Oral History of Dave Smith

Interviewed by:
Alex Bochannek, Computer History Museum
Gene Radzik, Audio Engineering Society

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Gene Radzik: The time is eleven o'clock (a.m.), on Monday, October the 29th of 2012. I'm Gene Radzik, of the Audio-Engineering Society [AES].

Alex Bochannek: And I'm Alex Bochannek, with the Computer History Museum [CHM].

Radzik: We're located in San Francisco, California, at the mixing studios of Dolby Laboratories, with Dave Smith. Thank you for granting us this interview. For this oral history, I'd like to begin by capturing your backstory. Would you mind telling us when and where you were born, and how audio entered your life?

Dave Smith: All right. <*laughter*> Going way back, I was actually born here, in San Francisco, 1950—while back. I've always lived in northern California, the Bay Area. I moved around a little bit: high school in San Jose, college in—graduated from Berkeley, 1971, with a degree in Electrical Engineering and Computer Science. I used to dabble around in pianos and guitars when I was a teenager. Played in a couple of bands, played guitar or bass guitar in college. I've always had a little bit of a music bent, but never a professional level. Played a few shows, but that was about it. Then, of course, I got my degree from Berkeley, so I was definitely a technical guy, also. That's kind of my rough background. We always had a piano in the house. My mother played the piano, so I'd play around on that. I always had this interest in music.

Radzik: Can you tell us, then, what led to your involvement with synthesizers?

Smith: Well, I graduated in 1971, and first got stuck in Aerospace; this was back in the days when engineers were not in demand. I worked at Lockheed, I think, first, down in Mountain View or Sunnyvale. It was about—I think it was probably about 1972, somebody told me this little music store in Santa Clara had this synthesizer there. I had heard synthesizers, but had never actually seen one in person. I went down there and looked at it, and it was a Minimoog—the first portable, real synthesizer on the market. I got so excited about it that within the next week, I got a loan from the Lockheed Credit Union, and went back and bought it, just for my own use. It was just perfect: a combination of technology and music, my two main interests. That's what really got me started.

Bochannek: You mentioned that your degree was in Computer Science and Electrical Engineering, from Berkeley and you then went on to work at Lockheed. Can you tell us a little bit about your exposure to digital technology, and computing technology, in general: what type of work did you do?

Smith: Well, the first work I did at Lockheed had virtually nothing to do with anything; it's kind of embarrassing to talk about the silly job I had there.

<crew talk>

Smith: Yes, basically the work I did at Lockheed was very uninteresting. I made a transition to General Electric next, where at least I was able to write software and do real engineering work on big systems that were highly secret at the time. My next job after that was— let's see; I went to Standard Microsystems. From then, I actually got into some real technology: microprocessor-based work, working for a silicon company in San Jose at the time. From there, I went to Signetics, where I worked on microprocessors. They had [a] 2650, I think, which was one of the first microprocessors to come out, at about the same time as the 8080. In some ways, I thought it was a better chip than the 8080, but Intel was a little bit earlier and a little bit better at marketing it. From there, I went to Diablo Systems, where I worked on some printers and terminals and things like that, doing a little bit of hardware, a little bit of software. I was getting my feet wet with— I was very comfortable with microprocessors, software, and the whole thing tied together. That's kind of how I got into that side of it. I was still working for the first five or six years out of college at a real job.

Radzik: And getting from a real job to the music industry, as one would like to say, and having that as your day job: can you share with us how you became involved with Sequential Circuits?

Smith: Okay. Well, when I got the Minimoog, the first thing I did—playing around with it, of course—I started building little things to control it: little light controller things, and this and that, little toys. Then I got a little more adventurous, and actually built this analog sequencer. It was in the old Moog style of 16 rows of three knobs that you could use as a sequencer, because I just wanted one to play with for myself. The ones from Moog cost too much; so, as kind of a side project I did just for fun. After I built it, I said, "Well, maybe somebody else would want something like this." I put a little, tiny ad in the back of Rolling Stone magazine in 1974 and ended up selling, I think, four units that way to various people. That was the start of Sequential Circuits, in 1974. That's when I came up with the company name, and it became a company. But I was still working full-time.

Radzik: What was that first product that came out of Sequential?

Smith: It was called the "Model 600 Analog Sequencer."

Bochannek: With your work in computing, was there sound involved at all? Was there anything you did in any of your jobs where there was an intersection between the computer engineering, the programming, and your interest in music?

Smith: Not back then. I mean, this is still before personal computers were coming out, so all the work was done on mini-computers. This still the age of mini-computers, more than microprocessors; there was no home aspect to all for many computers, from what I remember. So, no; I never got involved— I'm

trying to think back. In college, I actually wrote a little software program that composed a little bit of music, and printed it out on a plotter— just a single, monophonic line, something real simple, like that— as a senior project or something. But [with] any of my jobs? No, there was never any music involved.

Radzik: So, going to the Rolling Stone ad that launched the first product: what was the next evolution, from that point forward, of Sequential Circuits?

Smith: My next product was called the "Model 800 Digital Sequencer." This was the same idea—a sequencer. A sequencer is just a product that allows you to program notes. If you want to have something go <*sings*>, and then repeat that over and over again, that's what a sequencer does. It's like a very, very simple recording system. It doesn't use audio, but actually drives a synthesizer, instead. This, we'll see later, mixes into how early audio was on computers. It was the same idea: using the computer as a sequencer. My next product was this Model 800 Digital Sequencer. I think I sold a few hundred of those, actually, over the years. Initially, I was building them in the second bedroom of my apartment— because I still had a day job. This was in 1975, 1976. But that was my second product.

Bochannek: How did you finance these developments, and how did you go about fulfilling those orders, and shipping off product, and customer service—all these things you have to do when you're a real company?

Smith: Again, I was just working—I had a real job, so this was all at night, and it wasn't like the orders were rolling me over, and keeping me super busy. I was just a bootstrap operation. This is, I think, probably before venture capital was invented. Even if it was, later on at Sequential Circuits, we could never get funding from anybody—investors—because it was a niche market that nobody understood. It, of course, wasn't ever going to be a huge, monstrous business; it didn't have that capability. All of my businesses were always pretty much bootstrap; just, you know, living off credit cards. Figure out a way to make it work.

Radzik: From bringing sequencers to the market, and really allowing musicians to record their performances, what was the transition point from the 800 Sequencer to the Prophet-5, and introduction of your synthesizers?

Smith: Well, there was one more step in between, one more product. This was the Model 700. I wasn't very inventive with names for products back then. It was a programming unit. What this allowed was that you could plug it into a Minimoog, and it allowed you to program and save sounds. On the earlier synthesizers, one of the problems was that if you wanted to change from one sound to the next, you had to literally change 10 or 20 knobs, and you had to do it quickly and precisely. If, one day, you got a really good sound, and you wanted to get that same sound a week later, it would be virtually impossible, unless you wrote down where every, single knob was. So, the programmer actually allowed you to play around

with a sound. Once you got something you liked, you could press a button, and it would remember that sound for you. Since it worked with the Minimoog and the ARP [ARP Instruments, Inc.] 2600, it wasn't a 100 percent perfect method for programming every parameter; but it did allow you to actually make quick changes when you were playing live, to go from one sound to the next. This was, in 1976, '77 time frame. It wasn't until April of 1977 that I finally quit my day job, and got into this full-time. By then, I did have a tiny office with a couple of people in it to help build things, and get the units out, and that sort of thing.

Bochannek: How did this programmer actually work? How did it store the information about the settings?

Smith: There was a real tiny, little memory in there that had a—CMOS [complementary metal-oxide-semiconductor] memories were fairly new then, and they were very low-power; so you could actually put a battery in there that would keep the memory alive, or keep it from forgetting when you turned the power off. This was before flash memory and other versions of non-volatile memory. For quite a while there, the best way—and the only way of doing it—was with a battery-backed-up, low-power CMOS memory.

Radzik: Very cool. Going into getting beyond the sequencers and the programmer, you're delving into synthesizers. What was your first project, delving into synthesizers?

Smith: Well, the Prophet-5, of course, was the first real unit. My plan originally was just to build accessories; to not get into competing with the big companies, like Moog and ARP, that were actually making complete units, synthesizers. It got to a point—I think it was in early 1977—that I knew there was a chipset coming out from a company called Solid State Music, where they had one IC [integrated circuit] that was a voltage-controlled oscillator, another one that was a filter, another one that was an envelope generator, and another one that was a dual VCA [voltage controlled amplifier]. With my background in microprocessing, I knew that if you took a set of those and controlled it with a microprocessor, you could make a polyphonic synthesizer that was completely programmable. Going back into technical details here: the original Minimoog was monophonic, meaning you could only play one note at a time. If you hit five notes in a keyboard, it would still only play one note, because there was only one sound engine in there, so it could only play one at a time. My idea was, "Well, if you put five sound engines in a box, then you can actually hit five notes on a keyboard, and hear all five of them." Initially, I thought it was much too obvious of an idea, so I figured, "Moog has to be doing this, ARP has to be doing this." Of course; why wouldn't you do this? It's simple, it's obvious. After a few months, I was kind of realizing, "I haven't heard any rumors, and maybe nobody is doing this." I think I started in spring, early spring, working on the design for the Prophet-5. It was pretty adventuresome for me at the time; it was a huge project, and I kind of did the whole thing by myself. I designed the mechanical, I laid out the circuit boards, I designed the electronics, and I wrote all the software. When I say "write all the software," I think there was a two-kilobyte ROM [read-only memory] in there that held all the software. It was pretty tiny compared to what we have these days. It had a Zilog Z80 in it as the microprocessor. I pretty much worked on it for the rest

of the year, and was able to get it done enough to bring it to the NAMM [National Association of Music Merchants] show in January of 1978, introduce it to the world.

Radzik: Do you remember the—at the launch—what the response was from musicians and the music industry?

Smith: Oh, it was pretty incredible; first of all, both Moog and ARP approached me to see if I wanted to work with them on stuff. That was a sign that I probably caught them by surprise. But yes; everybody played. It was just amazing. Even though it barely worked. We had to, once in a while, power it down and back up again as it got lost or broke. But it made it through most of the show working, and it was enough of a demonstration to get people excited about it.

Bochannek: Would you say, "The response to the Prophet-5," and then follow it up with all that?

Smith: Yes. The response at the trade show to the Prophet-5 was incredible. We [were] approached by our competitors, Moog and ARP; musicians who played it loved it. It worked well enough to get through the show—not perfectly; once in a while we'd power down, power up again to get it going. But it basically made it through, and it was perfect; it was a great introduction.

Radzik: With a successful synthesizer like the Prophet-5, it seemed like a natural evolution, then, to get to more polyphony. Can you speak a little bit about the Prophet-10, and what were some of the inspirations to get to the Prophet-10?

Smith: There was an in-between step. When I designed the Prophet-5, it was meant to have two versions: a Prophet-5 version and a Prophet-10 version. Basically, you just added a second circuit board that had another five voices into the Prophet-5. The problem was that it wasn't very reliable. I was the only engineer. I didn't have a QC [quality control] lab, or QA [quality assurance]. I didn't have a lot of the benefits of doing things correctly. The demand for the instrument was incredible; we were back-ordered for a year or two, with a lot of famous musicians calling us all the time to get these things. We were just running around, crazy. What happened was: the Prophet-10 just was too hot, too much heat, not reliable enough because it was a very sleek product, and not much room inside. We finally had to discontinue the Prophet-10 because it just wasn't going to make it, and switch them over.

Bochannek: Can you talk a little bit about the direction in which music was heading that made musicians so excited about the Prophet-5?

Smith: The late '70s, early '80s was very synthesizer-oriented music. If you think of a lot of the bands back then, our products showed up on music videos, and every week, it seemed like, some group on

"Saturday Night Live" was using it. There was all that dance music—a lot of disco. The synthesizers also were being used for soundtracks, jazz musicians—you know, the Herbie Hancocks, and so forth; the Chick Coreas were all using them. Even some country music people were starting to use it because what synthesizers allowed you to do with one musician is: he could play string sounds, horn sounds, piano sounds, or just a number of different instruments, all handled by one person. All of a sudden, a band didn't have to bring a string section with them when they went on tour; they could have one keyboard player. Movie soundtracks: the guy didn't have to hire an orchestra if it was a low-budget film; he could just come in with a couple of synthesizer guys, and fill up the whole soundtrack with a very orchestral sound. The music business was getting changed, very heavily driven by these synthesizers; especially, once they became polyphonic, like the Prophet-5, and became programmable, so you could save all your sounds. You come into a session, press a button—there's one sound. If the guy says, "Oh, we need a different sound," you press a different button, and it's right there. It's not like turning a bunch of knobs, trying to get it back, and then only being able to play one note at a time.

Radzik: With all this growth around polyphony, and having the flexibility that it lends, can you describe the motivation to then create the Pro-One, and go back to mono?

Smith: Well, it was an interesting time. Obviously, we had the first year or two by ourselves, and then all of our competitors were building similar instruments. Some of them had four voices, a voice being one of these synth engines. Prophet-5 had five voices. Some had four, some had six, some had eight. Everybody was coming out with different versions of polyphonic, programmable synthesizers. At one point, after we did the Prophet-10 and the Prophet T8, we decided we'd go backwards. We made a non-programmable, monophonic instrument that was half the price of the original Minimoog. That was the Pro-One, which turned out to be a favorite for a lot of musicians—a lot in the UK [United Kingdom], a lot of bands were using them because they were low-cost, and it was more accessible to people. So that ended up showing up in a lot of music back then.

Radzik: Now, with the time period, in the 1980s, we're really talking pre-control—early sequencers, CV [constant voltage] control. What were some of the challenges in that timeframe, with regard to trying to orchestrate multiple voices, multiple polyphony, harmony and backup lines, and rhythm section, all in the digital main? Could you describe that time period for us? What were some of the challenges at that time, pre-MIDI [Musical Instrument Digital Interface]?

Smith: Well, the biggest challenge was every company was doing their own thing. One obvious thing is once you put a microprocessor in a music instrument, you can communicate digitally. That was a real obvious thing— that microprocessors are very good at that. At Sequential, we had our own high-speed serial digital interface that we use, and we built more complex sequencers that would allow you to actually overdub, and play more notes at a time, and make very long pieces of music. But it only worked with our synthesizers. Other companies were doing the same thing: Roland did the same thing, Oberheim— a lot of companies. Everybody had their own, proprietary interface. It kind of became a dead end after a while

because it wasn't easy to make a box that would convert one digital interface to another, because it would have taken a lot of hardware and software, and nobody was going to do it. That was the biggest challenge, which, of course, led to the generation of MIDI.

Radzik: Maybe on this point, a good segueway—at the 70th AES [Audio Engineering Society] convention in '81 in New York, you presented a paper on the universal synthesizer interface. Could you share with us the activities that ultimately led to the MIDI in that timeframe?

Smith: Well, like I said, this was early '80s; it was becoming obvious that we needed to do something. At trade shows—it was a small industry, this was a real small industry at the time. Everybody knew everybody else; I talked to the people at Roland, talked to Tom Oberheim, talked to the Moog people. We'd all talk about, "We really need to do something. Somebody should do something. Somehow, we have to do something." I went home after one of these shows, and decided to get a little more aggressive about it. Working with a couple of my engineers, we came up with this proposal that we called the "universal synthesizer interface [USI]." It was just a five-page paper saying, "Here's something that could be done. Here's the baud rate, here's the definition." We decided to go—I gave it, as you mentioned, [at] the talk at the AES convention. It was meant to be a proposal, as a starting point: "This isn't what it has to be, but we need to do something; here's a starting point, and let's do it."

Bochannek: How much work was going on at that time on the computing side in this field? Was there any interaction at all with consumer computer companies? A lot of home computers started to ship with sound capabilities, so was it really very isolated community from each other? Was there any influx of people, of engineers going back and forth?

Smith: There was no communication. I think the early parts of the development of MIDI— it was still pre-home computer. In fact, does anybody know the dates when the Commodore 64s [came out]? I think that was about '83, '84-ish, maybe? Apple IIes—[came out] about the same. I forget the dates, but a lot of this work was just when the home computers were starting to come out. In fact, the USI interface proposal did have—we mentioned computers in there, so I guess they must have been out by then. We said a computer could be used as a central point, controlling all these synthesizers using this interface. I guess—yes, the computers must have been out, but we weren't talking to them at that time; we were just trying to develop our own interface for the music business. Then we just assumed the computers would be a major part of that at some point.

Radzik: What were some of the challenges associated with taking the proposal at AES, and actually arriving at the MIDI standard?

Smith: It's called the art of compromise. After that I organized a meeting at the NAMM show in January, in Anaheim. This was three months later. I'd pretty much invited anybody in the industry who might be

interested, and got them all in one room. Just about everybody came, which was surprising. It was the same thing: I said, "Here's something. Who wants to get involved? Who wants to do something? Let's do this." It was weird, because most of the American companies just weren't interested. Either they thought it was too slow, and they wanted 16-bit parallel interfaces, or this or that; for others, it was not invented here, so they didn't want to get involved. I just got the feeling a lot of them didn't understand that it had to be simple; you want to compromise so everybody gets on board. Cheap, simple— get it out there. It was pretty obvious that nobody wanted to get involved. Later in that same trade show, I got together with four Japanese companies: Roland, Yamaha, Korg, and Kawai. We said, "Let's just do it on our own. If anybody else wants to join, they can; but let's get this started." It turned out that those five companies were the ones that generated what became the MIDI spec.

Radzik: From the launch of MIDI, then, when you start seeing products being developed, what was also the impact on new electronic and musical instrument design? What sort of new things did you see emerge from the MIDI standard being published? First, we need to define "MIDI."

Smith: Okay. Yes, we kind of made some big jumps there, so—

Radzik: It would be nice if you could something like, "'MIDI' stands for musical instrument, blah-blah-blah, and we developed it because we realized there was this problem, and I worked with this group of people to solve that problem."

Smith: The idea behind MIDI was: as I was saying, there was a problem that one manufacturer couldn't connect to another. MIDI is a digital interface, meant to be fairly simple. It stands for "musical instrument digital interface." The idea is that you could take any two instruments that have this common plug, and connect the two. Then one can control the other, and vice versa. Or, one can control a number of units; or, a computer can control a number of synthesizers. You can connect these any way you want. It took us a while to develop this because, again, it was compromise, and some people wanted something easy; some people didn't. Since we were the only American company, working with four Japanese companies, there were a lot of language issues we had to work through. But we got it all working. It was actually 30 years ago and a couple of months—the end of December, 1982, we shipped the first MIDI product, the Prophet-600. At the NAMM show, a month later, we connected it for the first time with another company, when Roland brought over their latest synthesizer with a MIDI jack. We plugged the two together, and it actually worked. It was kind of nice.

Bochannek: Can you define in what way it worked? What did it do, what could you demonstrate? What features did MIDI have originally, and how have those evolved?

Smith: Initially, it was very simple. We took a connection, a cable, from one of the product's out to the other product in. If you played on one, both instruments would play at the same time. Initially, musicians

really liked that, because they could take two different instruments from two different companies, or three instruments if they wanted to, and connect them all together, and play it from one keyboard. You get this huge sound coming out, because they're all adding up, playing at the same time. I don't know if you remember the videos from the early '80s, but they'd always have these keyboard players, who would have their arms stretched around five—there's ten different keyboards spread around them, trying to play them all at different times to get different sounds. With MIDI, you could play them all from one keyboard. It just enabled them to do all kinds of stuff they couldn't do before. But, obviously, MIDI's real impact came later, as personal computers started building interfaces to go with MIDI, to connect all these instruments. Because this was in the old days, where the computers were very slow, and couldn't do a whole lot. Digital audio on a computer was pretty much unthinkable back then. But, MIDI is a very low-bandwidth interface. It doesn't take many bits or bytes, and they can go very slow, and you can make a lot of sound that way. The very first home music studios were based on MIDI, where you'd have an Apple IIe, or a Commodore 64, and two or three synthesizers, and a little sequencer running in software on the computer that could control all your synthesizers. One person at home, for the first time, could actually compose music, and have it play back, all by themselves.

Radzik: So, having developed a number of analog synthesizers, and bringing this notion of the studio together, can you share the inspiration for creating a vector synthesis [VS] as part of a product called the Prophet VS Synthesizer?

Smith: Well, that was kind of a big job. This was a few years later. We went through this period that we tried to make lower-cost instruments. This is kind of funny; we actually tried to make an entry into the computer market by building little sounds cards that would plug into computers and so forth. We put a lot of effort into that, then it turned out to be pretty much a bust, because of the typical problem of being too early into a marketplace. We were, again, still self-financed through all this; we didn't have any investors. We bit off more than we could chew, and it brought us down pretty hard. We made a last, desperate effort to get back into our base business, which was professional musical instruments. That's where the Prophet VS came from: it was an idea of one of my engineers that we developed into an instrument that was very unique at the time. It was interesting also, though, because it was one of those instruments that when it came out, nobody was all that interested about it, and we didn't really sell all that many. Ten years later, it was—well, even now, for that matter, it became a very popular instrument.

Radzik: Could you describe the uniqueness of the Prophet VS? What was different about the Prophet VS, versus the other synthesizers on the market at the time?

Smith: Most of our products were analog synthesizers, where all the sound generation was done by analog electronics: you had oscillators and filters, and different modulation capabilities. This was also in the era when digital synthesizers were just starting to come out. There was the Yamaha DX7, which was the first, very famous digital synthesizer that came out in 1983, based on some technology generated here, at Stanford, by John Chowning. A lot of people were jumping into the digital side. What we did with

the Prophet VS: it was half digital and half analog. We had a lot of digital oscillators that we generated with some custom IC's that we made. Then, the signal went through analog filters after that. It was a magical combination of sound of the digital and analog combined together.

Radzik: It's been noted that it created sounds that couldn't be created on any other synthesizer. Could you maybe walk us through what made the uniqueness of those sounds?

Smith: A lot of things in instrument design end up being accidental. My biggest challenge when we were designing the hardware was that it was very noisy. Technically, the way we did the oscillators was not really the right way to do it, because we had a lot of what's called "aliasing," which was bad noise when you played higher notes. As it turned out, we had so much sound generation going on that when you mixed all the bad sounds together, it sounded really good. It became a fashionable sound, because there's still nothing that sounds like a Prophet VS; it's a totally unique instrument. When it came out, and people like Prince, or Trent Reznor, who used them all the time, started using them, it was a very identifiable sound.

Bochannek: You mentioned earlier that you tried to get into audio interfaces for personal computers, and that that was a case of too early in the marketplace. What was your vision for that product?

Smith: We had a couple of different things. We first built some MIDI interfaces that would just plug into a Commodore 64, and allow you to get MIDI in and out. That was one thing. Then we started building synthesizer boards that would actually have a six-voice, polyphonic synthesizer on one circuit board that would plug into a computer. It turned out it just—we didn't really understand that market. Things had to be cheap, and this was not cheap. It was early; people didn't understand why you'd want to do this. It wasn't mainstream. Things like that have to be mainstream to be popular, to sell well, and there weren't enough professional musicians who would bother with something like that. It wasn't until the real cheap FM [frequency modulation] stuff started showing up that music on computers started becoming more prevalent.

Radzik: Around the time of the late '80s, there was the advent of the digital sampling, as well. So maybe you could describe for us developing synthesizers at that time. What were some of developmental challenges? What was the market like in the late '80s for trying to introduce new synthesizers and new products when you use this change to, as you mentioned, FM synthesis for price's sake; and, as well, as digital sampling as a new method of sound creation?

Smith: Yes, sampling turned things upside-down. Going back a little bit, I made the realization at one point that most musicians only wanted emulative sounds from day one. The Prophet-5 was really popular because it was the first instrument where you could actually play all the different sounds—horns, strings, organs, and all that—as well as sound effects. That's why most musicians liked it; not because it was a

synthesizer, as such, but just because it did all these great, standard sounds that they could then play on stage. The next big instrument was the DX7, and it sold because it was more voices, it was cheaper, and it sounded like a Rhodes. Now, musicians didn't have to carry around their 200-pound Rhodes piano any more. The Korg M1, which came out, I think in '87 maybe, was the first standard sampling-based emulative instrument. There were samplers out there before that, like the E-MU products and the Fairlights, and so forth; but this was the first one that had it all ready to go, where there were real piano recordings. I should step back a second. Sampling is when the sound generation comes from an actual recording. If you put a microphone in front of a piano and hit a note, and record that, then you take that note, put it in the memory inside the synthesizer and when you play a key, it plays back that recording. What you hear is in fact a real piano. There are a lot of tricks involved with sampling because when you go up and down in pitch, it would get squeaky or sound silly, it doesn't start sounding like a piano anymore, so you fix that by sampling in multiple keys and then switching every once in a while. As memory became cheaper and bigger, you'd have more samples and the samples would get longer. The first samples, you'd only get a second maybe so it would be a very short piano, but it still sounded like a real piano. Going back to the Korg M1 which ended up being the highest selling synthesizer ever made even today because it was a real emulative instrument because it had real pianos and real horns and real everything because they were all recorded. That was the end of synthesis in some ways because now musicians had what they really wanted all along: any instrument they want under their fingertips. If you look at the most popular instruments even today since then, they're all just refinements of the M1 where there's more memory, better recording just because they have more bits and bytes to work with, more voices and that sort of thing. There hasn't been a whole lot of innovation on that side, it's just more and better.

Bochannek: There are really two different angles to electronic computer music though. You said there's the emulative side and the desire to have one instrument sound like many other non-electronic instruments and then there's the generation of completely new sounds. We talked about the Prophet VS as an example of something that sounds just so different.

Smith: Right.

Bochannek: Was that attention that was also visible in the product lines or was this a very personal choice by the musicians with the same product? Can you explain that?

Smith: Well, yes. I don't want to make it sound like nobody used real synthesizers because they've been around all along. In fact, I lost interest in samplers. We did do two or three of them at sequential circuits but to me, it wasn't all that interesting. I don't want to make a better sounding piano because if you want to play a piano, go play a piano. It didn't seem to make a lot of sense to me. I'm always interested in new sounds. That's what I like to hear. My music tastes are the same way. The thing that perks up my ears when I hear a song just go, "Oh, that's interesting sound. Where did that come from?" My latest company in the last 10 years, all we build are analog and hybrid analog digital synthesizers so the market isn't

huge. You sell a whole lot more of the emulative instruments. The big companies, Korg, Roland and Yamaha sell tens of thousands of those to thousands of what we sell. Of course dance music and electronic music has become huge in the last few years so business has been great for us building real synthesizers, but there's still a pretty big ratio between sales numbers for the what we call "slab synths" that just play the normal little stuff and real synthesizers.

Bochannek: I believe time wise we're in the late 1980s now. You talked about the Korg and other synthesizers that are going to the digital and the emulative sounds. What I'm curious about is how did computing developments at that point affect the musical instruments? You start seeing computers that have MIDI built in natively already like the Atari ST [Sixteen/Thirty-Two] for example. Then you start seeing sequencing software appear on those computers as well. What is that interplay now that you mentioned in the early days there was very little talk between the computer people and the music people? Has that changed by the late '80s?

Smith: It depends who you talk to <*laughter*> I suppose. In the early days, yes, there were always complaints that computer companies didn't care about sound or music and they always seemed to be more video driven than audio driven even though their computers had the power to do more. That started changing I think in the '90s maybe. It's hard to go back and see where anything changed but the complaints were always that nobody at Apple cared about sound and nobody at Microsoft cared about sound and they certainly didn't know what they were doing when they tried to get into it and get things working. It's kind of funny how it turned things around and stuff like the iPod are kind of what got Apple started to becoming the biggest company <*laughs*> in the world. It ended up all being about audio so it was kind of a revenge in hindsight there. I think in the early '90s people started realizing that you could do more and more, but even then it was very hard to do a lot with a computer. This was during the whole multimedia craze where everybody was talking about this and that. Even then MIDI was a much better way to do music because you could make it interactive. For example because MIDI can actually change what it's doing, it doesn't have to be a fixed sound so it could interact more with games and that sort of thing. I think all along the Holy Grail for computers was when they could actually have stereo playback play in a stable fashion without killing the bandwidth for the videos, processors and everything else.

Bochannek: To many computer users, MIDI is something that they're not very familiar with and often associated with in the early days of the worldwide web somewhat squeaky sounds that would appear as you go to a website that would play some audio in the background. Can you talk about how MIDI also became a format to store music on computers for these types of applications?

Smith: Yes, there was one part of MIDI that came out—kind of an add-on to MIDI—a few years after the original spec and that was called "General MIDI". What General MIDI did is it defined very specifically a set of 128 sounds where sound number 1 was a grand piano, sound number 2 was a different kind of piano, then organs and strings and so forth. What that meant is a hardware manufacturer could build a chipset or a synthesizer or something that implemented all of these sounds. Then a user could play back

a MIDI file knowing that it will sound correct because it'll play the piano sounds when a piano's supposed to play and a drum when a drum is supposed to play. That's what was used in a lot of these early computers and that was the stuff that usually sounded pretty horrible. I mean it was <*laughs*>—you had to cut so many corners. General MIDI was sample based, but since there was never very much memory—because memory was still expensive and processing time was still expensive—they had to cut lots of corners and make the sounds really short, really low quality in order to fit all the general MIDI sounds in. The net result was they usually sounded horrible. What's kind of sad is that when cell phones first started trying to integrate music, they had the same problem; they had the same limitation of processor power and memory so all those early cell phone rings that you'd hear—and you still hear them, the same ones—are just really bad General MIDI <*laughs*> implementations. On the other hand, there're billions of installations of MIDI out in the world right now because of cell phones and computers, which we never quite imagined in 1980. <*laughs*>

Radzik: So much like the resurgence of musical styles and tastes, over time we see the '80s coming back and we see different themes coming back throughout music, there's also the kind of a reintroduction of analog synthesizers in recent years. Could you speak a bit about Dave Smith Instruments and what was the inspiration for you to get back to creating analog synthesizers again?

Smith: There was a long period from the late '80s through most of the '90s where it was not really possible for a small company to build hardware because you'd have to do custom integrated circuits and a lot of things that involved fairly big investments. In the meanwhile, I actually got sidetracked in the early and mid '90s doing a project with a company called Seer Systems where I was the president and we actually developed the world's first software synthesizers. We realized that computers were finally getting fast enough that you could natively on the processor generate music, generate synthesis. We actually built probably the first real software synthesizer under contract to Intel for when they unveiled the Pentium. In fact, I think Andy Grove played some of the music in one of his keynote speeches at one of the Comdexes back then. After that, we built a second-generation version that we licensed to Creative Labs that they put on their AWE64 [Advanced Wave Effects] sound card and then after that, as computers got even faster, we made the first professional music software synthesizer which was called Reality. This is like '96-ish, back then. Even though we kind of knew that this was where everything was going—which that's where it did go and that's where it still is right now is; software's a huge part of the audio industry—I was beginning to realize that I was never playing with the synthesizer that I built. I always played around with my synthesizers and I began to realize it was because I had to sit there and have a monitor in front of me and a mouse and a typewriter keyboard and then the synthesizer was off to the side to play it and it just wasn't a good look and feel to me as a musical instrument. Right about then, I started getting a little bit more involved with hardware again. In the early 2000s I started working on my first hardware synthesizer in 15 years. What was great is the tools had changed so much, the software tools, the hardware tools that one person could actually design everything by themselves again. For the first five years of my new company, Dave Smith Instruments, I was the only person in the company and yet I was able to design and build and ship hardware instruments by using contract manufacturers. I love hardware. I love having a product that I could hold. I love having a product that when I turn it on in 10 years it will still work. The problem with software synthesizers is that if you don't continually update them,

they won't work in five years because the OS changes, everything changes. You spend your whole time constantly porting to new operating systems and multiple operating systems if you really want to keep it going and that's just no fun. As an instrument designer, I just like being able to have complete control of my instrument and not having to deal with other people's software. It's just complete control and it's just much more fun.

Bochannek: You mentioned you'd like to go back to the analog synthesis and most of music today is distributed in digital form and I'm wondering if you can offer some insight into that break between the analog and the digital world as it pertains to the music generation and the music distribution. That was obviously an issue in the sampling of analog instruments as well, but also the sampling capabilities have vastly improved since then. You mentioned the iPod as a very popular playback device and that is of course recording music digitally. Can you maybe reflect on that and how that has evolved and were you see the challenges and opportunities there?

Smith: Well, my background again is in musical instruments and in our case we have some good technology where we could make fairly reasonably cost analog instruments to compete with the digital instruments. In the case of a musical instrument, it's all about the sound that it produces. An analog instrument will have a different sound that most musicians appreciate; we just can't compete on price. Our two thousand dollar keyboard could be done for six hundred dollars if it was digital. Of course if it's software, it's, well free. <*laughter*> That's the other problem with building software instruments; it's hard to compete with free and they become free and people steal them and you can't steal hardware. I call it the ultimate dongle. On my side, the analog is all about the instrument itself. It's kind of funny because when a musician records with our instrument it's getting recorded digitally because virtually everybody records digitally now in studios. Once in a while you hear of somebody who still uses multitrack recording on tape. Some people record digitally and then run it through a tape machine just as a signal processor because it's a different sound. Analog is always there. It's like high-end audio. People still want tubes instead of transistors, people still like vinyl instead of MP3s and MP3s we know are somewhat flawed compared to full bandwidth recordings and so forth, but it's all a matter of memory. At some point, MP3s will disappear because memory will be so incredibly cheap and huge that you don't have to compress it anymore and then it'll be better. Though some people still think any digital music is bad. I'm not one of those people, but it's just a tradeoff. It's always been about memory size and bandwidth for the last 30 years and making adjustments accordingly.

Radzik: You mentioned tools were one aspect of bringing you back in and having the flexibility to be an adventurer again with regard to creating a new synthesizer now. With decades of all this development experience that you have, what had you learned about creating synthesizers that you were able to apply to the recent generation of analog synthesizers that you do create?

Smith: Well, the tools were great because for a thousand dollars you can get some software so I could lay out the circuit boards at home on my computer, e-mail them out to someplace and then a week later

get the boards back. I had to learn a lot about modern production techniques with surface-mounted parts and all of that, but the rest of it is just so much easier. The other thing I've always found is that when you work by yourself, you could be incredibly efficient because you don't have to talk to anybody. There's no marketing department, sales department, service department, mechanical department, software or hardware. I just make a decision myself. My design approach would always be that everything was based on time. If I got to a point where I could say, "Oh, you know, I could use this other part and save five dollars, but it'll take me two days to design it in," then I'd say, "No, I'm not gonna do it." It ought to be about how efficient I could be since I was doing everything by myself. It was kind of interesting and it's really nice because the tradeoff between hardware and software and the tradeoff between marketing and features and cost—when you don't have to talk to anybody it goes really quickly. That was very valuable in the first Evolver instruments that I came out with starting 10 years ago actually.

Bochannek: You mentioned that the time that's important to be able to make changes and also the time to design an instrument, but software is incredibly flexible and lets you make lots of changes very rapidly so that would suggest that software may in fact be possibly a superior way of solving this problem in order to achieve something within a certain timeframe. Is the tradeoff then maybe not just simply the time but also in another area of what you personally feel most comfortable with, the hardware?

Smith: Well, there're a lot of levels to this when it comes to instrument design. That is one of the issues with software synthesizers. I used to say that anybody who graduated from college with a technical degree can design a software synthesizer and half of them have. It's not that hard to do and a lot of people have done it, which is another problem. It's very hard to be unique in a product area where there's a lot of different things out there. When it comes to the design of a synthesizer though, one of the problems with software design is because it can do everything people tend to try to do everything and you end up with multiple levels and menu diving where it's got a million features. It does everything, but nobody could possibly find them all. I remember an ad just recently somebody advertised a synthesizer saying, "It's gonna take you 20 years just to take advantage of all the features we have," and I went, "Really? You're advertising that as a feature?" I try to make my designs very constrained. I like a set of knobs where you turn a knob and it does the same thing and 10 years later it'll do the same thing as it does right now. You don't have to remember, "Well, if I go to here and touch this and click this that this will happen." I try to keep things as clean-cut, simple and very easy to understand for musicians. Obviously they're still really powerful because you can do a whole lot of stuff with them and generate a wide variety of sounds compared to the instruments I did 30 years ago. I think it's really important as a musical instrument that it be somewhat constrained like that.

Radzik: Could you describe for us then the things that you've taken from your previous designs and you've carried over to new instruments and things that are unique about the instruments that you're now launching and bringing to market?

Smith: Well, it depends on which instruments you're talking about. My first instrument when I came back was the Evolver and I made it as a little desktop module with no keyboard on it. I tried to do something new on that. It was kind of a hybrid synthesizer where it had analog oscillators and digital oscillators and analog filters, but there was also a very tightly integrated digital processor. In fact, it had a DSP [digital signal processing] chip in there and it interacted very tightly with the analog electronics so you could do all these fancy feedback operations and all kinds of crazy things with it. It was old but new and that was the idea. I didn't want to just recreate what I did 30 years ago. The funny thing is, five years after that came out and after I did two or three different versions of it is when I came out with the Prophet '08 in 2007. This was a more standard straightforward '80s style polyphonic synthesizer. It did a whole lot more than what they did back then and it cost a lot less. It ended up being significantly more popular. Part of that is because a lot of the buying public right now are people who used to buy products when they were younger and now they're 50 years old and they're lawyers and they want to get back into music and they have money and they start buying this stuff. They always wanted a Prophet-5 but a Prophet-5 cost $45 hundred in 1978. You could buy two or three cars for that amount. Everybody wanted one but most people couldn't afford them. Now of course our Prophet '08 is only two thousand dollars and it does quite a bit more than that does. It's not something really new, it's more of a spinoff of the original products. At first I wasn't going to do that and I did it anyhow and it was *<laughs>* very successful and you can't argue with that. People like the classic sound. People still buy Prophet-5s now when they could find them in the old market so this gives them an alternative. It's like vintage synthesizer with a warranty.

Radzik: Perhaps a departure back to drum machines and other things that were connected for musical instruments. Maybe you could describe what was the inspiration to create the Tempest, another one of your recent creations?

Smith: This is something Roger Linn and I had talked about many times over the years; getting together and doing something. We got more serious about four years ago. We had a couple of missteps. We actually announced a couple of products when it was nothing more than a Photoshop or a thrown together image that we announced it to people. That was a mistake because we didn't really have anything then. We actually went through two or three gyrations. For a while, it was a standalone instrument and then for a while it was gonna be a product that actually had a motherboard in it and an LCD [liquid crystal display] screen and everything would be on the basic software running Linux or something. I ended up not liking that and then we weren't going to do anything. Then I finally said, "I want to do something like this; an analog-based drum machine because there hasn't been one since the '80s." We ended up working together on that. What we tried to do was something new because Roger is the king of drum machines, so he had a lot of great ideas for a new approach to drum machines where it was more interactive. The idea is you could press the start button and just start doing things and play for hours constantly changing things without ever stopping the music. Then my approach and my input was the analog electronics that went with it with a little bit of sampling but a lot of analog so you could make analog percussion sounds. It's really the only instrument of its kind that's ever been made so it's been pretty popular so far and it's a lot of fun to play with.

Bochannek: Quick question. The Tempest is an interesting name. Is that Shakespearean or where did that come from?

Smith: <*laughs*> Naming instruments is—I don't have any set formula for doing it. It usually often amounts to drinking a lot of tequila late at night and trying to come up with names and then throwing them all out the next day. In the case of the Tempest, this went on for months and we had all kinds of names and a lot of good ones. It's just really hard because it has to be easy to spell, easy to remember, one or two syllables; things that people won't misspell. It's amazing how many people call the Mopho a "Morpho", they throw an R in there; we didn't think that would happen. "Tempest" was just another word that one of my engineers came up with that was on a list. The more we thought about it, it kind of suggests tempo and it's easy to remember and then of course the whole storm aspect of it; "tempest in a teapot" , not so much the Shakespearean aspect of it. It was funny because I think the movie came out right about the same time—"The Tempest" movie—and it just seemed to be the best name that we came up with at the time.

Radzik: Was the Tempest a result of some of the availability of technology at the time? What from a technology standpoint enabled the Tempest to come to market? What sort of things came together that you were able to combine to make the Tempest? It sounds like a very unique instrument in the sense of analog and digital and sampling and interactivity. Could you maybe comment on some of the things that might be unique about the drum machine like the hood?

Smith: It really comes down to the software synthesis part. Software synthesis? Where did that come from? It really comes down to the analog synthesis part of it—the engine—because nobody else was doing that, especially in a drum machine. There have always been a lot of great percussion sounds you could do with an analog synthesizer. Some of our other products, like the Tetra, allow people to make really cool little drum kits and all in the analog realm. That was the other part of the idea. "Let's put that into a drum machine." But we had to add the sampling part too so if people want a real snare drum it's there, but they could also add a little bit of processing on top of that or double it up with some analog stuff to give it a whole new sound. It's about new sounds. Everybody's got their old drum machines that are all sample based that all make the same sounds and that's nothing new. This gives people a new sound, a new capability, a new pallet to work with. It is interesting because it was a huge project for us. It was well beyond what we should have been doing as a really tiny company because it was basically myself and my one software engineer and then of course Roger helping out in the design side of things but less in the technical side. We were talking about software earlier. That machine is all about software. We know how to do analog electronics, we know how to hook it up to some computers and get it all running because I think there's six, seven, eight microprocessors in that. We say analog electronics, but our technology is all about heavy digital control—microprocessor control of analog—so we self-correct for the analog stuff and we're able to make it much cheaper by having the microprocessor do what it does well and the analog electronics do what it does well. The software in the Tempest was just a huge undertaking and it continues now even a year after we've released it. We're still working on it, adding new features, tweaking things. There's a lot of software <*laughs*> in there for a hardware instrument.

Radzik: Could you maybe share your insights with the direction that the synthesizer and computer music industry and products are heading? Is there maybe something that you might be able to share with us that you're currently working on or where you see the industry as a whole and instruments going?

Smith: Well, it's funny. If you look at synthesizers, we know about the sampling side and that's gonna keep going just because there's a need for it. On the synthesis side, it's really basic subtractive synthesis that I think has pretty much passed the test of time by now. This is what Bob Moog originally invented back in the '60s. You have oscillators, filters and envelopes and VCAs. It's a very standard setup. You usually have two oscillators, a low-pass filter and a VCA controlled by an envelope. That's pretty universal. Even most of the digital synthesizers that are out there now are just emulations of the two oscillators, low-pass filter and an envelope. They take it further of course. There're a lot of other features when it's digital and they could do things cheaper and it's a slightly different sound when it's implemented digitally. Of course, [with] the software synthesizers it's the same thing; they're all implementing the same thing digitally only in software. There have been some other interesting ideas synthesis-wise that have come out over the years. One of them that I got very interested in in the late '80s and early '90s was physical modeling; a lot of work done at Stanford and other places in that. There, the idea was that you mathematically define an instrument. If you have a clarinet, you simulate a tube that gets blown into and it's actually a real simulation of the instrument rather than sampling. The high points are that you theoretically get something that sounds just like the original instrument, but unlike sampling it actually responds like an instrument. If you physically model a guitar string and you hit it once and if you then hit it a second time, it takes into account what it was already doing in the sound. It simulates a string that just got hit twice, whereas if you hit a sampler guitar string twice it plays it exactly the same way both times because it's the same recording. It had a lot of promise and I actually spent a lot of time looking at it. I actually worked for Yamaha for a period and Korg for a period and so we were working on a lot of that stuff back then. This is early, mid '90s. I finally made this realization, especially after Yamaha actually made a couple of these instruments, that the best way to control one of these instruments was—for example, if you take a violin, if you have a really good violin model to control it correctly you really need a bow and you really need a string. You can't really control it from a keyboard if you want to play it like a real violin. Once you get to the point where you have to do this <*mimics bowing a violin*> to control a synthesizer model, play a violin. It's the same thing with a clarinet. It's the same thing with a guitar. If the controller for the model has to be what the model is modeling, it kind of becomes pointless. That's when I kind of lost interest in that. For a while, I thought that was gonna be the future, but it's kind of disappeared now. I think Korg still has it in some of their newer products and they've done a really good job emulating some instruments digitally using physical modeling, but overall it just wasn't that interesting to me.

Bochannek: Along the same line, what generally inspires you? What drives you? What makes you come up with new ideas or decisions that you've arrived at after going down difficult paths, those kinds of things?

Smith: I could just summarize it in that there's something really magical about being able to start with nothing and end up with a musical instrument. I like to say there's very few people in the world who get to

do what we do because there's just something magical. It didn't exist before and now it does. I really love going to see bands that use our stuff. When bands come through town, a lot of times we'll talk to them and go to the shows and watch them play and talk to them afterwards. When you see them in videos, when you hear them in songs and recordings, as a designer, that's the real payoff. That's what keeps me going. Now that I have a real company, I think we're up to eight people now so we're getting really huge. I love contract manufacturing. That's the <*laughter*> way to go. It's more fun now because I've got some younger guys working for me and it's hard because when we design an instrument, they want to do everything. "Oh, we could add this. Let's add this. We could do this. Uh uh. We got to do this. It's all good." Back to what I was saying earlier about constrained design, I've got to say, "Well no, it doesn't have to do everything. If we hit 95 percent, that's gonna be pretty amazing. Let's get the product out the door. We've got to finish this thing at some point and we don't want it too complicated so let's concentrate on what works and what the best selection of features might be." There's always something new to do. When I first did the Evolver coming back, I was worried when I was working on it. "Well, what am I gonna do after this? I'm not sure if I have any more ideas." Over the years, it just keeps going. We have enough ideas now to keep us going for a long time. I'm trying to keep the company small. I don't want a big company. I just want to keep it simple, have fun, design synthesizers as a hobby almost and it's a great time.

Radzik: Any messages you'd like to share with the music instrument community or the audio engineering community out there or the computer history community out there?

Smith: Well, I have to say the whole MIDI experience has been kind of a revelation. When you think about a standard that's 30 years old, literally just about 30 years old exactly, that's used every day in every music studio, every university, every cell phone, every computer and it's still version 1.0. <*laughs*> It's kind of amazing it's gone that far. Originally people said it was too slow and actually even then it wasn't too slow, it was the instruments themselves that were too slow. We were all overdriving our microprocessors back then and so the note would come in quickly from MIDI but it would take it five or ten milliseconds to actually play it. There's this magic space of five to ten milliseconds. If it gets more than that you can hear it and the musicians can feel it. It wasn't MIDI that was too slow, it was the fact that getting it out of one box and into the next box and processed and played that would keep it from being as crisp as it should be. Nowadays of course, the physical interface doesn't matter because MIDIs over USB [universal serial bus], it's all internal and, you know, the speed is not the issue anymore. Beyond that, I don't know. I think we covered a lot of ground there.

Radzik: Definitely. Any other topics you guys would like to bring in?

Bochannek: No.

Radzik: Okay, fantastic. Well, on behalf of the Audio Engineering Society and the Computer History Museum, I'd like to thank you for this interview and for your contributions as an innovator.

Smith: Oh, thanks. I appreciate it.

END OF INTERVIEW

