religion. I would be in the, the Presbyterian church choir, or the Methodist church choir, depending on which one would let me sing alto, or something like that. And so these were the things that conditioned my directions.

Later on, when I went to university, I actually joined a cathedral choir, with—a very fine cathedral choir, in the manner of the King's College, Cambridge, Choir. In fact, the director of our choir in New Zealand, Peter Godfrey, became the director of King's College, Cambridge, Choir for one year. He and the director there swapped places for a year.

So I was in the midst, in that case, of some very fine and traditional choral—choral music. So this was rather important in informing my own interests. And I continue to maintain an interest in choral music.

When I was in Auckland, I was—I had a couple of choirs. I had a madrigal group when I was in university. I had a choral society that I conducted.

We would do things like [Handel's] *Messiah* every year and some other things, some more challenging pieces, like the Bach *Jesu, meine Freude*, the five-part motet. And this was a little village choir that I got to sing things of that quality. And so I was always pushing people at that—along that way.

LARSON: Did you do any of the Renaissance choral repertoire?

VERCOE: In that choir? Yeah, yeah, yeah. I—in fact, I have a—well, though—I have a real love for Renaiss music— Renaissance music, and so too does Marcus Thompson. So whenever we get together, we—we [laughs] actually listen to Renaissance music. And we go and hear the Tallis singers whenever they're in—Tallis Scholars, whenever they're in town or whatever.

LARSON: And that's Professor Marcus Thompson here at MIT.

VERCOE: Yes.

LARSON: So you mentioned you started composing as a child. Do you remember how that got started, or was it just a very natural thing for you to do?

VERCOE: I don't remember how it got started. I just—putting things down on paper and just creating—they were just simple one-page things. It wasn't till I got to university and really understood a bit more about harmonic structures and form and so forth that my compositions got to be anything memorable. In fact, the—one of the pieces that I wrote when I was in my senior year, it was sort of my—part of my senior thesis was a piece for choir, a setting of some—a [John] Masefield poem, "On Eastnor Knoll."

And it was finished. And I don't think I ever got a reading of that poem. I handed it in; it was fine.

It actually got its first performance here in Boston about two years ago. Forty-nine years after its composition, actually, [laughs] it was performed by a choir here. And it was—it did very well.

LARSON: Is it choir with instrumental accompaniment, or is it—

VERCOE: No, no, no, just a cappella.

LARSON: A cappella.

VERCOE: Yes.

LARSON: So why did you choose to pursue music in college?

VERCOE: I don't really know. Because I graduated Dux of the school in science and things like that. And everybody expected me to go on in math.

And I actually went in mathematics and so forth. I did two degrees in parallel. I did a mathematics degree and a music degree.

And I was—the music was the emotional thing. The mathematics was the sort of the sensible thing, perhaps, to do. Then I went—when I was then went teaching after college, I was teaching both mathematics and music, initially, in high school.

LARSON: And a lot of your information says that your degree in music was 1959, the University of Auckland. Can you tell me about some of the teachers you had there, any notable professors or people that you worked with?

VERCOE: Well, Peter Godfrey, the person I spoke to who was the director of the cathedral choir in Auckland, he was a professor at the university as well. My composition teacher was Ronald Tremain, who was London-trained. He had his Mus.D. from University in London. And good composer.

But I think like me, he—or before me, he also felt that New Zealand really didn't have very many opportunities. And he actually immigrated to Canada and was teaching then in Ontario, in Brock University. That's just near the Niagara Falls in Ontario.

LARSON: Now in college, was most of your performing experience as a singer, or were you also playing any instrumental stuff?

VERCOE: Well, I was in the University Singers and things of that sort, and—

LARSON: Were you in the band or the orchestra?

VERCOE: No, that's—I—the band performance was sort of my jazz life and not my classical music life, in a way. So classical music was really in the cathedral choir and doing things—I also had various groups that—in the dormitory I was in. I formed a choir there, and we sang a lot of things, like [Bela] Bartok and so forth. Lots of—

So I was always taking—and madrigal groups. I would always, sort of, form little clusters of people who enjoyed performing. And I was the ringleader, I suppose, in a lot of those things.

LARSON: Did you ever study conducting at all? Or is that pretty much—

VERCOE: No, no, I never studied conducting. I actually—my first conducting experience was in the brass band in high school. In the town band, I actually started conducting, taking over things, and was eventually appointed the, sort of, assistant conductor for the town band when I was about 15 or 16. But I've never had a conducting lesson in my life. [laughs]

LARSON: In college, how much exposure to contemporary classical music did you have there?

VERCOE: Well, there wasn't very much 20th century music in the program. It was essentially renaissance, baroque and classical romantic music, the typical British thing, as you can understand. We would study some [Igor] Stravinsky, I suppose. The—study—*The Rite of Spring* would be the thing that everybody studies, of course. And that's probably as contemporary as I got.

I didn't get into living composers. At least in New Zealand, there were not any giants of composition in New Zealand that we would tend to study. But we would look at Stravinsky and Bartok and so forth.

LARSON: Did you know anything about electronic music at all? Was that even—

VERCOE: No, that wasn't even thought about at the time I was going through school. And I was surprised to find a little later that while I was still at Auckland, there were some early computer music things going on in Sydney, which I've since investigated a little. Nothing very, really very interesting, [laughs] but it was indeed happening. I really didn't get into electronic things until I was in the graduate program at University of Michigan, which is where I did my doctorate.

3. Graduated study in composition at University of Michigan (18:48)

LARSON: Right. So tell me about how that came about that you went to the University of Michigan for that.

VERCOE: Well, they offered me a teaching fellowship at the university, in the school of music. And since I had no visible—other—no visible means of support otherwise, this was something I jumped at. And I was really very glad that I took that one up. I had applied to several universities. But it turned out that the schools of music in the Big Ten, the Indiana, Ohio, University of Michigan, *et cetera*, those schools of music were really wonderful places for composers to grow up.

Because my previous experience, as you might have presumed from what I said earlier, my previous experience in the university music department was that of essentially an academic upbringing. You didn't mix comp—composition and performance very much. In the schools of music, you have—it's both a combination of a music department and a conservatory.

So that what was missing in my New Zealand background was the conservatory aspect. There was no, sort of, real performance part of the curriculum there. It was beginning, but it hadn't really got—but when I came to Michigan, I suddenly found lots of performers and lots of composers.

And the performers very interested in the—what the composers were doing. Performers would come up to me and say, "I'm a violist. Do you have a piece for viola?" And there was—so suddenly, the integration of the creative and the performance side of things was very real. And I'm indebted to the University of Michigan for that real discovery.

And in fact, the—at Michigan, there was an honors string quartet. And you would expect the honors string quartet, who, you know, had their tuition paid just to perform, you'd expect that they would endlessly practice the late Beethoven quartets or something like that. No, they played only student works, only student works.

And if there's only three quartets out of—coming out of the student composers there, they would practice those all year. And it was a, sort of, an honor—tradition with the honors quartet at Michigan. And I was really quite taken with the place that composition was given in what was otherwise a sort of an academic department, but filled out in this other dimension.

LARSON: And you studied with Ross Lee Finney [1906–1997].

VERCOE: Ross Finney, yes.

LARSON: Were there other composers on the faculty there as well?

VERCOE: Oh, yes. George [Bach] Wilson [b. 1927] was there, also, well, later on—I suppose Ross Finney was my main compo—my main teacher. There was also Leslie Bassett [b. 1923], who was there at the same time. I didn't so much study with him, except in the last year.

LARSON: Tell me about some of the important things you learned from Finney.

VERCOE: Well, I learned the benefit of a long line of teaching, because Finney had been a student of Alban Berg. Berg, of course, being a student of [Arnold] Schoenberg, I was suddenly into this line of ways of teaching and so forth.

And Ross Finney would always say to me that he—his method of teaching owed a lot to his year or so with Alban Berg. Finney also had studied in Paris, as everybody else did, and so there was that aspect of his background. But studying with Berg in Vienna, I think, was an important thing.

And so I found myself taken with a lot of the Alban Berg chromaticism, his approach to the 12-tone row for instance. It's a very harmonic approach. And so all the pieces that I've done of the 12-tone, no one would imagine that these pie—these are 12-tone pieces.

My viola piece, for ins—that's a strict 12-tone piece. My clarinet, it's not a strict 12-tone piece, but people don't think of that. Because the organization of notes in the—in the row are sort of harmonically based and you can proceed in sort of harmonic chunks, I suppose, and make it sound really quite harmonic—harmonically organized. But it's actually strict 12-tone.

And that's the sort of thing that Berg did. He would twist the thing around to—sort of so he could get what he wanted without having to—he wouldn't break the rules so much. Although yes, he would at times, I suppose, where [Anton] Webern wouldn't. But I became very enamored of the Berg-Webern things, which Ross Finney, at one point then, thought that this was a bad influence, that it tended to, sort of, restrict one. And Ross was a much more, sort of, creative, open composer himself.

LARSON: Right, but he also did work for a period of time with 12-tone technique.

VERCOE: Oh, yes. Yes, yes.

LARSON: But had a very unorthodox way of dealing with it, too—

VERCOE: Yeah.

LARSON: —he was looking for tonal implications of it, as well.

VERCOE: Yes. Ross would always be talking about root forming situations. He was—talk about root forming. He always felt that a piece needed to be—to have a basis, a root, an implied root, at—through most of the piece. And he'd be talking about how, you know, how a root forming situation would occur. And so I was very conscious of that in my own pieces.

4. Encountering analog electronic music (24:40)

LARSON: So my research says in the summer of 1952, Finney worked with Mario Davidovsky at the Columbia-Princeton Electronic Music Studio. Do you know what interested Finney about looking at electronic music?

VERCOE: No, I don't know what interested him. But this would be '62, not '52, I pres—I think.

LARSON: Yeah, '62.

VERCOE: Because when I got to Michigan to work with Finney, he had this idea of doing—starting an electronic studio. In fact, what he did was then to invite Mario Davidovsky to come and be in residence at Michigan for the—for the following term. And so my first encounter with electronic music was to actually be working with Mario Davidovsky, the master of cut and splice techniques [Ed. Note: analog and tape editing techniques], and a person for whom I have enormous regard.

And this has continued. Even at MIT here, I continue to have relations with Mario and have him here. And I don't know if you were aware of that, but he would come for the summer workshops and things. So that was where I first got into electronic music.

However, I at the same time became rather disillusioned with—or disappointed with the fact that in the electronic domain, you had—you always had trouble maintaining the tuning of things. And so I soon realized that what has been—had been going on in—at Bell Labs [Bell Telephone Laboratories, Acoustics Research Division. Computer sound synthesis research began there in the mid 1950s] with Max Mathews [1926–2011; MIT Sc.D. 1954] in digital versions of things enabled you to have any degree of tuning that you might want, just because it was done digitally [inaudible] as opposed to, sort of, using a pitch fork or something to straighten out notes in an analog domain.

ETHIER: Before your exposure at the University of Michigan, had your background in mathematics and your study affected your composition?

VERCOE: Not really. They were two separate channels. I was interested in mathematics in itself and I was interested in music in itself. And the two of them really didn't converge. And it wasn't until I got into computer music, of course, that the two things did converge. But that would have been, you know, several years after I'd completed formal studies in both.

LARSON: I have some questions about that later on. So I'm looking forward to that. So there's one Finney piece that includes electronic tape part. There's a piece called "Three Pieces for Strings, Winds, Percussion, and Electronic Tape." Were there any other electronic pieces of his at all?

VERCOE: I—not that I know. No. At the time Mario was with us, he had written the—his Syn—started his S*ynchronisms*, the first one, which is *Synchronisms [no. 1] for flute and electronic sounds*, and then the second one, which I found a very fine piece, the *Synchronisms [no. 2] for flute, clarinet, violin, and cello*.

LARSON: Which you've done here at MIT.

VERCOE: Which I have performed, I've actually performed that in—also in New Zealand. And I became quite enamored of that piece. It's really quite good. The third one, the Synchronisms that were for cello, wasn't a big favor—favorite of mine. But I found that the musicianship that came out in the number two Synchronisms, where things were, sort of, very, very logically—that is, music logically constructed, were really, really quite enviable. And I, sort of, took a lead from some of those things.

Later on, Mario went—found that publishing these pieces became a big problem. Because you then had to get copies of the tape part, the analog tape part. And that—they were very difficult to mass produce.

And so Mario, then, later—and particularly since you had to—this was done with segments of the tape. That—so you stop and realign the capstan and so forth, and then start the tape on cue, *et cetera*. And this became a big problem, both in performance, particularly—but particularly in publication.

And so later on, he went to a technique of just, starting with his piano *Synchronisms No. 6*, for instance, he would just start the tape at the beginning and the pianist would just have to keep up with the tape because it just ran from beginning to end, and there was no—it was a—it was a very easily duplicated tape part, no cut and splice things. But I felt that the music really suffered as a result.

That piece—well, that piece—there was another he did for wind instruments. And that was all in 3/4. But—and one would think it would be much easier to conduct. I would never conduct that piece without a score, even though it was just in 3/4. [laughs]

But the *Synchronisms No. 2*, which had all sorts of time signatures and the tape part stopping and starting, I actually conducted that piece without a score, because—not because it was structured in a simple way, it just lay so logical—logically, just within the hands or within—the phrases just were very musical. That's the admiration that I had for Mario, that he could construct things like that, that you could conduct a very, very complex score—score without reference to the actual written document. And—

LARSON: So you've spoken about some of the practical frustrations of analog electronics. The basic sound material, did you find that just attractive to your ear?

VERCOE: In the case of the—

LARSON: Of the analog, when you were—

VERCOE: The analog.

LARSON: —at the University of Michigan. You were frustrated with tuning and the tape splicing stuff. But the basic visceral working with those sounds, did you find that appealing?

VERCOE: Not so much. I—for instance—this is going back again to Mario. Mario, of course, had a library of, you know, tape segments. And there were pegs up on the wall. And he would have these tape loops just hanging up there, and reach for this and

reach for that. I found after a while, after I had got to know some of his earlier pieces very well, that when it came to the later tape pieces, I found he was repeating himself. In other words, these became a resource, a usable resource. [laughs]

And this—these then began to, I think, affect his creativity in a way. His earlier tape pieces were much more creative because he was inventing them as he went, as opposed to relying on past fragments of sounds. And so you could hear the little fragments from the Synchronisms No. 2 in some later pieces. If you got to know that piece—that, that piece very well, you would recognize—ordinarily, you wouldn't recognize the repetition.

But I was a little disappointed at the lack of control in the electronic part. I mean, it's called Synchronisms. But the pieces, the electronic and the instruments, are not synchronized at all. It's really a misnomer.

The two things sort of operate in some sort of fashion. There were some things in the score that's supposed to align. But you can't—as a conductor or performers, you can't really align these things.

And what happens, you get to a point there where the tape part is about to stop, or—and it goes into this little—little loop, *yicka ticka dum, ticka ticka dum, ticka ticka dum, ticka*. And the performers sort of do that sort of thing until they hear something in the tape part. And then *tkk-tkk-a-shh*, and then you have synchrony again. So the synchronism is actually achieved only at about three or four places in the whole piece.

LARSON: So when you were in college, and at this time, serialism was a real major force, there's Pierre Boulez and folks like that. What was your feeling about some of the more strict serial ideas that were out there?

VERCOE: Oh, I was quite taken with the very strict control of Webern. I just love some of those Webern pieces. I just love Webern in itself. I mean, the—I think his *Five Pieces* for string quartet, Op. 5, are just—are just wonderful. I, in fact, have usually taught that piece in my classes. And so that, of course, wasn't serial at that time. But it was just Webern's control over things was quite admirable, and very different from Alban Berg. [laughs]

LARSON: Did the interest of serializing rhythm and timbre, did that also interest you?

VERCOE: That didn't interest me, not really, no.

LARSON: Can you talk about your compositional ideals? I know that's a tough thing to summarize.

VERCOE: Mm. I tend to go for closed forms, things that sort of seem, you know, that you know when you get to the end of a section or the end of a piece, or something that... I like the fact that pieces don't just—there's a lot of pop pieces these days sort of just fade away into the future. [laughs] I like to have a good solid ending or something—or something.

For instance, the end of my viola piece [*Synapse, for viola and computer sound]*, I don't if you remember, there's a long note that Marcus [Thompson] plays. And then *daaaah, da-dup*. And that *da-dup*, that's 11, 12. [laughs]

5. Early years of computer music research and development (34:38)

LARSON: So when did you first know about using computers for sound synthesis?

VERCOE: It was when I was teaching at Oberlin. After I graduated from Michigan, I taught at Oberlin Conservatory for a couple of years. And there was a—that's when there was someone else there by the name of John Clough, who was on the theory faculty there. And he had become interested in Max Mathews's program [MUSICIV]. And that's how I got to know, to become aware of this thing.

LARSON: Was there a studio there at Oberlin?

VERCOE: No, there wasn't at the time, no. I gave the first lecture on electronic music there. But I just did all the sound effects by voice. [laughs]

So I gave a lecture to the students. It was quite well attended. And it was about electronic music, and I could play some examples. But in giving a demonstration of gestures and shapes and things like that, I did it all vocally. That's the best we had.

LARSON: So you did some post-doctoral studies in digital processing at Princeton University. And how did that come about that you...?

VERCOE: Well, starting from the experience at Oberlin, John Clough and I then spent the next summer at Princeton. During the summer, we had access to the—to Max's MUSIC IV program there. And John and I stayed in a house in Princeton and lived there with somebody else, John Rogers from University of New Hampshire.

And we just spent the summer experimenting with things. And of course, there was no digital audio converter there. So we would create pieces or fragments of things on digital tape, and then jump in a car and drive up to Murray Hill in New Jersey and put it on a machine there.

And you could, you know—it was about a two-hour drive there. And you put it on this thing, and you hear your 10-second example, and whether it was what you expected or not. And then you'd say, "Oh, okay." Then pile back into the car and drive back to Princeton.

That was—that was our interactive thing. We did that all summer. And so that was my first exposure to digital description of sound. And in fact, the—one of the fragments I did in that thing, I actually then worked into the piece that I wrote the following year, when I was composer in residence in Seattle.

LARSON: Now, you weren't using any of the facilities at the Columbia-Princeton studio.

VERCOE: No, not at that time, no.

LARSON: Did you work at all with Milton Babbitt?

VERCOE: Well, I went to his lectures. He was lecturing once a week. And I sat in on his lectures. I can't say I was really a student of his. But I was quite taken with the man and really mourned his passing this last year.

LARSON: Did you ever get a chance to see him work at the synthesizer that he had—

VERCOE: No. The RCA Synthesizer? No, I didn't see him working there. I did get in to visit and see the massive machine. Was amazed that a little man like Milton could pull on these keys, I suppose, to imprint the holes in the—in the paper tape. 'Cause the paper tape's about this wide.

LARSON: Also, in Princeton, you worked with someone named Godfrey Winham?

VERCOE: Well, he was the main person I worked with, yeah. Godfrey was a really interesting person. He was British. He had been sent—during the war, he had been sent by his parents to be educated—well, I suppose, protected and preserved during the war, by coming to a school here in the U.S. And then later on, when he wanted to go to university, he chose to come back to the U.S. from England and joined the—became a student at Princeton.

As an undergraduate, Godfrey ran rings around all the graduate composers. He was incredibly gifted as a composer. He was also incredibly gifted as a chess player. [laughs] He told me the big decision in his life was to be—whether he was going to be a composer or a chess player. [laughs]

And there was someone at Princeton that he worked closely with, Ken Stieglitz, who was sort of like the Alan Oppenheim of Princeton. In fact, I've been with Ken and Alan together. They were very close friends. And as a scientist-engineer, Ken Stieglitz prided himself in his chess.

And he chall—and he challenged Godfrey one day. And Godfrey just wiped him off the board. [laughs] That's where Ken Stieglitz got his, his high regard for music and musicians. And the Princeton studio, then, sort of, was something that came out of Ken Stieglitz's involvement with Godfrey Winham.

LARSON: I see. Now Godfrey Winham, did he do—how much electronic music did he do? I don't see his name—

VERCOE: No.

LARSON:—discussed in that realm.

VERCOE: No, not very much. He was highly gifted, but lazy. And he was married to a wonderful singer. And she used to say to him, "Godfrey, why don't you do something and be famous?" "Ehh," he would... [laughs] His wife's name was Bethany Beardslee.

LARSON: Oh, of course.

VERCOE: And she was the one for whom Milton wrote his many pieces for synthesizer and voice: *Vision and Prayer* and so forth. And so she was quite famous. But Godfrey was content just to be the husband of Bethany Beardslee [singer]. [laughs]

LARSON: So you were studying composition with him, or—?

VERCOE: Well, not so much. I was studying digital techniques, I suppose, with him.

LARSON: Okay, so he knew a lot about digital audio, but he wasn't doing much himself.

VERCOE: No. Well, what he did was to create a digital version of MUSIC IV called MUSIC IV-B Well, let me—let me back off. MUSIC IV-B was the BEFAP version of Max Mathews' MUSIC IV. And then later on, when the big IBM 709, or 7094, which was

the BEFAP assembly language machine, was suddenly replaced by the 360, Godfrey decided he would never write assembly language again.

And so he then wrote a Fortran version of MUSIC IV called MUSIC IV-BF. And that became quite widely used. But of course, being a Fortran program, it was sort of slow.

And what I then did in parallel was to do my own version of that called MUSIC 360. And I was able to get—and I did that in assembly language. And I decided—Godfrey had decided he was never going to touch assembly language again because the—it was quite plain that the manufacturers just would switch assembler languages willy-nilly.

I decided this was such a big under—such a massive change, for IBM to get from the BEFAP assembler to the 360 assembler. I decided that 360 was likely to last a long time, which it did. And I was quite con—quite willing to go in and commit to the assembly language. And that gave me a speed advantage over the Fortran, of about six or eight to one.

ETHIER: How did you balance your time between building the tools and actually using them?

VERCOE: I think that I have erred, much to my chagrin, on the side of building. You might say there are—there are tool builders and there are tool users. And usually, the two are separate people. You rarely find someone who actually creates the tools and then goes on and uses them creatively.

And I think I've spent more of my life wri—creating the tools than cre—writing pieces. And I'm sort of sorry about that. And looking back, I—had the tools that I wanted been there, of course, I wouldn't have spent that much of my life doing it.

But it is a distraction. And then became a distraction when I came—came to MIT, of all places. If you want to be distracted by technology, this is the place to do it. [laughs]

LARSON: So, did Max Mathews have an affiliation with Princeton University?

VERCOE: No, we got to know Max when we would go up to Murray Hill and—to use the D-to-A converter that was there.

LARSON: So that was your first—

VERCOE: That was my first encounter with Max, yes. And I got to know him quite well, actually, then and in later years.

LARSON: Now he had written some programs, one called GROOVE and one called MUSIC. The MUSIC one, that's the one that you—

VERCOE: Right. That was a series of things, MUSIC I, II, III, IV. MUSIC IV was the one that stuck and then that we all used. And so did—too, did John Chowning at Stanford, got a copy of that.

The GROOVE system was an analog system. It was a computer-controlled analog synthesis system using a DDP-24 machine, which, when they decided to

replace it with a DDP-224, Max then gave the DDP-24 to MIT, his alma mater. And that coincided with my coming here, so that when I arrived here, I was—suddenly had a computer of my own, which was the Bell Labs cast-off that Max Mathews had used in his GROOVE experiments. And so I suddenly had in the basement of Building 26 a computer that was precisely for music.

But it was old and clunky. It—hard to maintain, and so forth. In the end we sort of used the tape drive for certain things. It would—the tape—you could spin the tape around, and it was a good way to make twisted pair, for instance, and—[laughs]

Just spin the tape and hook the thing up and have the wires all—you know, all the way down the corridor. And then spin this. And about—after about 10 seconds, you had 100 feet of twisted pair. It was really great. [laughs]

ETHIER: So the DDP-24 that you went down to Bell Labs to use was actually the same one that you had here at MIT.

VERCOE: Ah, no. I wasn't using the 224. There was another computer that was running the D-to-A converter. No, the two—the 224 that—or the DDP-24 that Max sent up here was sort of a cast-off. I don't know whether they got a tax writeoff or something for that. But it was Max's gesture to MIT, and also perhaps in—coincident with my coming here.

By that time, I had written the largest—the bulk of MUSIC 360. And Max was happy to see the—sort of, the digital tradition brought up to MIT, his alma mater. And so he gave the—the twen—the DDP machine as sort of—as a —something that had D-to-A—that we could use for D-to-A converters.

And so it worked for a little—little while in that capacity. But it was very hard to maintain. And we eventually threw it away.

LARSON: So Max Mathews is not only legendary, but in many ways, we can think of him as kind of the father of digital music. It's unfair to ask you to briefly summarize how you can look at the legacy that he left. But can you take a stab at just talking about, as we're looking back over the decades that he was active, how you look at his legacy, and how we're still seeing that today?

VERCOE: Yes, well, his insight and the ability to reduce things to simple terms was what gave us the digital oscillator. And particularly, be able to represent signal processing networks in simple terms like a digital oscillator and a digital filter, *et cetera*.

The digital filter doesn't even come from Max. That wasn't so much in Max's initial MUSIC IV. That was something that Ken Stieglitz contributed. Ken had done his PhD at NYU on analog filters. And he found in the course of it that he could actually represent these analog filters in discrete components.

Ken was the one who really pursued and did a lot of breakthroughs in digital filter design. And so that digital filter became part of the MUSIC IV repertoire, ultimately. So that was the first, sort of, collaboration between Godfrey and Ken Stieglitz. And that was where music and technology really were coming together for the first time in a serious way.

LARSON: Do you have any reflections about Max Mathews as a friend and colleague? I'm sure you do.

VERCOE: A dear friend. A dear, dear friend, yes. From those years in Princeton, he was—he became then a frequent visitor to MIT and to my house, in fact. Our spare bedroom at my house was always called the Max room [laughs] because that's where Max always stayed when he was up here.

He was just so generous. He gave away all his stuff. He never, sort of, took a patent on anything, not for, you know, digital technology. The man could've been very wealthy, had he patented a lot of these things that he sort of invented or caused to—caused to happen. But he would just give them away as fast as he thought of them.

And that is sort of what I've done, too. I've never patented anything, either. When I wrote these programs, MUSIC 360, MUSIC IV, and so forth—Csound—I just give them away.

And you can afford to do that if you're in an established place like Bell Labs and MIT, I suppose. You can't afford to give away your work if you don't have the—the job security that those places actually provide. But it served to actually advance the cause of digital music, the fact that we could actually do things and then just give them away. And I was constantly running down to the post office, handing out copies of MUSIC 360 on little digital reels for several years.

6. Studies at IRCAM in Paris (49:31)

LARSON: So you had a Guggenheim Fellowship from 1982 to '83. And you went to Paris at IRCAM. And from what I read, this is when you started working on this concept of the synthetic performer. Is that correct?

VERCOE: Yes, right. What happened just prior to that was I had written this piece called *Synapse*, which I wrote for Marcus Thompson, who is on the music faculty here, the violist. And that was one of these prerecorded tape parts. It was digitally synthesized but committed to a reel-to-reel tape. And then Marcus would then have to listen carefully while this tape was played. And he would sync—synchronize his own part with that tape part.

And he did that in the last—the latest performance that we did of that last February [2011], when we did the piece at the Media Lab. That was reverting to the original version of that piece. The only difference was the score was now on a screen as opposed to something on a—on a music stand.

But—and the tape part, instead of being cut and splice, you know, could—you could actually stop and start a la Mario David—Davidovsky. You could stop and start just digitally. And so that was a big improvement in the performance environment.

But at the same time, I felt that the performer had lost a degree of freedom in having to listen carefully to what the tape part was doing. And so what I wanted to do

was to get something much more interactive. So when I had the Guggenheim, I went to Paris and worked on the idea of the computer being able to track the live performer by doing pitch tracking and score following. So I sort of pioneered this whole concept of pitch tracking and score following, which later on became a big thing at IRCAM.

When I arrived at IRCAM, there was a digital audio processor called the 4X, the "*quatre X*," which [Pierre] Boulez had cause to be created there. Peppino di Giugno, who is an Italian physicist, was the one who engineered that whole thing. And Boulez was using that in his work, *...explosante-fixe...*, and so forth.

I felt that the way that was being used even there, the digital part was just being used as a big, expensive digital delay line. What would happen is the cimbalom [Hungarian folk instrument] in—in—would go, *brrt, brrt, brrt*. And it would be recorded, and it would sort of just be looped—loop around, *brrt, brrt*. [Ed. Note: Vercoe is referring to Boulez piece *Répons*, which includes an electro-acoustically modified cimbalom.]

And the way this would start is, you know, people watching Boulez, Boulez would gesture. And someone would press the carriage return on the computer. And that would then, sort of, start this digital part. And I thought this whole thing was little better than Marcus Thompson using his ears to synchronize the electro—his performance with the electronic part. And I wanted something in which the computer would beco—would assume a musically responsible role in the ensemble.

It would listen. It would decide when to come in. And it would keep time so that the idea of speeding up and slowing down was then—something that I gave the performer this—back, this degree of freedom that they would ordin—usually, normally have in chamber music and other things where all the players would listen carefully to one another. So this was something then—something new to actually give the digital medium, this role of the human—human-like interactive performance.

LARSON: So when you were at IRCAM, did you do any specific work for Pierre Boulez? And what was your role in working with him?

VERCOE: In relation—well, I saw him every day. Because since I needed the machine entirely to my own—to myself, because other—other people were using MUSIC IV—or MUSIC V happened then at IRCAM—so they'd be working during the day and running the programs on the machines and so forth.

To do the work I was doing, I needed the entire machine to myself. Because I was—you know, I couldn't tolerate, sort of, time shared or anything like that. I needed the whole machine. And the only way I can get that is to start when the—all the Frenchmen went to dinner.

So I would show up about 9:30, 10 o'clock each night and start my work. And I'd work through until 7:00 in the morning, when Pierre would show up. And he'd come in because he was working on *...explosante-fixe...*, and we'd sort of have a 15-minute conversation every morning. And then I'd gracefully exit, and he would get down to work.

Now, I had an accomplice in this, which was Larry Beauregard, who was the first flutist in the Boulez ensemble, Ensemble Inter—InterContemporain. Fantastic

flute player. And a graduate—he got that job actually right out of school. He was graduated from the Toronto Conservatory. And he was also—his father was an aeronautical engineer, and he was sort of interested in things. And so he was very interested in tinkering.

And he was the one who caused the—the flute to be outfitted with little optical sensors on all the keys. There are 15 keys on the flute. And so you had 15 bits of information that were being sampled 30 times a second.

And so it was possible, then, to find—to follow—he was a fantastic player, but the computer could keep up with what he—whatever he was doing. So we had a very keen sense of what was happening there.

So I was using that as the—as part of understanding what the flute player was doing, initially just to get the key motions. But of course, since with any one—with any key combination, you can—depend—you can get typically three notes, depending on how hard you blow, that didn't give me the pitch. So what I would then do is lay down a filter on the out—

So I had this key, so I said, okay, it's either this, this, or this note. I'd then lay down a filter in one of these—in all three of these things and see where the energy actually was. And so that was how I did my pitch tracking of the flute, using both the key positions and the key sensor.

It was interesting that at first, before I had the filter things working and I was just looking at the—at the key combinations, I wasn't getting a very good sense of where the performer was in the piece. Because what would happen is that a flute player would prepare notes and, particularly at the phrase endings, taking a breath [ah], the natural thing, grab the next note.

And the computer that's looking at the key positions would think, my heavens. He's already up to there. And so would race ahead, [laughs] because he wasn't there at all.

Larry told me he could learn not to prepare notes. But he couldn't. It was so ingrained in his technique that he was always prep—you know, constantly preparing the next note.

And so what he ended up—we were having a very, for want of a better word, spastic sort of performance of the—of the computer part because the—it was getting a very, sort of a warped idea of where the flutist was. And so Larry had developed a relation to the computer, in that sense that looking at this as perhaps not a very competent accompanist. So he would sort of make adjustments.

He would adjust things because we had through him potentiometers that could adjust things, like if you're ahead, if you realize you're ahead, how quickly do you catch up? And once you're caught up, where do you want to be? Do you want to be exactly with the soloist, or should the accompaniment be a little bit behind, or whatever?

So these potentiometers gave Larry control over that. Because performers do have a relationship to the accompanist in some kind of a—some kind of way like that. And so Larry had got used to this thing and its—and its sort of spastic performance.

He was a very devoted colleague. He would—you know, I'd be working away, and he would sleep on the floor. He had a sleeping bag on the floor in the studio, the 4X studio.

And then he would sleep and every—about 2:00 or 3:00 in the morning, I'd give him a kick. "Okay, let's try this one." [laughs] And he'd wake up.

He had to get some sleep because he was rehearsing with Boulez during the day. And he was just spending nights with me, that's all. [laughs] And so what would happen is that we would try something, and then, "Oh, that doesn't work. Okay, back to sleep." So he'd get back to sleep. And...

But he had developed, as I said, a particular relationship to the—to this synthetic accompanist, based on this funny way of tracking. Then when I got the filter thing working, I now could know exactly when he was starting a note. So my sc—my score tracking, score following, was now very accurate. And I could really understand what was going on.

And the first time that this—I turned this on and made it work, I said, "Larry, you've been screwing around with the program again. I used to like these potentiometers set—set right there. And now they seem all wrong." [laughs] And what was happening is he was changing his—the relationship between him and the synthetic accompaniment.

And curiously, it went in the opposite direction from what I expected. I thought that once he had a very sec—secure of feeling of where—what the computer was doing, that he would be willing to let the accompanist be an equal partner. And he would be willing to sort of play, sort of, really quite in sync. No, he wanted to be further out in front.

So what we learned from that is that in—at least in the melody and accompaniment sort of things—different in polyphonic structures—but in the—in the melody and accompaniment thing, the soloist likes to be out in front. And that degree of being out in front depends on the confidence he has in his accompanist. And that's apparently what happens on stage, so that—or when people rehearse together. That's the relationship that they create in the act of rehearsing.

7. Coming to MIT, teaching and research (60:38)

LARSON: So I wanted to ask you about how it came that you came to MIT. I know that John Harbison [MIT Institute Professor of Music] and David Epstein [MIT Professor Music and conductor of MITSO] had visited Bell Labs and had become familiar with some of the work of Max Mathews. But is that how they found out about your work? Do you know how, what led to your being appointed here?

VERCOE: As I understand it, Max and David were quite enamored of the GROOVE performance that they heard, in other words, not strictly computer music, but something that had a bit—a little bit more, sort of, human motion in it. And they decided that was the future. But duplicating the GROOVE machine would be a bit of a problem. And what I had done in the meantime was written most of what later became known as MUSIC 360 while I was at Princeton, and got to know Max in that way.

So I applied for a—the position here. [James K.] Jim Randall [music theorist and electronic music composer] at Princeton [University] suggested that I do that. So I came up and interviewed that. There were two or three other candidates as well. But I had not only the digital exp—experience at this point, but I also had a small portfolio of pieces, instruments and things. And that sort of showed them that I could actually teach counterpoint.

And in fact, the counterpoint stuff I had been teaching previous to this at, at Oberlin. I was at—teaching there for two years. And my favorite subject, in fact, still is 16th century counterpoint. And so I—this came as a result of my performances in choirs and Renaissance groups and things like that. And so I was—had done a lot of counterpoint teaching.

I had my own special way of teaching counterpoint which was not to use the species counterpoint technique, but to use a lot of just hearing, just listening. And so I've got a very aural way of teaching counterpoint. And that's what I then came here and started teaching. And that was, you know—that became the way to teach counterpoint for a while.

Later on, as other faculty members came in who sort of taught the species way of doing counterpoint, which I think is sort of counterpoint by numbers, I decided—well, I gave up on trying to push my idea. But I always felt that species counterpoint, or counterpoint by numbers, was not the thing you should give to MIT students, because they'll soon learn how to crank this thing, and they wouldn't hear a thing. And I was very concerned that the young students learn how to listen and learn how to just create in that manner.

And so my counterpoint teaching was mostly singing. It was particularly the—using the two-part motets, that were sort of very simple structures and things that one could get one's ear around. And I would come into the class and turn the beginning of one of these two things. And we'd sing this whole thing through, and then switch—switch voices and sing the other part. And people in the—in the class would essentially learn these things by ear.

And having got to know the—I mean, I wouldn't teach things like here's how you get—do a 7/6 suspension and, you know, resolve the suspension into a—into a consonance. I wouldn't teach those things. We would sing them. And they'd learn it by osmosis.

And so I would sit and, sort of, play, and they'd hear this thing. And they'd just naturally, well, they would be writing something and come up with the seven-six suspension, and they would just write it automatically because they were soaked in that through just hours and hours of singing these, these two-part motets in class.

Now what had really happened is I'd sort of thrown the—I had put—had put them into the position of composers in the 16th—in the 16th century, where they were just surrounded by that sort of thing. And they would learn and perhaps advance a little bit, each one, from extending, you know, what they were familiar with. But this is really the way to teach 16th-century counterpoint, not to go back and look at it as a theorist and sort of impose some theoretical approach to this thing.

LARSON: So when you came to MIT in 1971, was it also you had in mind to do more digital music, and—

VERCOE: Well, I think—I think what happened is that upon my being brought up here, the—I was given a small budget. And people would assume that I would open a studio, an analog studio, probably, you know, using some Buchla equipment, or at least Moog equipment or something. And I would hand keys out to undergraduates and say, there we are, electronic music at MIT. But I came here with my MUSIC 360. And I just had a very diff—different idea of how we were going to do this.

So in the first two years, we had a studio, a room in the basement of Building 26. It used to flood all the time, but that's where we had the DDP-24. And it was far enough off the ground so it didn't matter if there were six inches of water on the floor. It was okay. [laughs]

But that's where we—it was still good enough to do—to do D-to-A [digital to analog] converters. The actual synthesis was being done on the IBM 360 in the next building. And so that's how we did our initial compositions here.

Then when it got to the point that I wanted to do something special for MIT, I started, then, to design a digital synthesizer. And I actually—I mean, I spent about two years doing that. Starting very soon after I arrived at MIT, I was—in parallel to this MUSIC 360 thing, I was designing a real-time digital synthesizer.

I still think that's the best work I've ever done, designed this really great synthesizer that had digital filters and oscillators and things like that, and the control structure that would allow us to do performances in real time. Because I thought performing in real time and being able to interact with the machine, so that you wouldn't have to do what Marcus Thompson had to do, listen carefully. But you could actually have the computer, then, listening. Doing this sort of thing would be the way to do this in the future.

I peddled this design to people like Marvin Minsky [MIT Professor of Computer Science] and also [Edward] Ed Fredkin [MIT Professor of Computer Science, 1968–74; has been visiting scientist at MIT Media Lab], who at the time was the head of Project MAC [formerly, LCS—laboratory for computer science; currently, CSAIL], what later became the Computer Science Lab. And they thought this was a good idea. But then Ed Fredkin said, "You know, building digital technology like this should be happening in industry. You shouldn't do this at MIT. This is where we can experiment with things, but you shouldn't do something like that."

And so what Ed did was to negotiate a PDP-11 from Digital Equipment Corporation. And so after the first two years, I was suddenly given a PDP-11. "Given," because it actually came free of—free of charge.

What had slightly preceded that is that when I had given a presentation on my digital synthesizer design in probably '72—I was give—gave that to the humanities department at a faculty retreat we had out in—at the house [Endicott House] out in the western suburbs [Dedham]. Jerry Wiesner, who had been part of my coming here in the first instance—

LARSON: Right, and that was President—MIT President Jerry [Jerome B.] Wiesner. Yeah.

VERCOE: Yes. Had sent out the Dean of Engineering [probably Alfred B. Keil]—to actually hear my talk. And he decided that what I was doing was really something innovative and would certainly fit in to the, sort of, engineering goals within the School of Engineering. So I suddenly had the support of the engineering heads, at least.

And so regarding my digital synthesizer, Jerry Wiesner said, well, instead of having it built, that he would have Digital Equipment build it for us. And so that's when—that's when I thought, "Well, okay. This is—we're now on the road." And Jerry was going to do that because at the time, Digital Equipment Corporation was owing MIT money, the royalties, I think, for the PDP-11? No, the PDP-10 that had come out of some of the research that had been done here at MIT. So the PDP series of, you know—had some royalty money. And so what Jerry was going to use was simply to use the royalty money to have DEC build this digital synthesizer.

At that point, I got cold feet. And this is one of my big regrets. I think it's the best design I've ever made. I think it would've been a wonderful instrument, ahead of its time as a digital synthesizer, when everyone else was using Moog and Buchla boxes.

But I began to see myself as forever maintaining hardware. And Ed Fredkin said, "Barry, you should just do the whole thing with—with your own computer. Instead of using the big IBM 360, you should have a PDP-11, make your own programs, get a D-to-A converter, and do it all that way. It won't be interactive the first few years, but ultimately, this—this will become interactive."

So I went along with that idea. And so in 1973, we then took a—took delivery of a PDP-11, in fact, an 1170, the top model that DEC was producing at the time.

Well, what happened—how that came about is that Ed Fredkin was negotiating with DEC about—because I had specced the design that I wanted—this and so much disk, and so much this, *et cetera*, so much memory, *et cetera*. And he was negotiating with DEC about having them give a machine or something like that.

And then that following—that summer of '73, DEC suddenly called up Ed Fredkin and said, "There's a machine to your spec sitting on the loading dock. If you move it off the loading dock before June 30, it's yours." I mean, June 30 being, you know, the—accounting for another machine out—completed, and so you're on the register that way.

And so Ed said, "Right, we'll do it. Move it off—move the machine off the loading dock." And then we got the machine here and set it up. Now it went into Building 26, not in the basement, but up on the third floor.

A week later, DEC called up Ed Fredkin and said, "Now, about the cost of that machine." And Ed Fredkin says, "Well, we weren't expecting to pay for this." He said, "The only difference between what we—the negotiations we had before and now is that now the machine is here." [laughs]

So that's—so DEC got some mileage—they got some—they sent a photographer. We got, you know—DEC gave this big gift to MIT. So they got some PR out of it. But that's how we got the PDP—the PDP-11 here.

The space we put it in was a lab that Amar Bose was about to give up. Bose had been doing his resear—his research at—like a—the normal professor at MIT, half a sort of research thing, and half teaching, *et cetera*. But he decided—when he decided he wanted to do all his research out in industry and didn't want to do any more research here, thank you, he was such a good teacher that MIT cut him a deal. They said, okay, you can still keep the title if you teach one course. [laughs] And so he continued to teach the thing.

But on his moving out, moving his research off there, there was suddenly this room up in Building 26, 26-311, that was acoustically treated. And so it was just the thing I needed. So we moved into Bose's space, took over his. And Bose left me a couple of his, you know, little tape recorders or something that was there.

But basically, I took over the Bose lab, or what was left of it after he moved out. And that's—became the—the Experimental Music Studio [also known as EMS; 1974–1999]. And with the PDP-11, that's when I then started to write MUSIC 11, as opposed to running MUSIC 360 on the campus machine.

8. MIT summer courses in Computer Sound Synthesis and Composition (74:19)

VERCOE: And that's what—when we got into this whole series of what ultimately became summer workshops for composers. And they ran those for several years. There would be something like 35 composers would come in. So I was—give a two-week course on digital techniques, of oscillators and filters, and, you know, how to write pieces, and that sort of thing. [Ed. Note: This course called "Techniques in Computer Sound Synthesis."]

And then from those 35 people, who were all paying—they were paying about $1,000 or something, $1,500 to come and take this course for this two-week summer. It was when people were, sort of—just wanted to get some—some chops in digital techniques and so forth. They'd come and take this. And from those people, I would then choose 10 to actually complete a piece.

So by that time, we already had, three weeks into the future, we had a concert in Kresge scheduled. We just didn't yet have any pieces. So the 10 that I picked out as

the most likely to be able to complete a piece in the next three weeks then got to stay on for those three weeks [course called “Workshop in Computer Music Composition]. And we would just work around the clock getting those pieces done. And that was the summer program.

And it was a very popular concert—free. But computer music, at the time, 1973, quite novel. We overflowed Kresge [Auditorium] every time. Kresge doesn't, sort of, degrade gracefully when you've got speakers up in the corner, 4-channel speakers, Klipsch horns. And there was, just—it was always a big crowd. It was quite a thing.

You wouldn't get that sort of crowd these days with a computer music concert. Nothing novel about that. But in '73, well, through that—through the '70s, it was really quite a novel thing to do. And I did that every year before I went to IRCAM, even after I got back from IRCAM in the '80s.

LARSON: So what was the impetus to start the summer workshops?

VERCOE: Oh, I suppose spreading the word. Giving away what I had done. So everybody who came, of course, got free copies of the—so—of this program they'd been using, MUSIC 11. And they would go back to their own places and try to get a PDP-11 to run this program on, *et cetera*.

And they'd—they would go out of the—well, those who were composers would come here, in two weeks they would get the basis of digital techniques and how to write for this machine. And they'd go out—three weeks later, they'd go out there with a completed piece under their arm.

So for those who really tr—really put in the effort, it was a big step for them from no digital knowledge to walking out the door with a piece under their arm, not just the piece, but actually a media review. Because typically, the—[laughs] the newspapers would be there—news media were there. So they'd go out with a piece and a review of the piece, *et cetera*, all in the space of four, say, four weeks.

So it was a big attraction for people to come in and really work hard. And they did work hard. We ran that machine around the clock. People were, sort of—you know, had the midnight hour, sort of, 12:00 to 2:00, or whatever it would be.

And there was—[laughs] there were a lot of cases of people sort of working in the cracks and using time they shouldn't be using, *et cetera*. Because they were very, very competitive. But that got a lot of pieces done. And that's how the series of these summer workshops arose and got quite a reputation.

Meanwhile, Stanford was doing something similar. So what was happening at that time was people would sort of do their rounds. They'd do the New Hampshire or Vermont workshop that Mario—Mario Davidovsky was running. And they would do the Stanford summer program and the one here. So all three, peop—most people would in three years have taken them all.

ETHIER: How did that musical influx every summer affect the design and development of the tools?

VERCOE: Oh, the tools were precisely a result of the pieces. Yes. Csound, even, but particularly MUSIC 11, is where a lot of this stuff—MUSIC 11 was where I first came up with the distinction between audio signals and control signals. So that what you find in Csound are k—k-values and a-values. A-values are the audio streams, and k-values are the control streams.

That I actually copied—I copied that from the Buchla synthesizer. Because whereas on the—in the Moog synthesizer, you had sort of one set of patch panel—patch cords and things, and then everything was essentially audio signals. In the case of the Buchla box, Don Buchla had different colored cables for control signals and audio signals.

And it was—became very plain to me that in the digital domain, you need to do the same sort of thing. You need oscillators and so forth that put out the audio signals, but you control the frequency of those things, vibratos and envelope shapes, and so forth, with much slower-moving control signals. You needn't waste a lot of compute time on things that were, in fact, moving slowly.

In fact, the human ear doesn't hear audio. The human ear only hears control signals. So what you're really playing to, then, is the capacity of the ear, which—you know, it can't hear changes any faster than perhaps, you know, 1,000 times a second. That's the fastest that the neurons can move.

So you only hear things that can—that are changing at that—with that as the, you might say, the sampling rate. So any vibratos and envelope shapes and so forth can be very adequately represented with—with lower frequency. You might be running a 44.1 or something high—high data rates for the audio, but you don't hear audio. The ear only hears control signals. And so by being able to build up a very complex control structure, you get very complex, structured pieces.

So it was important to develop the—the control part of the—of the software. That wasn't part of MUSIC IV. MUSIC IV didn't have control signals. But I put those into MUSIC 11. And that's how we got a lot of the really fascinating pieces, because of the—the richness of the control structure that we had in the—in that program.

LARSON: Tell me about some of the notable pieces that came from the workshops. I notice that one of the pieces was by this gentleman, Andrew Culver, who was later known as—he did a lot of work with John Cage. But do you remember his piece?

VERCOE: I don't remember his piece very well. No, a little bit about it. But no, I couldn't speak to it.

LARSON: Do you remember working with him at all?

VERCOE: Well, I mean, at the time, I had 35 students who were in his class. And although it was reduced to 10 who then got onto the Kresge stage, and I was working with them all. I do remember Andrew—tall person, and—but I don't remember the details much of his piece. A lot of other pieces did stick with me.

LARSON: There's a piece by Charles Dodge called "Any Resemblance is Purely Coincidental," a piece for piano and tape. And it was performed by John Buttrick, who was on the faculty here. Do you remember that piece?

VERCOE: I remember the piece. He didn't do it here. He did that down in Princeton.

LARSON: Oh, because I thought I saw it. Okay, there was a list of pieces that came out of the studio. I didn't know if that was—okay, it wasn't done at Kresge, then.

VERCOE: It was performed in Kresge, yes.

LARSON: Yeah, it was, okay. Oh, but it wasn't—

VERCOE: It didn't come out of the studio here.

LARSON: Oh, okay. Okay. Any notable pieces that you recall by the students in the workshops?

VERCOE: From the workshops? Well, we moved from workshops ultimately to commissioning composers. And that was sort of a second phase. In the very beginning, the pieces that just came out of the workshops themselves—there was a piece that Peter Child did [Ed. Note: Peter Child was a graduate student at Brandeis University at the time of the workshop. He is currently an MIT Professor of Music]. There was a piece—

LARSON: Was that that piece called *Ensemblance* [for flute, clarinet, piano, percussion, violin, viola, and violoncello and computer sound]?

VERCOE: Yeah, right. Wonderful piece. Now that just came out of a workshop. So he was in—he was one of those composers. He came in, two weeks, sort of got some chops, and then in three weeks did the piece. And so had elevated himself from no knowledge to being, you know—to having a piece and a—and a newspaper review under his arm.

And let's see, Richard Boulanger [Professor of Music at Berklee College of Music] did a piece called *Trapped in Convert*. That also came out of the—the studio. Let's see. There were other pieces.

There was a British composer by the name of John Lunn. He was actually from Glasgow. And he came and did a piece called "Echoes," I think it was called, a really fascinating piece. He decided—he was an okay pianist himself, an amateur pianist. And he wanted to do this piece in which you would play something on the keyboard, and then the computer would do—so you'd play *bom*, and the computer would do *da, da, da, da, da, da, da*—would sort of echo this in a little way.

Combining analog, or piano analog, with digital technology, or pre-recorded sound, because these echoes were pre-recorded, meant that the—all the—the composer had to—the performer had to do was just to beat the echo by the right amount. So, *bom, bom, bom, bom bom*. *Bom, bom, bom, bom, bom*. *Bom, bom, bom, bom bom*. So it was a very tricky thing to actually play. And John actually did a wonderful performance of, of his "Echoes" for piano and computer.

I was—I would never have dared do that. [laughs] But it's—I suppose it's a measure of creativity that—and innovation that people get to doing things that they don't understand are not supposed to be the way they—they work. I don't think John realized how difficult it was going to be to synchronize things this way. But he decided—he committed himself to doing this piece and eventually learned how to—

how to perform this, just having a very acute sense of timing. Just when to play this thing ahead of the tape part that you have to know, of course, very well.

But it's always the case that if you don't know that this thing is impossible, you sort of just go in and do it anyway. And that's a lot of what innovation is about.

LARSON: That's very much the MIT way, too.

VERCOE: Yeah, yeah.

9. Teaching computer music courses at MIT (85:25)

LARSON: So tell me about some of the undergraduate electronic music courses you taught during the regular school year. There was one called 21.828, "Electronic Music Composition," another one called 21.671, "Digital Music Processing." So tell me about the undergraduate courses.

VERCOE: Yeah. Well, by then, I had—Csound [computer sound synthesis program by Barry Vercoe] was probably running. Maybe the first instances of those courses would have been using MUSIC 11. But once I had a good package of things that people could learn and learn about.

When I was teaching the course on digital music techniques, a course would take them through the—even the structure and the content of the MUSIC 11 program. So they would see how filters worked and so forth. I firmly believed that people should understand something about the contents of digital processing modules.

Otherwise they—so that they'd understand, you know, what's happening and how they can sort of get control of this. Otherwise, they—if they don't, and if it's just a big black box, they're in con—in constant fear and dread that the computer is going to eat their piece or something like that. So they need some, some familiarity with what's going on.

And so that, that—the first course, which is sort of taking the, the two-week summer course and making a whole semester out of it, is teaching the techniques. And then the follow-up, then, would be, okay, now let's write a piece using these tech—techniques that you've done. And so what then became, you know, "Writing for Computer Performance" or something would be a follow-on from that sort of thing. That people were presumed to have knowledge of the media before they could then get in and be writing pieces.

In writing pieces, I—while I did condone pieces that were just for computer alone, I always try to encourage people to write pieces involving instruments. All of my pieces involve instruments, you may notice, because I just love instruments. And I think they still— that instruments are king, still. And at some point, the computer might emulate a whole lot of those things. But not yet. And so I just loved the idea that the instrument would lead the way when I wrote my viola piece [*Synapse*] for Marcus Thompson [MIT Professor of Music].

There was an occasion there where I had designed this envelope which went—it had a particular attack shape. It had a steady state period in which there would be sort of a decay. And then there was a release. So attack, decay, release, a typical thing in an envelope.

And what I was doing in this early version in MUSIC 11 of this thing called "envlpx," an exponentially controlled envelope, was pegging the—the rate of decay, so that after a certain number of seconds, your envelope would have decayed, and—just like a piano. Hit a piano note, and after two seconds, it's gone down to some predictable amount. And that's the envelope that I was using in my "Synapse" with Marcus Thompson.

I found that Marcus had envelopes that were most unlike that. Because string players can have control over this, the pseudo-steady state. And they don't have to end. It doesn't have to go down.

He—he can—and he would use this as a means of articulation between notes. He would sort of get out of there quickly, so articulate in between notes. And, and—or some other times, he'd sort of let—had the, the rate of decay very slow. And so I changed the—what the envelope module in MUSIC 11 was to something that more approached what a—what a string player could do, someone who had control, who had a musical, listening control over the envelope of the note. And that's the way you actually can—can induce phrases and things.

Now pianists, of course, who have no control of the, you know—are able to induce phrases. Of course, they would, you know, release early, or whatever it is. But string players have a very different way of inducing phrases. And I decided that the computer version should be more string-like than piano-like because you've got so much more options—so many more options and so much more control.

And so that's an example of how the modules within MUSIC 11 and ultimately in Csound came out of pieces, out of real life challenges. This doesn't work. What do we need? Change it. Make it do this instead.

And now, now we have a phrase that can—we can actually have the computer match what Marcus is doing. He doesn't have to play his viola like a piano. And of course, the piano option is still there. But you have to have something that gives the computer composer, or the computer performance, the same sort of options.

ETHIER: So this work, in a way, was driving your understand—your attempt to better understand actual performance, between what happened with IRCAM [Institut de Recherche et Coordination Acoustique/Musique in Paris, France], with trying to follow a musician, and learning about the timing between an accompanist and a performer, and the, sort of, looking really at the detail of a phrase and how a violinist—so that was actually helping to drive your own musical understanding as well.

VERCOE: Yes. Well, in both cases, it was—in the case of IRCAM, where we were finding things about the relationship between the soloist and the accompaniment, and so the, the solo plus accompaniment has this certain kind of thing it's like then if the accompaniment follows along behind. If you—if you listen very carefully to

recordings of things like that, there's this gap. It's like the, Prince Philip following the Queen. There's sort of a certain distance behind that, that is appropriate.

And it depends on the nature of the pieces. If the pieces are differently constructed, more contrapuntal, then it's, it's of course tighter. That's what, what happens with voices that have equality. They're like this, with one—with one reservation. In scores, there is usually—in a contrapuntal context, there's usually one leading voice.

In [Arnold] Schoenberg scores, you'll find the *Hauptstimme* markings. So that there's one voice that really is supposed to be in the lead, and the others have a subservient role. So in, in Schoenberg, you find that, and Berg also, the *Hauptstimme*, and in the—the voices. And that's sort of part of this thing here. So it's not strictly equal contrapound. It's count—counterpoint in which there is a leading voice, a *Hauptstimme*.

But to give the performer or the computer performance that sort of option is to really have a very differently structured thing. And so you've got to have something in which it's able to hear, to follow the leader, but then decide, you know, to be a certain distance behind.

And I think I've derived a lot from listening to chamber music and working with Marcus Thompson, who is a chamber music performer and, in fact, teaches chamber music here. I learned a lot from how chamber music players interact, sort of this small society of performers, in which one player—it's egalitarian society. One player is willing to take the lead, but equally willing to give it up. And that's real chamber music. So, to have—to have—

LARSON: You continued to work on this interactive digital technology even after IRCAM. You continued to—

VERCOE: Yes, yes, to some degree. But not at the rate at which I was working on it at IRCAM.

10. International conferences on computer music (93:55)

LARSON: So in 1976, the first International Conference on Computer Music was held here at MIT. And you were the conference chair. How did that all come about? And why that conference was held.

VERCOE: There had been another conference, a computer music conference, in 1974 or 5, I think it was, at Michigan State University. And David Wessel was there at the time. And it was—David was very interested in having, you know, computer something or other working in '74, '75. And he got some money from the National Endowment for the Arts, for their jazz program, to actually run a conference.

And a lot of us went to that conference. And that's when I first of all talked about my digital synthesizer design. [Peter] Pete Samson from Stanford came and

talked about his digital synthesizer design, which you may have heard Pete doing—speaking about.

[James] Andy Moorer from Stanford was there. He had—was, you know, one of the—he was a—he was an MIT alum, actually. It's a—Andy Moorer, did you know that? [laughs] And so he was there talking about some of the work he was doing with John Chowning. I don't think John Chowning was at that conference.

John Grey was there. These people were working in aspects of timbre, timbre recognition and so forth. Well, doing multidimensional scaling of timbres, placing the different timbres of the in—instruments you orchestrate in a three-dimensional space or N-dimensional space. Interesting work.

In getting to that conference, I went there with my sidekick here from MIT, Steven Haflich, who had been a student of mine here. And Steve and I went—were going to this conference, too, to present some things. But there was a snowstorm. We got down to the airport here [laughs] and found that Detroit, which is where we were planning to go through to get to East Lansing, Detroit was closed. Oh dear.

So I said to the people, "Okay, what's the nearest place we—that's still open?" They said, "Well, Chicago's open." "Okay, let's get to Chicago. So change our ticket. Let's—get us a ticket to Chicago." So we went to Chicago, which was still open. Of course, that's on the other side of the lake.

Got to Chicago and found in the airport John Grey, Andy Moorer, [laughs] Pete Samson, all these people from Stanford who'd planned to come early, and been in the airport there for like a day and a half. They'd spent two nights there already because East Lansing was closed. They got to Chicago all right, just as us. So here we were, the—sort of the essence of this first computer music conference, all in the Chicago airport. And there was no prospect of the commercial flights going there.

So I walked around the airport. And they—my friends, you know—any more—and everybody—they were, sort of, in sleeping bags and, sort of, lying around the airport there. And I went around and found a total of a dozen people who wanted to get to East Lansing.

And I chartered a plane. Chartered a small—it had two engines, I think—I think that's—[laughs] because flying over Lake Michigan in a snowstorm with only one engine didn't seem like a good idea. But two engines, okay, I'm happy with two engines.

So I chartered this plane and, you know, took up a subscription from everybody. So they were willing to sacrifice—to trade in their tickets for, you know, a part of this thing. And we sort of got to East Lansing on this, flying over in the middle of a snowstorm, just flying over Lake Michigan.

And we arrived, and the conference happened. And so that was really the first computer music conference. It was something that Dave Wessel had done on his own, really, put together.

The following year, then, in '76, was it? Is when I decided then to do the follow-up on that. And while that had been called the first, you know, first

conference, first computer music conference, I named this the first international conference, so the ICMC or whatever. The international bit came from my, sort of, raising it up a notch and having people come from France and various other people—from various other places. So that's how the thing at MIT happened. [Ed. Note: The ICMC now lists the MIT Conference as the 3rd International Computer Music Conference.]

11. Orchestral composition—*Metamorphoses* (98:57)

LARSON: There's a piece—an orchestral piece of yours called *Metamorphoses* that was premiered by the Cincinnati [Symphony] Orchestra in 1965. It was conducted by Max Rudolf.

VERCOE: How did you find out about that? [laughs]

LARSON: Doing some research, you know. Do you want to talk a little bit about that piece?

VERCOE: Yeah, okay. It's a piece that I wrote when I was working with Ross Finney on a piece for orchestra. So I had come from—I was tea—at the time, I was teaching at Oberlin Conservatory. But I was still finishing my work with Ross Finney in Michigan.

And the piece hadn't been performed. I'd written it with Ross, but I hadn't yet had a performance. And I submitted it to the Cincinnati Orchestra. And they chose this piece to have a sort of a reading, if you will, and a recording, a reading and a recording.

I was very impressed, when I got there, with Max Rudolf. Not a hugely well-known conductor, but just his way of going about this impressed me. And you'll see in a minute why.

The piece was somewhat contrapuntal. And it was a fairly—fairly big piece. At one stage in the rehearsal—so I was just sitting there and he was rehearsing orchestra, and, you know, "Let's try this movement again," *et cetera*.

And at one point, he came down from the podium and said to me, "I feel here that there needs to be sort of a lead melody and a sort of subservient part. So can you please tell me which are the—which are the lead pieces, and which are the subservient parts?" And I said, "Okay."

He didn't mark the score. He just said, "I—this page, Okay. This is the most important. And down here, it's this voice here, and this voice." He didn't mark it at all. He said, "Okay," and went back up on the stage.

And he said to the players, "Okay, this time, watch me." And he did it. I was very impressed. [laughs]

But that was just reaffirmation in my belief that con—counterpoint is, you know—has *Hauptstimme*. And though I hadn't marked *Hauptstimme* in the score, the conductor required it, and—in order to—to breathe some—put some air into the piece.

LARSON: I'd love to hear a recording of that piece sometime. I don't know if you have a recording.

VERCOE: I've got it somewhere, yes. I've in fact rescued the score of it just last week, when I had to clear out my closet in the Media Lab.

LARSON: Maybe we can get a copy for the Music Library, too.

12. Thoughts on computer music (101:50)

LARSON: So I want to ask you about some early music—early computer music, aesthetic kinds of questions. So from the beginning, this technology wasn't just for modernist composers. But many modernist composers were interested in it. But there were other applications and reasons for some of this early research. Can you talk about what some of the pragmatic goals of those early years were?

VERCOE: Well the early experiments at Bell Labs were applications of mathematics, I suppose, Max being an engineer. And even the people that he collected around him were people who were mathematically competent. For instance, one of the brilliant minds down there that was attracted was someone by the name of David Lewin—

LARSON: Oh, yes.

VERCOE: —who ultimately ended up teaching at Harvard.

David Lewin had gone through Harvard as an undergrad in mathematics, actually. In fact, he got—he graduated summa cum, not magna cum, but summa cum in mathematics, and then decided, well, there's no real future in mathematics, I'm sort of interested... And so he went out to Stan—to Berkeley, I think, and did his—did a Ph.D. in composition. So he sort of worked as a composer from then on, as a composer-theorist.

He became a fascinating theorist because he had the ability to go in and take Fourier transforms of all these sort of music theoretic things, things that Allen Forte could not match. And so at some point later, then, Allen Forte appointed David to join the music theory faculty at Yale. Ultimately, David came to Harvard.

But after I started the studio here at MIT, during which time David, I think, at the time, was still at Stony Brook, before he went to Yale. He had a—took a sabbatical year and was actually at Harvard for one year. And he spent almost every day of that in the studio at MIT. I used to give him a ride each day from where he lived in—out by Fresh Pond [Cambridge, MA]. And he had some great insights into things.

Two or three of the what you might call up-codes, the sort of signal processing things in Csound, owe their origin to David Lewin. There's a—I'll just give you an example, one of those. I had something called "buzz." It's a—

You can divide one sine tone by another and then get a whole spectrum of sine tones from this—a whole spectrum of cosines. So that, essentially,

$$\sigma \cos(n\theta) = \sin(\theta) / \sin(\theta / 2)$$

So that's a simple formula. So by just generating two sine waves and dividing one—one by the other, you can actually generate this whole spectrum.

And "buzz" was a good way of generating a glottal pulse. So you could—because you had a bandlimited pulse train, just as the glottis produces a bandlimited pulse train. And so we were using this for speech synthesis and so forth as the driving function for speech synthesis. So you would have this buzz generated, and you'd follow that with a bunch of signal recursive digital filters, representing the formants of the mouth.

David looked at this and said, "You know, the buzz formula you've got is just a special case of a general thing that we could actually create." So he came up with this thing called "gbuzz," in which you had all sorts of controls over the content of the signal. You could, instead of there being equal strength cosines—the cosines were, you know, on the level like this and then flat. So you have all the equal strength cosines and then flat—you could actually have these things that were sloped down or sloped up. So you could emphasize the highs or emphasize the lows just by changing the formula. Instead of being a simple sine wave divided by another one, it was a slightly more complicated sine wave.

This is the sort of insight that David, as a mathematician, would have. Fabulous pianist himself and music theoretician, but also having this mathematical insight. So that's another example of the intersection of science and technology, science and music, I should say, the contributions that people like David Lewin had made.

Now David had been down at Bell Labs working with Max in the early days. So he'd been attracted to what Max was doing and the idea of being able to control things in very special ways, had not the two been available to compose, such as using analog techniques.

LARSON: So there were other people who were interested in not only analog electronic music, but the digital stuff, because they saw it as a way to break with the past, and saw new musical resources that just were not related to the Romantic tradition. They wanted this modernist break.

How did you see that when you were—yourself as a composer with some of these new resources? When I first heard electronic music, that was the first thing that attracted me. I always thought that was almost a new art form.

VERCOE: It sort of has a mathematical purity about it, or can. And that was very appealing to a lot of people. Not to me. Even though I was creating the means by which people could compose and build up musical structures using these things that I had developed, I was not particularly attracted to composing that way or thinking that way.

As I said, instruments and the voice have been sort of my driving force. You know, it's my, sort of, belief in choral music and so forth that leads me to write things

that are for instruments as well as computers. So I very rarely have done things for computer alone because it just lacks the kind of a life, although it is interesting to look at a structure that's totally prescribed, as you might—as you could well have in computer music. And there's an elegance about that, too.

I mean, I like a lot of the pieces that have come out. For instance, there's one of the pieces that came out of the studio by [James] Jim Dashow, who, when I was in—at IRCAM on the Guggenheim [Fellowship], I brought Jim Dashow from Italy to come and teach my course here and run the studio. I had enormous regard for Jim's musicianship. He was actually trained at—out at Brandeis [University].

And he wrote a piece when he was here—it's on the CD, our CD, called "In Winter Shine," stemming, I think, from his experience of walking across the bridge over the river here. Because he had had digs over in the main part of Boston. And he was struck walking across in the winter, with the sun coming in over the river. So he wrote this piece called *In Winter Shine*.

But it's an amazing piece. And he found a new way to relate consecutive timbres as follows. That he would—it's—it sort of reminds me of [Franz] Schubert and Schubert's modulations, where Schubert would have a common tone from one chord to the next chord, so—and it would—even though the other—there would be three new notes. There was one note that was common to these things.

And Jim was doing something like that in the area of timbre. That he had—he would create timbres as non-harmonic overtones. So we're not talking about, you know, sort of strict harmonicity and root forming situations, but non-harmonic overtones.

And you'd have these two things. But there would be two notes common between this timbre and the next timbre. And there was sort of a logic to it.

And Jim's piece "In Winter Shine" is just full of stuff like that. And when you hear it, it's just beautiful. It just seems to sort of flow.

It's clearly not consonant. It's not simply consonant. There's a lot of dissonance in these timbres.

But the timbres seem, sort of, to have a logic about them. And that's it. That's the secret of it. And Jim did that. He worked that out when he was at the studio here and teaching my course, essentially.

ETHIER: So you made a distinction between a computer and an instrument. So would you not view a computer as an instrument, given how the technology has evolved?

VERCOE: I don't know. An instrument is something you play, isn't it? I don't think the computer is to the point yet where you've got—where composers/performers have got real control over what goes on there.

ETHIER: So what's missing in your eyes?

VERCOE: The fact that music, in my view, is sort of an extension of body movement, expression, and so forth, is sort of a—that just—that—that just isn't in music that's strictly computer. That just—we just don't have that. Maybe we'll, you know—brain

things later on, we'll have some way of doing that, or shaping things with your hands, and all that sort of thing.

And to be sure, there are controllers that allow that these days. And even, you know, the control—the MIDI controllers, you can sort of shape. And there's a whole coll—there's a whole raft of 127 MIDI things that are devoted to controllers.

And so I don't mean to say that that's not there. But I don't feel it the same way, somehow, that one feels from—one gets the feeling from live performance. So I think it's an instrument in the making. And I'll make the analogy as follows.

In the 15th century and 16th century, there were instruments called a viol. Okay? They were stringed instruments. You sort of played it like this. And it had a sort of not very sexy body. It was, sort of, you know, that sort of shape. It didn't have—and it had frets.

And the instrument makers at the time started fooling around with this. One of the things they did was to remove the frets, so you could then do vibrato. And the other thing they did was to give this in—this new instrument a sexy kind of shape and give the whole in—this new instrument a name, a different name.

It wasn't viol. It was called, they're called a violin. It was about 1580.

What the performers—I mean, ins—these instrument makers were probably experimenting with all kinds of things. But this one seemed to catch on for the reason that the fact that you had vibrato available, and also this very curved resonance cavity that gave rise to a very large spectrum, created a sound that was differentiable from other instruments. And that's because when you vibrate on an instrument like that, all the harmonics are sort of moving with the fundamental.

And it's this movement of harmonics that enables the ear to latch onto that as coming from a single source. Because there's a, there's a—a—what would you call it? There's a sort of similarity of motion. And it's the similarity of motion of harmonic components that enables us to sort of think, well, all of that must be coming from one place.

And you didn't get that with a viol. Because the frets prevented the vibrato, and the harmonic structure was not too interesting. But this new thing that they called a violin had that ability.

And what you get coming out of that is then, beginning with the violin, you get a whole new thing in which it's sort of the beginning of instruments having their own, sort of, life. You go from choral music, in which the instruments—you know, Renaissance choral music, in which the instruments play a subservient role, usually doubling the voices, but apart from the odd piece for just the viols and so forth, you don't get a real tradition. You get into the Baroque period where suddenly the instruments take over. And they determine the style.

That it's an instrumental period. It's an instrumental style. Even Bach's choral music is instrumental, as opposed to the choral music that you find in the Renaissance. But that took quite a number of years for these instruments—for this—this instrument, the violin—the violin, and other instruments of course. Coming from

that, you eventually get, you know, the beginnings of the violin concerto and the concerto grosso and so forth. Then you get also—

But what you really have there is another medium. You've got the vocal medium and also the instrumental medium, now, in its own right. So you can have pieces for instruments. You can have pieces for instruments and voices, oratorios or what you—whatever you—whatever—or opera, whatever you might want to call them. But there was quite a large period before the instrumental medium became mature, you know, 150 years or something like that.

Now in the 20th—21st century, you've got—where we are now, we've got a third medium, the electronic medium. It's in its infancy still. It doesn't really yet have the mature—maturity of the previous, the voices and the instruments and so forth. The electronic medium is still in its in—it'll take a while. But ultimately, you will have the same sort of real combination of instruments and voices and electronic parts in which they have equality.

[End of Interview]