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TURMOIL IN MIDI-LAND

The Fast-growing Synthesizer Industry Struggles To Implement A Standard Digital Interface

By Dominic Milano

ONLY A YEAR AGO, MIDI was a novel feature found on just a few forward-looking instruments. But today it's become a fact of life. Chances are that if a new electronic instrument doesn't have the Musical Instrument Digital Interface on it, you'll be advised against buying it. What's so wonderful about MIDI? Well, to begin with, you can connect two synthesizers (or more) together with one patch cord and play them both from the same keyboard. You can sync drum boxes together and never worry about them running out of kilter with each other again. You can connect sequencers to drum machines or other synthesizers. You can hook your synthesizer to a personal computer to do all sorts of wonderful things. . . . Or can you?

Anyone who's tried hooking synthesizers together with it knows that things are not all peaches and cream in the land of MIDI. Problems, incompatibilities, and inconsistencies crop up that were undreamed-of when the specification for the MIDI computer code was written. And the manufacturers have been too busy trying to figure it all out for themselves to take time to answer the hundreds of inquiries that they have to field every day. In some cases, trying to overcome the difficulties can be so frustrating that you'll feel like packing the remains of the instrument you've bought in a shoe box and sending it back to the manufacturer marked 'unacceptable.'

To be fair, it's not all the manufacturers' fault. Consumers have been led to expect miracles from MIDI. The trade press has jumped on the bandwagon, preaching the gospel according to MIDI before the would-be messiah even had time to get toilet-trained. And consumers have tapped into the buzz without taking the time to understand what you can and can't do with MIDI. Synthesizer builders haven't had the chance to breathe since they introduced MIDI. They've had too little time even to gather the information needed to analyze all the problems that have come up, let alone implement the fixes that are needed to guarantee compatibility. The unexpectedly high consumer demand for an all-knowing, all-seeing, all-doing interface has forced the manufacturers to action. Most have or are planning to issue at least one systems revision in the form of new EPROM chips containing MIDI-compatible operating software for their instruments.

It's that same instinct for self-preservation that is now forcing manufacturers to do the unthinkable—communicate with their competition. But even something that should be as easy as picking up a telephone has its problems. A few of the manufacturers are talking to one another. Not as often as they should, but they are talking. Other companies feel they're being ignored, left out in the cold to play catch-up. The problem is magnified by the fact that no one seems to have had the foresight to hire or assign employees whose job is specifically to monitor MIDI; many just don't have the funds for such luxuries. As a result, the people who answer consumer questions and complaints about MIDI are often the same people who have to struggle to understand the competition's incompatible implementation of the spec, while worrying about designing next year's product line. This overload makes these folks hard if not impossible to reach, which in turn makes manufacturers look like prima donnas who haven't got the slightest regard for their public. And that's anything but true.

But what is MIDI? What is it to a manufacturer and what is it to the player? To a manufacturer, the MIDI specification is a set of rules and guidelines for transferring digital data from one instrument to another. A simple application would be in connecting two keyboard instruments together so that when you play a chord on one, the same chord sounds on the other. This allows you to do things like layer the sounds of different manufacturers' instruments without having to go through all kinds of techno-whiz acrobatics. There are more complex applications, too. MIDI can be used to connect keyboard instruments, drum machines, and sequencers to a master computer controller to form a complex composition system. However, such applications are only now beginning to be explored. Incompatibility between instruments and a decided shortage of comprehensive computer software are the main obstacles, and both will be overcome in time.

Bob Moog wrote an extensive MIDI primer for *Keyboard* readers in our July '83 issue. In that article, he pointed out that MIDI utilizes channels to send data over. These channels don't exist as independent connections that need to be made with separate patch cords, but rather are electrical labels that are attached to and serve to identify packets of digital information. There can be up to 16 MIDI channels on an instrument. According to the spec, manufacturers have the option to determine whether or not a given instrument has the ability to select which channel or channels it will respond to. This is one of the options that has led to a lot of incompatibility problems. For example, Yamaha's DX series synthesizers only transmit on MIDI channel 1. Roland's MSQ-700 MIDI sequencer won't allow you to reassign channel information. The channel that the information is recorded on is the channel it goes out on. So the DX and MSQ combination only works if you use channel 1.

At the time Bob's article appeared, there were three modes of MIDI operation. These determine how an instrument will respond to channel select information. The modes are called *omni*, *poly*, and *mono*. In omni mode, an instrument will respond to information that is sent over any channel. This is used for ganging keyboards. An instrument in poly mode will respond to information on the channel to which it is assigned. This is used to control different instruments at different times from one controller. In mono mode, each voice within the instrument may be programmed to respond to a different channel, allowing multi-timbral instruments like Sequential's Six-Trak and Oberheim's new

Xpander to do some fancy tricks. However, there is now a fourth mode that was created when technicians at Yamaha misinterpeted the word mono to mean monophonic, as in single-voice. This new mode assigns all incoming channel information to one voice. The tone of the rumors that flew over this misunderstanding was not especially friendly.

One of the biggest misconceptions about MIDI revolves around what happens when you hook two different instruments together. Many people expect that characteristics exclusive to one of the machines will be somehow magically transferred to the other. Here's how the story might go: A player hooks a DX7 and a Memorymoog together with MIDI. The DX7 has a velocity-and pressure-sensitive keyboard. The Memorymoog does not. The player thereupon gets ticked off when the Memorymoog doesn't respond to the velocity or pressure information from the DX, and complains to both manufacturers. He is dumbfounded to learn that MIDI was never designed to perform the miracles he expected of it. Which in this case is as it has to be. MIDI cannot transmit information about functions that are hardware-dependent—that is, functions that require a certain type of circuitry to allow them to work. If one instrument has multi-timbral capability, hooking it to another instrument that isn't multi-timbral won't make the non-multi-timbral instrument multi-timbral, any more than it will give syncable oscillators or six-stage envelope generators to an instrument that didn't start out with them.

Of course, there are some machines that are designed to accept external control signals for functions that they themselves don't implement *per se*. Witness Roland's TR-909 drum machine, which can be controlled dynamically from a velocity-sensitive keyboard. Still, most instruments won't be transformed from lead into gold by using the mystical MIDI interface. Information that is exclusive to specific instruments falls under the heading of system-exclusive information. The MIDI spec makes provision for system-exclusive information, but it's up to each manufacturer to decide what, if anything, will be done with the capability.

The MIDI specification also allows for voice parameter, mode selection, program change, and auxiliary controller information like pitch-bend and modulation wheel amounts to be transmitted. This information is supposed to be sent over a specific channel, but it is up to the manufacturer to determine whether such optional data will be sent at all. A case in point is the Siel DK 600. It does not send any pitch-bend information to its own expander module. Also, interesting anomalies are created when you hook together two instruments with programmable pitch-bend depth controls.

Timing information for drum machines and sequencers and a few other data labels that call up segments of sequences are included in the MIDI spec too. But as far as we've heard, these haven't caused any great commotion yet. Most of the problems have arisen from the many different interpretations of how the spec should be implemented and how it has been implemented. Happily, these differences should be clearing up before too long. But there are other points of dissension out there that may be with us for a while.

MIDI is a serial interface, which means that information is sent down a single line one bit after another. A parallel interface, like the RS-232 computer interface, uses a whole bunch of wires to send multiple bits of information at once. The rate that bits are transmitted at is called the baud rate, which is an expression of how many bits per second can be transmitted in a computer line. MIDI's baud rate is 32k, or 32,000 bits per second. That sounds like a lot, but many people feel it's inadequate. Compared to the baud rate of many computers available today, it's downright slow motion. Take, for example, Apple's new MacIntosh. It has two baud rates, the faster of which is 1 million. RS-232, a standard in the computer industry, is nominally slower than MIDI, but it is a parallel interface, so it can actually pass more information in the same amount of time. In the interviews that follow, you'll hear some of the arguments as to why this aspect of the spec does or doesn't need to be upgraded.

Yet another point of disagreement over MIDI is the function, purpose, and direction of the International MIDI Association (IMA). The IMA is a non-profit organization designed to disseminate information on the MIDI specification to end-users — the players who buy MIDI-equipped instruments. The organization is also supposed to help software designers get information on protocols for various instruments and help manufacturers stay in touch with each other and keep up to date on all the implementations of MIDI. However, some manufacturers aren't cooperating with IMA. Some out-and-out refuse to acknowlege its existence. Still others can't understand why their colleagues are holding out. Everybody professes to support the idea of and the need for such an organization, but no one we spoke to was willing to go on record to explain their reservations about the IMA or the apparent personality conflicts involved. Which is as it should be. It would be counter-productive to get tied up with gossip and innuendos that serve no purpose but to confuse the issue and make everyone look petty. Nevertheless, the fact remains that for one reason or another, IMA is having some trouble getting all the manufacturers to pull together as a team.

In preparing this article, we spoke with representatives from many synthesizer companies, including Dave Smith, president of Sequential Circuits, the person who's credited with getting MIDI off the ground; Jim Smerdel, spokesman for Yamaha and steering committee member of the IMA's MIDI Evolutionary Council; Jim Mothersbaugh, technical representative of RolandCorp USA; Roger Clay, head of IMA; Tom Oberheim, president of Oberheim Electronics; Marco Alpert, spokesman for E-mu Systems; Tom Rhea, former *Keyboard* columnist, electronic music historian, and current head of marketing for Moog Music & Electronics; Carmine Bonanno, president of Octave-Plateau Electronics; Chris Albano of Passport Designs; Will Alexander, U.S. technical manager for Fairlight; and Ralph Phraner, an independent software consultant. There were also many others whose comments we weren't able to include here for lack of space.

As you'll see, there's a lot of disagreement over what MIDI is and should be. However, there's also a lot of optimism mixed in with the gloom and doom pronouncements. MIDI is starting to show up on instruments of every size and shape, and it doesn't take a fortune teller to know that it's going to be with us for a long time to come.

Dave Smith

You're credited with getting MIDI off the ground. What's the history behind the origins of MIDI?

The very first contact I had with the idea of an interface was when Tom Oberheim approached me at a NAMM [National Association of Music Merchants] show, which must have been in June of 1981. He was approached by Kakehashi from Roland about the possibility of getting a standard digital interface. Tom just mentioned the idea to me, and after the show the people at Sequential Circuits started speaking more and more about it. We started getting really interested, so we worked up some proposals and possibilities. We talked to Oberheim while they were still interested. Meanwhile, the Japanese had started doing some work on the idea. In what must have been October 1981 we had a meeting between the four Japanese companies — Roland, Yamaha, Korg, and Kawai — Oberheim, and Sequential Circuits. That was just to talk about the idea. We didn't get too specific. The next thing that happened was that I gave a talk in November '81 at the AES [Audio Engineering Society] convention in New York. I made a proposal for something called the USI [Universal Synthesizer Interface], and described exactly what it would be — a high-speed serial interface. There was some vague interest after that. Next, we called a meeting at the January 1982 NAMM show. We had about 10 or 15 companies come — Oberheim, E-mu, all the Japanese companies, Moog, Fairlight, GDS [Digital Keyboards], just to name a few that come to mind.

That must have been an interesting meeting.

Yeah. It became real obvious real quick that it was going to be hard to come up with anything that everybody could agree on, which we kind of expected. We had the digital people who wanted to make parallel interfaces that ran at extremely high speeds. . . . What we found was that nobody really followed up on the ideas except the Japanese, who contacted us later. So we started working with them. They shared the desire to bring out something reasonable. We knew from the start that the interface had to be a compromise. No one in the States seemed interested anymore, and we lost interest in trying to round everyone up, so we worked

with the Japanese companies. At that point we started going back and forth. The Japanese made a lot of suggestions. I think that Roland did most of the work. They did most of the coordinating in Japan.

How much did the spec change at that point?

The Japanese had a lot of good ideas, and we made a lot of changes in the spec based on them. But it still stayed a high-speed serial interface. It was Roland's idea to put in the optical isolation; it was their idea to make it 7-bit status. It's real hard to say who did what beyond that because it was a true cooperative effort between the five companies.

When was the term MIDI coined?

We had started with USI, but decided that we didn't like the way it sounded and that there might be some legal ramifications. We wanted it to be more of a *de facto* standard, and that's when Roland came up with UMII, which stood for Universal Musical Instrument Interface or something like that. You were supposed to call it you-me. We came back with Musical Instrument Digital Interface, because that seemed the closest description to what it was.

What was the intended use of the interface at the beginning?

From the very beginning, the only thing that was supposed to happen with MIDI from unit to unit was that when you played the keyboard of one, the other would play too. And that's really the only thing that's defined 100%. The real bottom line with MIDI is that it is a compromise. It wasn't ever supposed to be 100% compatible with what every machine will do. It can't be. Everyone in the manufacturing community wants to design their own instruments, instruments that are different from all the others. MIDI is supposed to be a basic common ground that everybody can work with.

By the end of '82 and beginning of '83, we had a working spec, and Roland and Sequential both brought out instruments with MIDI on them. That's when the fun started. It was one thing to work on a spec, guessing how it would be used, and another for different companies to go away and design instruments using the spec and then come back and see how they worked together.

Of course, the other thing that complicates the process is that no company wants to go out of their way to pre-announce to their competitors a product they haven't announced to the public yet. You want to keep them secret. You don't want to go and say, "Hey, we're going to come out with this product in six months and it's real hot. We need to check it with your MIDI stuff." So you almost have to wait until your product is out on the market before you can start testing it.

And that's exactly what happened with the first instruments you and Roland brought out.

Yeah. We had this first set of products come out and they were basically compatible. We had our momentous little occasion at the January '83 NAMM show, when Roland brought down a JP-6 and hooked it to a Prophet 600, and they talked to each other. You could play the keyboard on one and the other would play right along with it. That was the first time you could do that with off-the-shelf products.

> "It's going to get more complicated before it gets less complicated. I'm sure it's the same for every other company. Our phones are ringing off the hook. People are trying to interface a large number of computers and synthesizers and sequencers and drum boxes a lot sooner than we thought they would. Even sooner than it's practical."

But there were problems?

We immediately found that there were a lot of subtle differences. For example, we sent all of our arpeggiator information across the line and Roland didn't. They sent out what the keyboard was actually doing, not what the arpeggiator was doing. Neither of those ways is the correct way of doing it, necessarily. They both have their good points and bad points. They're different approaches. And there are a lot of other things that were done differently between the two machines. So we started realizing some of the problems that were going to be coming up. That was when we sat down with the five companies — Roland, Yamaha, Korg, Kawai, and Sequential — and came up with what we called the 1.0 spec. This was in Japan in August 1983. That's the version that we released. It's the version we finally agreed that we weren't going to change anymore. Before the 1.0 spec, we were going back and forth changing things. Roland would want to implement something. Then Yamaha would do something differently. Then we'd want something else. We began to realize that if we didn't freeze the spec, it would get worse real quick. So we got together, managed to work out our differences after six months of having products out there, and finalized the spec. The problem was that the finalized spec didn't match the first set of products that came out with MIDI on them.

Why not?

They were really the ground-breaking instruments. They were released in a vacuum as far as MIDI products are concerned. We didn't really know how they were all going to tie together. Now it's gotten further confused because MIDI instruments have come out in two or three or four different levels. There's the new spec and the old spec. And there are a whole lot of different ways that the spec can be implemented. Since everybody has different ways of implementing their product, there is going to be both compatibility and incompatibility — a lot of different levels. And that's where the confusion is right now. You can look at the basic things like one machine has velocity [keyboard velocity sensing] and one doesn't. Or what happens when you hook a T8 and a DX7 up. They both have velocity and they both have pressure, but the pressure on the T8 is polyphonic and the pressure on the DX7 is monophonic. That part isn't going to communicate. Sequencers and timing information is another thing. We now have multi-timbral instruments. But it's like everybody expects that if you get one of them you can plug it into the Prophet 600 or something else, and all of a sudden make those other instruments multi-timbral. People just don't understand what you can and can't do. They want to do things that just don't make sense. And it's going to get more complicated before it gets less complicated. I'm sure it's the same for every other company. Our phones are ringing off the hook. People are trying to interface a large number of computers and synthesizers and sequencers and drum boxes a lot sooner than we thought they would. Even sooner than it's practical. I think too many people aren't expecting problems early on. They're expecting them to be worked out immediately. The problem is that Joe Customer is assuming that because an instrument has MIDI, everything works the same. When in fact MIDI is going to be emerging and growing into more of a standard over the next couple of years.

Do you see the spec changing, being upgraded with greater bandwidth, in the near future?

My first feeling is that MIDI will not change for at least two years. If anybody attempts to make a change in the spec, they'll be totally blowing it. We've had instruments out for a year and a half already and it's still far from settling down. If a couple of people get together, form a committee, and decide to try to change the spec, they'll really be opening a can of worms. Nobody really owns the spec, so it'll become a real mess. Right now, we're struggling to make sure that the kind of lack of cooperation that existed two years ago doesn't come back to haunt us. If the digital synthesizer people want super high-speed elaborate things that only the $30,000 digital synthesizers can keep up with, what's the point?

What about the consumer and MIDI?

It's going to take more sophistication from the user. They're not going to be able to

Turmoil In MIDI-Land

just randomly buy keyboards, connect them, and expect to be able to do a lot. If they only want to work them on a simple basis, then it'll be fine, but if they want to do fancier things, they're going to have to look into MIDI specs on instruments a little bit more before they build up a system. They're going to have to put more thought into what they're doing.

Jim Smerdel

Where does Yamaha stand with MIDI? Do you feel there is constant communication between companies, or are you working in a void?

I've been trying to put together a dialog between all the other companies. Most of them are being very cooperative. We're going to try to get together and exchange instruments. I think the thing we want to avoid is this business of saying, "It's not our fault, it's their fault." We all design MIDI and what we want to do is support it. It's to everyone's advantage to do that. I think everyone is pretty much in agreement with that. We have to get past being used to having years to develop our own things. We have to get used to being open. We are going to set up this thing where we meet and discuss the different problems between our instruments. The idea is to remedy things.

What do you see as having been the cause of the problems between various MIDI-equipped instruments?

There are three areas in the MIDI spec. There's the standard protocol, there are the optional codes, and there are the system-exclusive codes. I hate to call the standard protocol standard, because it's a very loose standard right now — there's a lot of flexibility within the standard as to how you can implement it. The optional codes don't have to be used at all. It's up to the development company. The system-exclusive information is information that pertains to each specific instrument. It's going to vary with every model. That's the part of MIDI that pertains to the technology and features of each instrument.

Do you feel the consumer has expectations that exceed the limits of what MIDI was designed to do?

That's possible. MIDI certainly hasn't been taken to its full extent at this point. I think it's going to take some time before it reaches its full potential. I think that we're okay as far as keyboard-to-keyboard interfacing goes. MIDI 1.0 seems to work for that application. At least that's the feedback I'm getting. Where we're running into problems is with software. Sequencers. One reason for that is that we're sending a tremendous amount of information down the line right now. And we're trying to do a lot more. The other reason is that manufacturers design software and peripherals for their own product line, initially. A lot of them will only be doing things for their own product line. Other companies will be looking to get everyone's instruments to work with their products. You're going to get some crossover problems in the beginning.

> "Everyone is working as hard as they can, because we all want everything to be as compatible as possible, but it seems that the technology is going a lot faster than we're able to implement it. If we had had open communications channels to begin with, a lot of these things wouldn't have happened. It's hard to keep track of your own products, let alone everybody else's."

Are there any examples you'd like to cite?

Okay. Because Roland could change their transmit channels, they packed the channel assign data in with the actual music data. When I say packed, I mean that it's encoded into the RAM. Their sequencers don't have the ability to redirect the channels. So whatever channel the information is recorded on, it has to come back out on. Now if you were to try and use their sequencer with our products, you could run into problems. The DX7 and DX9 only transmit on channel 1, but they can receive on any of the 16 channels. [*Ed. Note: All the channels in MIDI are polyphonic.*] As long the Roland sequencer is receiving from the DX on channel 1, you're okay. If you record on any other channel, it won't play back. All our own sequencers don't care what channel the information comes in on. That information gets thrown away. The sequencer can reassign the incoming channel assign data to any one of the 16 channels. Our sequencer would theoretically work with any transmit or receive scheme, but it was basically designed for our products. The Roland sequencer works with Roland products, but I'm sure they weren't aware that we were only transmitting on channel 1. So their sequencer will work with a DX, but you have the limitation that you have to be on channel 1.

We've heard a few complaints about interfacing Sequential's Commodore 64 sequencer with Yamaha products, too. Can you give us any details?

The problem, to my understanding, was with the DX9. Apparently, Sequential only tested their sequencer with a DX7, which sends key on, key off, and we send the status byte again. So you've got a status byte every time, whether you turn a key on or off. That's perfectly legal under the MIDI protocol. However, what we did on the 9 was this: We didn't have a lot of room in the memory, so we decided that you don't need to send the status byte again. Sequential, for whatever reason, didn't test their sequencer against both the 7 and the 9. I'm sure they thought they were done the same way, so you get problems when you try to run a 9 with their Model 64 sequencer. The lack of available memory was also the reason why the 7 and 9 only transmit on channel 1.

Do you think these problems are going to turn consumers off to MIDI?

I think the consumer has to give the manufacturers some slack. They've got to remember that the music industry has been in the computer software/MIDI age for what, six months? I think everyone is working as hard as they can, because we all want everything to be as compatible as possible, but it seems that the technology is going a lot faster than we're able to implement it. If we had had open communications channels to begin with, a lot of these things wouldn't have happened. It's hard to keep track of your own products, let alone everyone else's.

Consumers are going to ask why they should buy a MIDI instrument now, since the bugs haven't all been worked out.

It depends on how you define bugs. Again, I have to stress that there are going to be differences in the products. Even if we communicate, even if we were all working for the same company, there would still be different implementations. Implementations that aren't 100% compatible. They may work in the way that a Roland sequencer and a DX work — on channel 1 only. They're still usable, because with that sequencer, no one says you have to hook up eight DXs. You may have one DX and a number of other products all hooked up to the Roland sequencer. I think what we need to do is make the customer aware of the differences. At least then he'll know before he buys the products. He'll know that these aren't bugs. These are limitations.

You mentioned that MIDI hasn't reached its full potential.

We've just begun to implement MIDI. As we sit down and talk we'll start to make the specification much more specific. But there are a lot of unknowns right now. We're just starting to write sequencer and composing programs. All kinds of things that have never been explored before. And we're going to run into limitations — things that no one will think can be done with MIDI. But then some enterprising young person is going to come up with a way around it. Even with the initial things that have come up, I haven't really seen too many limitations to MIDI at this point. I think there's just a lot of misunderstanding over how to use it and what it can do.

Continued

Turmoil In MIDI-Land

> "How do you know what pitch-bend on one instrument is going to do on another instrument? Have you tried pitch-bending on a Poly-800 connected to a DX9? You get some very interesting intervals happening."

What do you think of the idea that MIDI should be upgraded to some higher level?

Here's the thing. It's got to start with getting a dialog going between the companies, and that's where we're starting. We've got to get MIDI as it is to a very highly polished level. I think you're going to see tremendous strides in what MIDI can do when we reach that point. If we started right off saying okay, let's change it, it would be disastrous. We haven't even brought it to maturity yet. I think you're going to see some changes made, but at this point I have no idea what they'll be. They may just be agreements on implementation. That would eliminate a tremendous amount of user confusion. My gut feeling is that we have a good year or two down the road before we get everything straightened out and polished. Again, I have to say that I don't feel like we've reached a limit or a real barrier with MIDI at this point. From that standpoint, I don't see any real major changes in it for a while. But if anyone came up with a real super idea that could be done feasibly, I don't think anyone would oppose it.

When you say feasibly, do you mean inexpensively?

I'm saying economically. When we had our original meetings, there were two ways we could have gone. There were the hypothetical perfect systems, and the systems that looked at the real world. The five companies that actually developed MIDI took the realist view. They looked at the economic factors and the manufacturing problems and the costs involved. When we had that first meeting, there were people in there talking about laser transmission, unbelievable baud rates, and 32-bit parallel output. Incredible stuff that certainly would have been better than MIDI as it is. But my personal feeling is that having a very functional, useful system is better than having no system at all. And that's what we would have had if we had gone with all of these other great ideas. You're asking companies to invest millions of dollars to put MIDI on thousands of instruments, and you have to face what happens if the idea flops. What if MIDI had died? People could have said, "Who cares?" So we felt that the present system was powerful and economically feasible.

Jim Mothersbaugh

You field a lot of user phone inquiries about MIDI for Roland. What's your impression of what is happening?

MIDI, since its first introduction, has proved a remarkable success. Musicians are finding they have to learn new ways to communicate. Discussing things like operation, command, defaults, and things like that. But overall, they're discovering new-found freedoms of interfacing not just with our products, but with everybody's products. Secondly, we have been able to develop products that couldn't have been developed before. Before, they would have been highly specialized and not universal. The idea that we can come out with a guitar synthesizer that can be hooked to a Sequential Circuits T8, a Yamaha DX7, or a Roland JP-6 is real exciting. Thirdly, yes, there are still a few bugs in MIDI between manufacturers that are being sorted out.

Does Roland have plans to get together with other manufacturers to iron out problems between instruments?

Yeah. Yamaha, Sequential, and Roland will be getting together shortly to work out the last of the bugs in their systems. Basically, the technique that we've found works in Japan will probably prove to be most productive here. That's where the manufacturers get together and confront each other, deal with each other, and analyze the situation to see what the best way to cure the problems is. You've got to expect this kind of thing. It happens with virtually any new concept. Everybody's producing new products so fast that at this stage of the game there are bound to be jams in the traffic.

Are there any problems in communicating with other companies?

I don't think so. In Japan, the communications link was developed a few years ago, so it's a little easier there. Here, the American companies are just now learning how to do that. A couple of years ago, you would have never thought of seeing Oberheim and Roland sitting down and talking about interfacing products. It would have been totally ludicrous. It's a reality today. That's the exciting part for me. It opens up whole new avenues such as education.

How will MIDI affect education?

With education, I see using the computer. As programs get developed, there will be very interactive systems. They will be able to display your errors. They will be able to display what you played and what you should have played. You'll be able to work on your timing. It'll play counterpoint melodies along with you. And the computer will work at your own pace and convenience. Rather than go to a teacher once a week, you'll sit down at a computer.

How has MIDI affected that? Can't computers do that already?

It can be done to some degree without MIDI. We had products like Roland's CompuMusic, that were leaning in that direction, but it was a closed system. Now, due to the fact that computer prices have come down so far, computer literacy is up. Fear of the computer is going away. Musicians five years ago would shiver when you put them in front of a Prophet-5 and a Linn drum machine. Nowadays, it's like they're ready to sit down in front of a Synclavier or Fairlight and just start rattling off commands.

What specific problems have you encountered with MIDI so far?

Probably the main one was lack of understanding. MIDI is so new to our industry. There are a lot of people who say that it's not fast enough, but we've found that we can turn on and off 500 notes in one second. That's pretty fast. One of the misconceptions was about what channel assign did. Many of the early instruments didn't have that function. So we've had to go back and try to define things more clearly. Trying to go to engineers and say, "Okay, invent the wheel," is bound to produce a number of different versions of the wheel. A lot of the problems come from hearing the language, but not having the same set definitions for the terms. Things like omni, poly, mono, channel, default, all mean different things to different people. Yamaha encountered the same thing when they introduced the DX7 and 9, because they dealt with a whole new kind of terminology. They had algorithms versus VCOs, VCFs, and VCAs. It's a complete relearning process. But I think we're at a point where computers are working for us. A few years ago people were talking about our children growing up and running computers. They said that they thought these kids were going to be whiz kids and know all these complex computer languages like Fortran and C. But we're actually learning that the computer is more personal and easier to operate. That's what MIDI should be. What we're missing is the Laymen's MIDI Handbook.

What happens to the customer who bought MIDI instruments early on, before all the incompatibilities were worked out?

My basic feeling, beyond what the board of directors might say, is that we analyze the problem, theorize if it's our fault or theirs, figure out who should make the correction, and support the people we sell to. We have had a few cases where we had to go back and make corrections to our products. But that's the manufacturers' duty to the public.

Otherwise, you won't sell to them again.

Exactly. My living is made by the customers. None of these companies have such wonderful attitudes towards life that they can operate at a loss. We all have to pay bills somehow. Usually, the problems are solved by changing an EPROM, just plugging in the right computer code. The last thing we want to hear out of customers are complaints. Complaints mean returned product and end of sale. And nobody can afford that in today's market.

Continued

Turmoil In MIDI-Land

Roger Clay

> "We're even thinking in the direction of not making keyboards anymore. We'll make sound-producing units and playable controller units. They'll hook together with MIDI and everything will look like an old ARP 2600—little keyboards and separate sound boxes."

Where do you see MIDI going? Do you foresee it changing direction or expanding?

I see that if it is handled in an intelligent and open forum, it's going to go very far. I see that it can become an entertainment industry interfacing system. Not just a music industry interfacing system. I see that initially, it can go into computer-assisted performance. And I see it going into education. We're very big on the prospects of MIDI in education. Both on an academic level and on a personal development level. We see that the uses of inexpensive home computers for teaching basics, music basics, with MIDI are incredibly good. You're not locked into any one particular type of machine to do it with. You can use whatever instrument you want. If you want a Casio, you can do it with a Casio. If you want a Fairlight, you can do it with a Fairlight. We see MIDI as a new user interface for computers. It's another friendly user interface, sort of a continuation of the current trend in computers which uses soft-tech user interfaces.

You don't feel that it's too technically limited for advanced applications?

No. You have to understand — at present there are technical limitations, but I personally look at MIDI as being a concept. Although it is a defined specification, it is not necessarily etched in stone or permanently indelible. I think it is conceptually a music interface. There are limitations at present. There is a definite bias towards keyboards. For some people the speed that it does things at is a problem. It's going to start off being a musical performance interface, but it needs to stabilize. There is a question of whether it's going to be able to stabilize if it doesn't have enough of a solid framework for software developers to design useful software for it. All these questions are questions that people disagree on greatly. It goes beyond what MIDI protocols and specifications you need. It gets into what the ramifications are if you make any additions to the MIDI spec or leave it the same. There is a great deal of contention in that area. It doesn't mean that anything is necessarily bad for MIDI. Look at all the peripherals and additions that have grown up around less than perfect computer products. The Apple II is a perfect example. It was a less than perfect computer, but the thing that was great about it was that it was an open architecture system.

The real question with regard to MIDI is whether music people are that interested in doing a lot of programming and configuring to get it up and running. I don't think they are. They just want to plug something in and have it work. We're adamantly working to see that type of thing happen. MIDI should not be a political issue between manufacturers. It should be an open system. If you're going to do MIDI, you've got to release all your MIDI information, make it known. The more open you are about it, the less likely that things are going to come up that go wrong. Hiding MIDI mistakes can't help. Make them known so people can get a conceptual picture of what can go wrong and why.

How do you feel about expanding the spec to allow for more demanding applications? Some people feel it should be a couple of years before anything like that happens.

I think that's absolutely true. I think that what should happen is that we start working on getting a new spec ready to go right now. We can start getting it debugged and all that sort of stuff. That needs to start immediately if it's going to get in place by two years from now, or a year and a half, or whatever the timetable is. That's how long this kind of thing takes. But there should also be a group that is working on cleaning up the specification, because there are a number of places of contention. It's not a matter of changing the spec. It's a matter of clarification.

Some of the implementation on continuous control alone is incredible. How do you know what pitch-bend on one instrument is going to do on another instrument? Have you tried pitch-bending on a Poly-800 connected to a DX9? You get some very interesting intervals happening. From that standpoint, there are a lot of things that need to be cleaned up. It's usually easy enough to do. Software fixes are standard computer industry fixes that can be applied to instruments. But in order for the manufacturers to do that there has to be some group in place that is willing to work on these problems, and by and large, my experience so far with the engineering group from manufacturing is that (1) they're engineers, not software developers, and (2) everybody's too busy building their next product. They haven't got time for MIDI. Okay, fine. Who can do it? Who has authority? And will they allow those questions to be answered? That's all part of the politics of MIDI. Those things should be addressed. There should be a group in place to do that. If that doesn't happen, then we're going to have significant problems.

My whole purpose in getting some talks going on additions or another specification is that the concept is right. There should be discussions going on about how to make it happen under any circumstances. How to improve it. I'm sure that most of the people I've talked to would be more than happy to support the thing for the time being, while something else is being worked out. Use this specification as a proving ground. Sure it's imperfect, but you learn to use imperfection. You can use it to make sure that you don't run into the same thing with whatever happens next, because there'll be problems with the next one too. And that's not unusual. There are problems with RS-232. They're being shaken out, and it's not as sophisticated an interface as MIDI.

One of the other things that we're calling to arms on is a splitting off for actual specification purposes of the hardware and software aspects of the spec. I talked with a couple of people about the specs, and there may be three actual specifications that should come out, if it ever goes to standardization: a hardware spec, a software spec, and a spec for formatting data information. I intend to give a talk about it at MIDIsoft [a conference about MIDI software scheduled for May in San Francisco]. It's one of the things that we're going to suggest, or recommend, since the IMA is a communication and information exchange. And that's what MIDI is all about.

Tom Oberheim

You were pegged as being very much anti-MIDI when it was first being proposed. Do you still feel that way now that you've started including MIDI on Oberheim instruments?

We made some statements early on that gave people the impression that we were anti-MIDI. That was more an opinion of individuals at Oberheim, not the attitude of Oberheim, the company. I think that MIDI will further to a great extent what we started three years ago with our system idea. MIDI is going to let other companies hook into each other's units. The theory behind MIDI, as we all know, is that you can hook anything into anything. If that takes place, then anybody is going to be able to make a system from any combination of units. What's sure to happen is that synth systems will take on another level, a higher level of complexity, because now we can face the next level of system consciousness. We'll be able to think past the idea of simply hooking machines together. We'll be able to start thinking about what to do with the system, not just the individual pieces. Some of the companies making large digital machines are already doing things with that. Companies like Synclavier and Fairlight have the integration of music composition and music writing with the synthesizer itself.

So you're not holding out for a better standard anymore?

No. I think anybody who doesn't accept MIDI as a fact of life is being kind of silly. One could argue that these standards are better than those standards. My guess is that prob-

ably after people have experimented with the system concept for a couple of years there might be a revision made, or a second standard that will allow some things to be done on a little higher level without so much treading of water.

You don't feel that that will strike fear of obsolesence in the hearts of consumers?

There's really no way to prevent that. I bought a Beta VCR a year and a half ago, and now VHS has made Beta obsolete. But now there's something else coming out that could well make VHS obsolete. There's no way to prevent that. The problem with designing new products is that they make the old ones obsolete. And if you don't do it, someone else will. It's a no-win situation. MIDI was conceived to do a very simple thing, and it's now being used to do very complex things. But it can and will work. We're even thinking in the direction of not making keyboards anymore. We'll make sound-producing units and playable controller units. They'll hook together with MIDI and everything will look like an old ARP 2600 — little keyboards and separate sound boxes. Like a component stereo system.

Marco Alpert

E-mu held off on MIDI at first, but now you've gone ahead and implemented it. Why?

We had some reservations at the start, and in fact still have some reservations. The major reservation was that in picking a non-standard interface method, we were cutting ourselves off from the advantages of easy integration of the interface. If we picked something that already existed within the computer industry, we might have had to work a little harder to make it work for us, but the fact that it was real popular in the computer industry meant that you would probably see the entire interface on a chip coming somewhere along the line, making it very very cheap and also standard. By picking something that's totally non-standard, it's unlikely that any chip manufacturer is ever going to think of marketing a MIDI chip simply because the potential market doesn't compare to the computer market. However, something is better than nothing. And the way both manufacturers and the public in general have jumped on the existence of such an interface has shown us that. . . . Whatever its basic shortcomings may be, it works, and people like it. And you can do useful things with it. Consequently, we've retrofitted Emulator I's with it, and there's going to be a MIDI interface for the Drumulator soon — from Jim Cooper in L.A. And Emulator II will have gobs of MIDI.

Do you see the spec changing?

I think it already has, hasn't it? I know there are early versions and later versions of MIDI, and there's some incompatibility between instruments from different companies. But certainly the spec, as far as what the baud rate is and where you stick certain things that are basic to the interface, will pretty much stay the same. How you'll be able to use those things will evolve as people think up new things to do with them. How that's going to be worked out between the various manufacturers is the question. One manufacturer may be very interested in compatibility with guitar controllers, while someone else may have no interest in that at all. How those two implementations of MIDI might be compatible or incompatible when those two instruments are used together is an interesting point. But I think most standards go through this problem. Look at the S-100 buss that people were trying to make the computer standard for quite a while. I don't think they ever agreed on a completely consistent standard, and there are a lot more computers out there with S-100 busses than there are synthesizers with MIDI.

Do you see MIDI bringing in the age of component systems?

Modular of a sort might be coming back. You see it in the thing Yamaha is bringing out — eight DXs in a box — and Roland's plan of having a master keyboard controller and the other stuff mounted in a rack. I would suspect that you're going to see systems with one keyboard and a lot of MIDI-based rack-mount instruments. Given people's bent for multi-keyboards and the awkwardness of jumping around from one side of the set to the other, the idea of just being able to select multiple MIDI instruments off of a single keyboard is a real neat idea.

You've included both MIDI and RS-232 interfaces on the new Emulator.

Yes. We have MIDI, RS-232, and SMPTE. We're trying to cover the past, present, and future — not that RS-232 is the past. Now we tend to feel SMPTE is the future, but I think there's room for both MIDI and SMPTE. I think a keyboard setup that's being played by MIDI and controlled through SMPTE is an astounding combination. It gives you the ability to treat the whole multi-keyboard setup as if it were a multi-track tape recorder. You can do fast forward, reverse, scroll into the middle of your sequence and start it playing at that point. Right now, to buy a SMPTE reader and clock you're talking about thousands of dollars. We're hoping to put that capability in a no-cost accessory to a standard musical instrument.

By putting it on a chip?

No. We have other ways of doing it. We're using some computer power that's on board the Emulator. I suspect that if SMPTE catches on — we're going to be working like crazy to make sure it does — that the cost of implementing SMPTE can come way down from what it is right now in the professional film and video industry. But I see a very interesting future for combining MIDI with SMPTE.

> "There's really no need to criticize MIDI. It's been ballyhooed to the point where it's a necessity. I am just sorry to see that we have a standard that we have to evolve out of rather than one we can grow into."

Tom Rhea

Moog has started using MIDI, but you've voiced criticism of the MIDI spec in the past. How do you feel about it now?

There's really no need to criticize it. It's been ballyhooed to the point where it's a necessity. I am just sorry to see that we have a standard that we have to evolve out of rather than one we can grow into. First of all, there are some techical problems with MIDI. I'm sure somebody will point out that bandwidth [the amount of information being transmitted] will probably be a problem for instruments of the very near future. There are some other aspects about it that aren't standard for computers. I'm afraid that it's not what it's been billed as. That's the part that bothers me. It's an inexpensive way to do some things that are useful. I can certainly resonate with that. It's unfortunate that with increased through-put [more creation and processing of data] on instruments it's going to be one of those things where we're all of a sudden going to need a new standard. The other problem is with the various implementations, which have created a few problems. But those aren't very severe.

That still sounds like you're disappointed with MIDI.

I think that it's unfortunate that MIDI will truncate some interesting things that could happen with instruments like the Rhodes Chroma. By that I mean that it's probably not able to adequately support things like the velocity and force sensitivity and all the parameters that can happen on a Chroma. I think that MIDI has been brought on because of market pressures, not because the *de facto* standard is technically exquisite and has such compelling musical bases that everyone simply acquiesced by acclamation. I'd have to say that a number of people at this point, who may or may not come out in the open and say it, pretty much felt that they had to do it [add MIDI to their instruments], simply because if you don't have this on your instrument you're going to suffer in the marketplace. People have been promised so much. It's not MIDI's fault that that happened either. It's like everything in the industry. It's oversold. Witness the fact that certain instruments are being advertised as on a par with the invention of the wheel and the electric light bulb. What do you expect in an industry that goes for hype like that? MIDI has some uses, certainly. The computer field has MS DOS, the Apple system, CP/M, Xenix, Unix — there's a lot of diversity. I think that diversity has stimu-

lated a healthy situation. In the final analysis we're not that far away from instruments with a lot more through-put, and as computers become more sophisticated, this will be more and more the case.

Of course, MIDI is also oriented around transmission of keyboard information. That may not be very useful in the future. I suppose you could always evolve to a new standard. Maybe the solution is to have two standards. Maybe we need a parallel standard along with a serial standard. Maybe that needs a good bit of thinking about.

Is that how you feel as the director of marketing for Moog?

I suppose that I should be talking up the Memorymoog Plus with MIDI and clock compatibility. Those are things that people worry about, and they do matter. I'm not denigrating MIDI. But as a guy who has spent 15 years being concerned about the evolution of instruments, I see MIDI as a point of potential homogenization. It means that we might feel safe with what we have and not try to go further. I think it was a bit early for a standard. Now it remains to be seen if we can evolve to new standards and things with greater through-put.

How do you feel about industry politics and MIDI?

Standards become political and PR things because they involve competing companies. But as the old saw goes, the great thing about standards is that there are so many of them. I may be in the minority, but I have different feelings about what instruments ought to say to each other. I was standing next to Bob Moog at a NAMM convention, and I made the comment that once you start doing certain things, MIDI is going to gag. He said no, it's not going to be a serious problem. I said, how do you figure? I can multiply as well as anybody. It takes so many milliseconds to run so many bytes of information, and when you start doing more sophisticated things and interacting with one panel and causing things to happen elsewhere, you're going to have problems. He mentioned something about if you cause a 7-millisecond delay, that's no more than being 6 feet away from somebody on a stage performing. I knew what he meant, because I'd played in marching bands where you were sometimes as much as 100 yards away from the other people playing. The point is that there is a little bit of slowdown. And even though people are spread out on a stage, nowadays people have monitors within 6 feet of themselves. Sure, time delays happen naturally in music, but you don't always want them.

Do you think all this talk about new standards is going to frighten the consumer with visions of obsolescence?

That's always on people's minds. I think it would be easy to support the idea that one of the best used-instrument markets in the country is for Minimoogs. That means a lot of people are still playing Minimoogs. You notice the Moog company does not make Minimoogs. How does one explain such an anomaly? Well, the Minimoog is obsolete *technology*. That means a company can no longer make a Minimoog and make a profit on it because of the various techniques involved in putting it together. The discrete components and labor involved make it too expensive. On the other hand, the very fact that thousands of people play this thing and make music for a living with it is living proof that the *instrument* is not obsolete. So I think when people decide about buying or not buying an instrument, they ought to base their decision not on whether the technology is obsolete but on whether the instrument is musically obsolete. There are very easy ways to do that. You have to ask yourself if you like the sound, if it's musically useful for what you're doing, and if you can get service on it. When transistors came out, people said that vacuum tubes would go, but the amplifier people haven't gone along with that idea. People still play the Hammond B-3, and you're talking about a basic design that's from 1935. People still play the Rhodes piano, and it was designed during the Second World War. In a sense, MIDI is the same way. It's there. If a thousand instruments come out with it and then a new standard comes along, it doesn't mean you'll no longer be able to do things with MIDI. It has utility. Although I must admit that a standard is a little more prone to becoming obsolete than an instrument, because after all we have instruments that are thousands of years old that aren't obsolete. But here's what can happen to MIDI: If you sell a person a product and at the outer reaches of its limitations it fails to do what it's supposed to do, you'll disappoint that person. Here's an example. You have a sequencer. It works fine until you turn its playback speed all the way up. When you do that and start tweaking knobs to alter the patch it's playing at the same time, the sequencer slows down. That's because the processor in the instrument is getting overloaded. The customer gets upset. Now you can avoid that problem if you don't allow the sequencer to be set to its outer limits to begin with. Then the person who buys the instrument won't expect it to do something it can't. MIDI has been oversold to the point where people expect to be able to hook it up to a computer and do all kinds of things, when they can't. I've seen all kinds of articles on MIDI that really push the idea that you can do more than is possible. They were really overselling this thing. By overselling it, you get everybody coming in with great expectations, and when those expectations aren't met, they go away disappointed. You'd think that the industry at large would start to get a feeling for this and lower its force just a little, but that hasn't happened yet, has it?

> "The only thing I won't give in on is this stupid 5-pin DIN plug thing. I can't stand it. To force people to go out and buy a piece of shit connector that they can't use for anything else in their whole rig is insane."

Carmine Bonanno

What is Octave Electronics' position on MIDI now that you've implemented it on the Voyetra Eight?

The only thing I don't like about it is . . . I don't know how I can put this . . . I think because the industry is so small, people inherently get into cocoons. I think that if they talked to each other more rather than try and hide everything, MIDI would be a lot better off than it is. What happens is that someone will get an idea and try to implement it, and then you have the usual "pooh, pooh, this is no good." And then the big boys say gee, this other thing isn't a bad idea, maybe we should try it, and the little boys try to catch up to the big boys. Like when Yamaha changed their spec without telling anybody [*Ed. Note: Yamaha misinterpreted the language of the specification and implemented a different kind of mono mode.*] The position we're in is that we're always having to chase people. When we find out that other instruments can't be controlled by ours, we find that it's because the other people changed the spec and didn't tell us. I don't think that MIDI is going to happen unless someone with a lot of credibility gets down and says, "Okay, everybody. We're going to hold hands and we're going to get this right." Just like they did with the IEEE buss. Conceptually, MIDI is fantastic, but it's just not coming together because of this communications gap.

You never hear from the big companies at all?

I never get letters from Sequential. I never get letters from. . . . If someone changes a MIDI spec or wants to do something, do they contact anyone? No. If they're big enough, they just do it, like Yamaha. Everybody's got to follow them. That's what scares me. I think that if we continue to do that, we're going to make more enemies than friends among consumers. I can't tell you how many people scream at me because DX7s don't respond to some kind of command from early Voyetras. And we have to update the software. We have to absorb [the cost of] people bringing the machine back, taking it apart, putting new EPROMS in, because when we first released the software Yamaha didn't have whatever it was they were doing with note-off data. So now we have to absorb that cost. So what happens when that happens again? We have to absorb it again. And it just keeps happening and happening. And then there's the idea floating around about putting a

Turmoil In MIDI-Land

MIDI-2 spec together.

Others in the industry seem to feel that that would mean death for the spec if it were to happen right now.

That's how I feel. First of all, I don't think they've accumulated enough data to get a decent MIDI-2 spec. Everybody talks about what they hate about MIDI 1.0, but it hasn't been out more than a year; so you're going to design a new spec on a year's feedback? It's symptomatic of the music industry that people don't want to talk to each other. That frightens me. I don't know if it's limited to the music industry, because I deal in the music industry. But it's like people are so protective of their own ideas that they don't want to talk to you. Here's an example of the kind of attitude I've run into: Allen Organ is suing us for using a scanning keyboard, because they have a patent on it. They're eventually going to wrap up the whole synthesizer industry with this patent [because every polyphonic synthesizer uses a scanning keyboard]. I called up Mr. X and Mr. Y and Mr. Z and they said, like, screw you. It don't affect me, so the hell with you. That's their attitude. Transmit that to the MIDI generation. Everybody's kidding themselves. It's the survival-of-the-fittest routine. And that's just not where it's at. Jim Cooper is just as important as Yamaha. I think that unless a committee like the one the IMA is trying to do is put together, MIDI is going to be led by one or two huge companies, and everybody's going to have to follow them. And you're going to get these inherent problems of people having to chase them to find out what's going on. I don't know. Maybe it's the West Coast people. Maybe they're so close to each other that they talk all the time and the East Coast people only get to see them at conventions. The small companies that I speak to are really shunned a lot by the big boys. I've given in to the fact that we're just going to have to follow what people do.

But you're still using 3-prong XLR connectors for MIDI instead of 5-pin DIN plugs like everyone else.

The only thing I won't give in on is this stupid 5-pin DIN plug thing. I can't stand it. To force people to go out and buy a piece of shit connector that they can't use for anything else in their whole rig is insane. It's just totally insane. If the idea is that down the road the other pins are going to be used for something [*Ed. Note: MIDI only utilizes three of the five pins of a DIN connector at the present time*], then put another connector on when the time comes. If you want to hook a Voyetra up to another instrument, then we sell the adapter cable. Maybe I'll have to do it, but for now I'm not going to give in. Why didn't anybody get together and rationalize it? You know how we found out about it? It was just done; that was it. There's no mechanism to distribute information around to all the manufacturers. That has to change. If it doesn't, everybody will have to check with the big boys whenever one instrument doesn't work with another. You know, you'll ask, "Has something changed today?" And they'll say, "Oh you didn't know?" That's the way it's going to happen, and you're going to have a lot of pissed-off customers and smaller manufacturers.

> **"It seems to me that MIDI was designed for the guy playing a gig in a bar, not the guy in the professional recording studio."**

Here's what else might happen. Yamaha has a MIDI card for the IBM PC. People are going to have to contact them to find the specs in order to write software for that card. Now if the specs aren't some kind of standard, and Yamaha changes them, who's going to write software? Are you going to write a software pack a week? Software *a la mode*? You've got to have something that's a standard. You've got to be able to buy *Byte* magazine and read their article on MIDI that's going to tell you how to write programs for it. And it has to work with everybody's MIDI card, whether it be Sequential, Yamaha, or anybody. They have to all have the same protocols. The industry is really growing up with all these software support packages, which is going to help everybody. But things like this lack of communication are going to prevent it from really happening.

What's to prevent you from taking the initiative on staying in touch with the larger companies?

The way I see it, the problem is a matter of economics. I estimate that this industry does anywhere from 60 to 70 million dollars per year. That's about the size of a decent supermarket, which is pretty funny when you think of it. All these people getting excited over a market that's the size of an IGA or Alpha Beta. A good supermarket does something like a half million bucks a week. It's unbelievable. One department store outsells the whole synthesizer industry. And people are getting bent out of shape about that! But it's obvious that the problem of communication is one of economics. This industry is so small that it's easily dominated and swayed by the people that own 30% of it. Look at my situation. Do I devote a bunch of time to worrying about MIDI, or worrying about running my company, or or worrying about getting my products out? We employ 28 people. That's the whole company. Am I really going to devote that much time to worrying about what everybody's doing on MIDI? Or am I just going to wait for them to tell me? I can't afford to take the time. We're too small. So, if there were a committee . . . now there would be a different story. Because there I know that I've got something to say and I can go in there and be heard. But I'm not going to write letters to Yamaha and Sequential. Besides the fact that they won't listen to me, I don't have the time.

Chris Albano

Passport is beginning to focus on MIDI software. Yamaha is licensing some MIDI programs from you, and you've got your own product line. From your standpoint, is MIDI technically limited?

Not at all. It may be limited for Michael Boddicker, who needs 18 million synthesizers tied together to do film scores, but I don't think the MIDI spec limits us in terms of software, because most guys go out and buy one Yamaha DX7 or they buy a DX and a Roland JX-3P. They just want simple productivity. They don't need a super-fast baud rate and all this crap to do what they want. If they raise the standard — let's say there's a second generation of MIDI — then great. We don't think it's necessary right now. We don't see it hindering us in any way. We have some good programmers, and the biggest problem with the software standard is that the manufacturers have not adhered to it in one way or another.

They've all used different implementations.

Right. So you get this spec that's very wide. Very vague. So we have to take that into consideration. But so far, we've had no problems with it. Interestingly enough, the only gear that's given us problems is the Sequential stuff. I don't think it was done intentionally on their part, but there are some problems with their Six-Trak. We'd really like to access those six tracks for different MIDI channels, but we can't because their instrument only sends on one channel. I would personally like to see the American manufacturers be a little more communicative about what it is they're doing. We'd like to be able to support whatever packages they come out with with software immediately. But what I see is all these manufacturers swinging at each other. Everybody is going to try to eat up each other's market, and that's kind of weird.

Will Alexander

Will MIDI be implemented on the Fairlight? To what degree?

Yeah, why not? We have a MIDI board which will be out at the end of April, first of May. It will basically be able to control eight channels of MIDI, input and output. That's either eight in or eight out. Basically, we're thinking of going to MIDI on our keyboards, so we can use someone else's keyboard controller and get out of the keyboard business entirely.

Where do you think MIDI is going?

They're going to have to do a lot of revisions, of course. And the sooner the better. They need to at least double the transmission rate, if not triple it.

To keep up with the applications you have for it?

Exactly. When you start talking about

what the Fairlight will eventually be doing — 64 channels of programming, and things like that — you'll have 48 channels that the Fairlight can't play by itself. If MIDI were faster, it would make things a lot easier. What we plan to do is put multiple MIDI ports on it, because. . . . I've noticed that when you take two DX7s and hook them together and you play 10 notes, you can hear delays. There should be no reason for that. If you have three DX7s, you hear a lot of delays.

Delays or arpeggiated notes?

Delays. Percussive kinds of sounds are always late getting there. If you're playing slow strings, it's cool. But it seems to me that in the initial conception of MIDI, they were thinking of two 8-voice synthesizers being hooked together. I think 16 voices was an afterthought. They should have designed it to where it could have handled 64 voices easily, and there's no reason it can't. It's just that most musical instrument engineers are not that proficient in digital concepts. They finally got computers happening, but when it came to transferring data quickly outside their synthesizer, I think they blew it. It's, shall we say, too simple. But I think it's a great idea.

When do you think a change ought to be implemented?

If they're going to change it, they ought to do it soon rather than have everybody buy 10,000 instruments with MIDI 1.0 on them, and then come out with MIDI-2 and make them obsolete. Or they have to make the retrofitting of the MIDI end of the operating system software feasible. The way we're doing MIDI is our MIDI has a separate computer dedicated to doing just that one thing. So if we want to increase the baud rate — the transmission rate — it'd be no problem. It seems to me that MIDI was designed for the guy playing a gig in a bar, not the guy in the professional recording studio.

Ralph Phraner

From your vantage as a software consultant, how do you see the software community viewing MIDI?

The people I've talked to are happy to see some kind of standard, because it obviously means that in the future we can expect to see concerted development. On the other hand, there are some technical worries about the standard which are basically centered in two areas. The first is that the bandwidth needs to be expanded. I'm told that with a very small addition in cost — hardware cost on the order of a couple of dollars — it can be upgraded from the current 31.25 kilobits per second to about a megabit per second [1 million bits per second]. I'm not sure about that, but the people are very sound technical people so I have to respect what they're saying. The other side of the comment is that there are not enough holes in it for future development. Software people want to see longer length packets of information so they can get into microtonal pitch, because at the moment, MIDI will not accommodate that kind of thing. And that seems fairly important for the development of controllers other than keyboards. As far as supporting the standard, there's a lot of enthusiasm for it. There's an interest on the part of some big corporations in what's going on in MIDI. New computer companies and some of the larger ones have people investigating MIDI, whether it's official or not.

> "I have a very strong feeling that if MIDI is allowed to grow, there is a whole new industry that's waiting to be uncorked. And the new industry is something that just can't be seen at this point. What it involves is something that has the kind of universality of the stereo industry, where people will buy a box that will plug into their home stereo units, which might do any one of a whole bunch of things."

What about what's going on in the music industry?

It's going to take suspending personal interest to some extent in order to get anything done. What really needs to happen is that the manufacturers have to agree to agree. They have to agree that it's in everyone's interest to come to some final conclusion about MIDI and really support it. What's happening now is you have a bunch of guys out there that are relying on the fact that if they make their system-exclusive information Byzantine enough, nobody will bother doing it their way. And then everybody can go about merrily doing it their own way. Therefore there will be all these exclusive devices out there that will basically be great for a Yamaha or Sequential machine but do nothing more than manipulate pitch information for everything else.

The best thing that could happen to the musical instrument business would be for somebody to do an Apple kind of trip where somebody comes out with an open box and says, "Let's have a bunch of guys out there build cards for this. Let's publish the standard. Let's see what happens with individual creativity." But I don't think that's going to happen. If it does happen, it may not catch on. It may be just a small guy that does it.

Have you looked at much software for MIDI yet?

No. I've seen the Passport system and looked at how that deals with various MIDI instruments, and it's nice. But having the computer act as a sequencer doesn't make a hell of a lot of sense. You can build a better sequencer on board a synthesizer than you can by having the computer do it. What the computer is best for is manipulating the complex parameters that are involved in setting up these instruments. The more sophisticated these new instruments get, the more difficulty there is getting musicians who feel non-technical to play the instruments. The reason why I'm so strongly for getting away from system-exclusive information is because I think that in the long run, the winning strategy is going to be making some kind of standard interface between the musician and the instrument where the musician is able to define his timbre in some way that is instrument-independent.

Do you see MIDI evolving?

I sure hope so. It's a little too early to make prognostications. It's entirely in the hands of the manufacturers. You have the IMA, which is going to be nothing more than what the manufacturers allow it to be. MIDI is going to be nothing more than what the manufacturers allow it to be. I have a very strong feeling that if MIDI is allowed to grow, there is a whole new industry that's waiting to be uncorked. And the new industry is something that just can't be seen at this point. What it involves is something that has the kind of universality of the stereo industry, where people will buy a box that will plug into their home stereo units, which might do any one of a whole bunch of things. They might be able to buy a box that would allow them to play music given some yet-to-be defined user interface. It could create background all day long — a kind of controlled randomness. I hate to pop these ideas, but you could apply the fractal mathmatics idea to generating random music. I would think that that would be a very beautiful thing if it were done right. There are a whole bunch of concepts like that that MIDI can allow to happen. MIDI is necessary to interface these boxes with something that can down-load to them. MIDI should be used to interface the box as a general piece of equipment. I would think that that box could plug into a port on the stereo just as easily as it could plug into a MIDI port on some future computer. It could be part of a home computation center where the person dials up a local network and down-loads a whole bunch of their favorite music into a local memory and then plays it over a local instrument. Why not? There's a lot of that kind of thing that MIDI could open the door for. Because it provides, for the first time, a viable commercial interface between the computer business and the music business. But that's all just words at this point. Just riffing on words.

Continued on page 106

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TURMOIL IN MIDI-LAND

Continued from page 63

Do you think the manufacturers are going to give up enough control of MIDI for something like that to happen?

I think enough manufacturers are far-sighted enough to see the advantages of it. I don't know the internals of Yamaha—they're kind of monolithic and hard to get inside—but their machine and the extent to which they and Roland have gone into MIDI shows that they've put a lot of money into it. There will be a very powerful incentive to hold on to the standard, and that kind of thing can be very beneficial.

You mean not change it.

Yeah. Not try to improve it or use something else. At the outset, MIDI is kind of like a test thing. And if it fies, if it starts to make some money for people, then they might start to deepen the groove.

Holding on to the standard could also have meant not releasing information to the public on it.

Well, I think there is that temptation. But on the other hand, it's going to become very apparent commercially to these people that if they try to do that, sales are not going to expand. When a person buys a Roland sequencer they may well want to buy a Yamaha DX7 for it to run. If those instruments are incompatible, then both Yamaha and Roland or at least one of the two is going to lose a sale. I'm a little afraid of the current standard, because if you're trying to do an orchestral piece you just don't have the bandwidth to send enough note on-offs. It's fine to say you can transmit so-many-note chords in a second, but you just don't have enough bandwidth to do more orchestral-oriented things where you might have 256 independently articulated lines. Somebody should work backward from specs that could handle that to figure out a bandwidth and then develop the cost of that, figure out what's possible to do, look at some advanced opto-isolators and serial transmission, and come up with conclusions and say, "Here's what we can do within the next whatever period of time."

What would an updated spec do to all the instruments currently available?

It wouldn't have to have any noticeable effect. What you'd do is have the most capable device ask all the others in the chain if they're capable of handling a megabit baud rate or whatever. They'd do that by manufacturer ID number or whatever code was decided on. All the instruments in the chain would answer back, and a unit that couldn't do a megabit might answer back, "No, I can only do 31.25k." Then the most capable unit would say, "Okay everybody, we're going to talk at 31.25k now." If all the devices answered back, "Yes, we're capable of a megabit" then they would all switch into enhance mode and be able to transmit at the higher bandwidth. I would see that as a way to move smoothly from the equipment out there now to equipment with an enhanced standard. But it's all in the hands of the manufacturers now. We'll really have to wait and see what happens. ■

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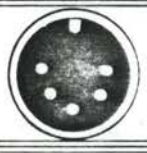

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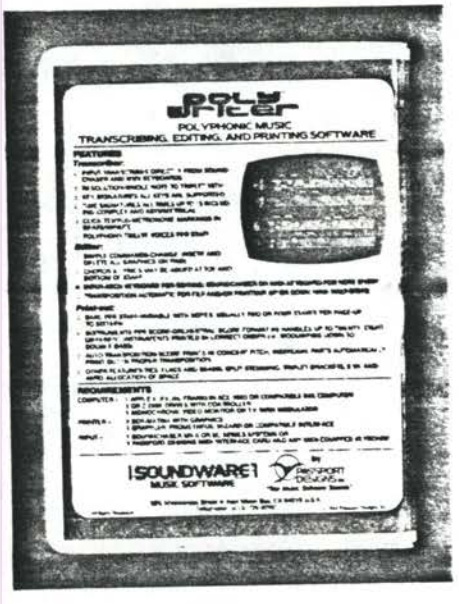

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COMPUTER SOFTWARE for Musicians

EVERY TIME A TECHNOLOGICAL breakthrough hits, we marvelously adaptable humans have to learn new skills. We grumble a bit, but we end up learning. Before the taming of fire, it didn't matter whether you knew how to tell green wood from dry wood. Until the stone-tipped spear was invented, there was no need for marksmanship.

In more recent times, our great-grandparents witnessed the arrival of the automobile, which transformed the face of the world and made a whole new set of skills necessary. Not just driving, but checking the oil and the air pressure in the tires, and knowing where to clip the jumper cables when the battery dies. Very few of us are qualified automobile mechanics, and fewer still design cars for a living, but we take it for granted that we ought to know something about them. Even if you never own a car or ride in one, you have to know enough to stay out of the street.

In the last five years, the computer has become as much a part of our lives as the automobile. And even though most of us will never be programmers, we're going to have to learn enough about computers and how they work to deal intelligently with them. When they fail to perform as expected, we need to have at least a sketchy idea whether we're looking at a machine malfunction, badly designed software, or operator error. And as we ask computers to do more and more things for us, it's vital that we understand what their strengths and limitations are.

If you've been living in a cave in the Himalayas since 1978, you may be surprised to learn that computers have invaded the musical instrument business in a big way. Digital technology is being used both to record and process existing sounds and to generate new sounds from scratch. Even more importantly, it's being used to make musicians' lives easier by storing, retrieving, and transmitting all sorts of useful information — information about the settings of knobs and switches, about the timing of notes in a musical performance, and so on. In effect, the computer gives the musician a few extra hands, which he or she can use to execute musical patterns so complex that they would be impossible to achieve unaided. The trick is to get those extra hands to do what you want them to. If they start developing a mind of their own, you'll be no better off than the hapless victims of *The Beast With Five Fingers*.

As with any new technology, unexpected problems do show up once in a while — usually after the system has been sold and set up and is supposed to be working perfectly. (A few unlucky folks got burned learning to live with fire in their caves, too.) The good news is that a solid 95% of the digital music systems on the market today are performing up to or beyond expectations, making it possible for us to play music that Debussy and Duke Ellington never dreamed of. And we're only at the beginning of the process of evolution; during the next decade, the decreasing cost of computer components and the growing sophistication of instrument programmers will give us machines that — well, I'm drooling already just thinking about it. The bad news is that there are a few bumps in the road, and the shock absorber is still only a gleam in some mechanic's eye. We could fill dozens of issues of *Keyboard* talking about the many positive developments on the electronic music front. (We do, come to think of it.) This month, though, we thought we'd take a look at a couple of the places where the pipes and girders are still showing through the half-finished edifice of technology. The creaks and groans you hear whenever the wind blows will be eliminated, we are solemnly assured, by the next software update, due out by the time you read this. (This paragraph hereby nominated for a Block That Metaphor mention in *The New Yorker*.)

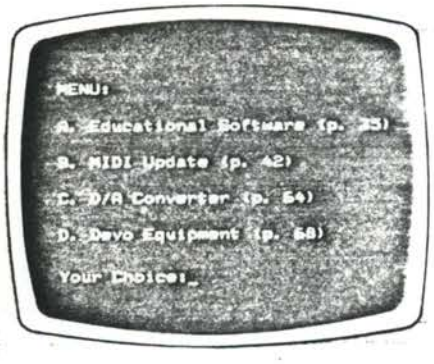
Once you have a stack of computer-based synthesizers, the next step is to ask yourself why they can't all talk to one another. Computers do all their fancy footwork with ones and zeros, after all, and there isn't any reason why you can't send a string of ones and zeros down a wire from one instrument to another. What the ones and zeros mean, however, depends on how each computer has been programmed. In order to get your synthesizers to talk to one another, they have to speak the same language. The language, in this case, is MIDI (the Musical Instrument Digital Interface). MIDI was created a couple of years ago to let synthesizers do various stunts that were previously difficult or impossible to arrange, like having the keyboard of synthesizer A tell synthesizer B

what notes to sound. A musically powerful idea, and one that has very quickly become a reality. But while in theory MIDI is a standard specification that is supposed to be implemented in the same way by all manufacturers, two MIDI-equipped devices may have as much trouble communicating as a Cockney Englishman and a black hipster from New York, both of whom are, nominally, speaking English. For this month's cover story *Keyboard* talked to the people in the industry who are most heavily involved in implementing MIDI, and found a surprising divergence of viewpoints. There are strong arguments on all sides of the MIDI controversy, and we're sure we haven't heard the end of the story. We're also sure that if synthesizers are ever going to talk to one another, it will be because manufacturers are willing to talk to one another. We hope these outspoken interviews will help keep a productive dialog going.

Computers can be used not only to play music but to teach us about it. The educational software field is another in which developments are rapid and sometimes chaotic, and the music education software available today ranges from incredible to not so hot. In a special report this month, we take a peek at some of both. And if you're still not satisfied, if you still want *more* on computers and music, don't miss our introduction to do-it-yourself computer control, in which an expert tells how to launch your trusty old-fashioned analog synthesizer into the space age. Is that it? No? You mean there's *more??* Well, we did talk to Devo's equipment guru to find out what kind of customized digital gear a leading American techno-rock band is kluging together these days.

We probably could have written another eight or ten features on computers this month, easily, but the whole staff was too busy playing video games on our word processors. (Hope the publisher thinks this is a joke.) The only computer problem we encountered first-hand was that Milano scored over 1,200,000 points at Ladder, and nobody else can even get close to him. Computers, you see, in case I forgot to mention it, are *fun*. Sure, things aren't always perfect. But when they work right, they're not just useful, they're fun. If it wasn't for the fun, why would most of us bother?

—Jim Aikin



Educational Software 1984

An Overview

By Jim Aikin

EVERYBODY KNOWS you can't teach an old dog new tricks. Teaching a new dog old tricks isn't always a snap, either. The new dog for the '80s is the personal computer, and as the central element in a booming new industry, it's been tossed enough juicy ham hocks (read: money) that it's shamelessly eager to sit up and beg for more. Unfortunately, it still has a distressing tendency to roll over and play dead. Even when your hardware and software are functioning exactly the way their designers meant them to, you may be dealing with a stiff.

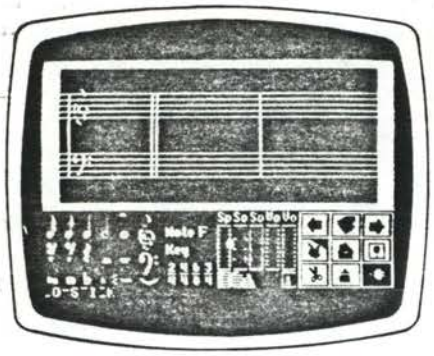
Computers are very good at certain kinds of things and appallingly inept at others. The task of a software designer is to teach the computer to walk on its hind legs, so to speak, so that it can become a part of human society. And doing this well isn't easy. You have to find ways of matching the computer's strengths with people's needs. The personal computer has been called a solution in search of a problem, which is another way of saying that we don't yet know exactly what needs it can best take care of. Even when we think we've found a use for it, we may not have defined the need with enough precision, or we may have defined the need but not figured out how to get the computer to address it. This is a major reason why software isn't perfect.

Personal computers are being used more and more widely in education — not just to teach youngsters about computers themselves, but to provide instruction in a variety of fields, from math and spelling to the natural sciences. A computer is certainly no substitute for a live teacher, but it can effectively supplement the teacher's activities in some ways. Computers are not very good at explaining basic concepts to children, because various children may have different sorts of trouble with the concepts, and only a live teacher is flexible enough to go through all the steps with a child and find out where the gaps and misperceptions may lie. However, a properly programmed computer can be very effective at drilling students on problem-solving activities after the teacher has explained the necessary concepts to them. It can also tabulate student errors during their drills and give the teacher feedback on what areas need more attention.

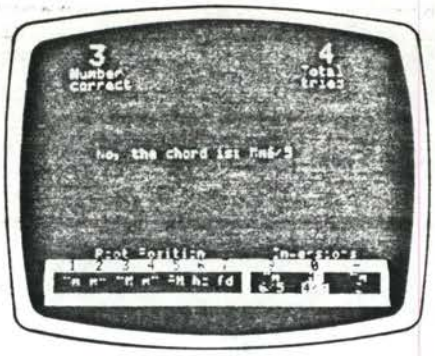
Music education requires more one-to-one student-teacher interaction than most kinds of education, so it might seem that computers would offer few benefits. But in fact, the computer's strength lies precisely in the area that is most often neglected by music teachers. A surprising number of musically educated adults, even professional musicians, encounter enormous difficulties when asked to listen to a phrase and then analyze it in terms of chord functions, play it themselves, or notate it correctly. Why? Because their teachers skimped on their ear-training. Ear-training is boring for the teacher because it involves endless hours of sitting at a piano playing various sorts of melodies, intervals, and chords while the student laboriously learns which are which. The kind of task that a machine will cheerfully handle for you? You bet!

Much of the music education software we examined in preparing this article provides ear-training drills of some sort. The simplest programs ask the student to play back a random diatonic (white-key) melody generated by the computer, beginning with a one-note melody and adding more and more notes until an upper limit is reached or until the student makes a mistake. The more complex programs play a variety of seventh chords, sometimes in inversions or as part of multi-chord progressions, and ask the student to identify them. Another computer application that has enormous potential for the future (though we found only one series of programs that uses this capability) is the comparison of a student's keyboard performance with a note-perfect performance recorded on disk. We also looked at tutorials in note recognition (on the staff), basic aural perception for young children, tuning, and composition. We focussed on programs for the Apple IIe computer, primarily because there is far more music software available for the Apple than for any other personal computer. (For a discussion of some of the music programs available for the Commodore 64, see *Keyboard*, Feb. '84.) Not having time or space to exhaustively test every tutorial program on the market, we tried to choose a representative sample. Even if the specific program you're interested in isn't discussed below, our analysis of the strong points and shortcomings of these packages should give you a good idea what questions to ask in making your own evaluation.

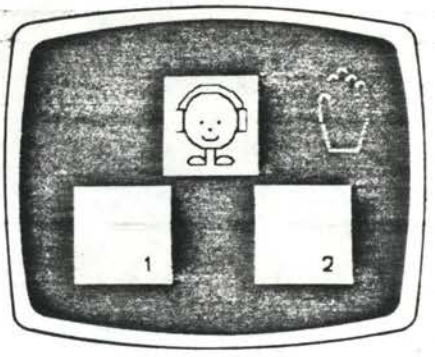
In order to present ear-training drills, the computer has to be able to make musical tones. The Apple has a tiny built-in speaker which can be made to beep at various pitches, and the simplest programs we looked at



The screen display for the Music Construction Set from Electronic Arts. The pointing finger icon is used to pick up notes and rests from the lower left and place them on the staff. Pointing to other icons at the lower right activates control functions.



The menu of choices, score tabulation, and response statement in the Seventh Chord drill from Electronic Courseware Systems.



The screen display for Toney Listens To Music, from Temporal Acuity Products' Micro Music Software Library. The raised hand appears when the student has pressed the space bar to indicate that he or she is ready to identify the tune in box 1 or box 2 as being the same as Toney's tune.

Educational Software An Overview

actually use this to generate scales. It won't play chords, though a clever programmer can make it arpeggiate between pitches fast enough that it seems to be playing chords. A more serious difficulty is that it will only pulse at certain frequencies, which are apparently dependent on the machine's operating speed. As a result, the higher notes in a scale are audibly out of tune by as much as a half-step in some cases. We would not recommend trying to learn music with any program that uses this sound-generating method. (These are the ones you'll see advertised as "requiring no peripherals," as though that were an asset rather than a liability.)

Most music software uses add-on circuit boards that plug into slots inside the Apple and attach to your stereo's auxiliary input jacks. These boards represent a significant added expense, making tutorial software a pretty expensive proposition if you're just buying it for your own kid. For elementary and secondary school classes, however, where many students can share one computer, the boards would be reasonably cost-effective. It would be wonderful to report that ear-training software designed for one plug-in board could easily be adapted to run on another, but we know of *no* case in which this is true. Even if you already own Mountain Computer oscillators, you'll have to buy a Micro Music DAC board in order to run Micro Music software. (More and more of the new generation of computers are being equipped with built-in oscillators; this is true of both the IBM PCjr and the Apple MacIntosh. But it will be a couple of years before a complete selection of music software is available to make use of them.) While all of the available music boards offer much better pitch resolution than the Apple's built-in speaker, they all suffer from subtler problems in one degree or another. Aliasing (computer-generated out-of-tune harmonics in a tone) is the rule rather than the exception. In addition, when two or more tones are sounded together the blandness of the waveforms and the purity of the harmonics can cause them to blend more completely than a piano's tones do. Particularly in the low register, it is often easy to mistake a minor second for a major seventh or minor ninth, even when you know how to distinguish between these intervals.

Because of the cutbacks in public school budgets during the past few years, and because of the widespread trend (not only in music) away from classical expertise and toward instant electronic gratification, we can anticipate that in the future great numbers of musicians will be self-taught rather than conservatory-trained. So there is a definite need for accurate, comprehensive do-it-yourself educational materials. How does the currently available software stack up? Well. . . .

* * * *

The Music Construction Set from **Electronic Arts** is being marketed as an educational package, but it is oriented toward composition rather than ear-training. As there are no drills to take, the Music Construction Set is more a toy than a classroom aid, though it's a toy that could teach some important musical concepts in an entertaining way. It offers the novice a chance to build a piece of music (either original or copied from sheet music) one note at a time on a treble-and-bass piano staff. This is done in a simple and elegant manner by moving a pointing finger around the screen, picking up notes, rests, accidentals, dots, ties, and so on from a menu at the lower left and setting them down on the staff. You can move the finger with the cursor keys on the Apple keyboard, or with a joystick, but the smoothest, most efficient system we found was the Koala Pad from Koala Technologies Corp. This allows you to move the screen finger by running your finger or a special stylus around the surface of a special black rubber pad.

Move the pointing finger over a little icon of a grand piano and press a button, and the Music Construction Set will play back what you've written. It will play music of up to three voices by addressing the built-in speaker in the Apple, but as this makes for a horrendously cheesy sound, we'd suggest that you invest in a six-voice board called a Mockingboard (available from Sweet Micro Systems), which will let you play music through your stereo speakers.

The Music Construction Set has several utility features in addition to the basic note-moving capability. You can scissor out entire measures and paste them in wherever else in the piece you like (handy for copying a repeating bass line without having to enter the notes over and over). You can transpose a piece from one key to another. You can also adjust the relative volumes of the bass and treble clefs. The transposition system does incorporate one rather unfortunate anomaly: While accidentals are moved along with the notes, they are not changed to reflect the new key signature. Let's say you're in C major and you've got an *E*♭ in bar 1. Now you transpose the entire piece up to *D* major. Bar 1 will now contain an *F*♭. However, this will *sound* as an *F*♮, because a flat in this program merely lowers a note by a half-step, no matter what the note was to start with. Teaching beginners the wrong conventions of written music like this is hardly an ideal approach. Still, in the example just given the sound of the music won't be affected, so you might think it's no big deal. However, let's reverse the example. You're in *D* major and you've got a *D* minor triad in bar 1, so you've entered an *F*♮ on the staff. Now you use the transpose feature to move down to C major. Well, you've still got the ♮ in bar 1, but now it's before an *E* — which means that your *D* minor triad has just been transposed into a C major triad.

The 13-page booklet that comes with the program does offer some sketchy information on rhythm values, accidentals, major and minor keys, and the Circle of Fifths, but it's rather badly organized. The beginner would undoubtedly require a clearer and more thorough explanation of fundamentals, and probably some adult guidance as well, to make effective use of the program. One difficulty the beginner would be likely to encounter would be the effect of putting

more beats in the left hand than the right in a given bar or vice-versa. If you make this mistake, Music Construction Set will cheerfully offset that entire hand's part for the remainder of the piece, *without* updating the display screen. As a result, what you hear and what you see may be entirely different.

Another somewhat embarrassing shortcoming of the Music Construction Set is that the pointing finger on the screen doesn't point exactly where it points. The visual image, in other words, is a line or space low relative to where the computer's innards think it is. The program is designed so that when you point at a line or space and hit "P" on the keyboard, the note will sound and the display will tell you what its name is. Unfortunately, when the finger is pointing at *E*, the computer tells you you've got an *F*, and so on.

In spite of these defects, the Music Construction Set does offer the student a real opportunity to discover the mechanics of composing and get instant (well, relatively quick) aural feedback on the sound of a set of notes, even if he or she lacks the skills to play the notes up to tempo on a keyboard. This is a very valuable capability, and it's exactly the sort of thing that computers can do very effectively.

An extremely simplified line of music courseware is available from **Electronic Courseware Systems**. Their offerings include a three-part Aural Skills Trainer, as well as programs called Clef Notes and Ear Challenger. The Aural Skills Trainer series is designed to be used in a school system; each disk includes utility programs for instructors, allowing them to keep track of students' performance on the training drills. A tabulation of which types of intervals or chords the student had trouble with is included in the utility program — a very helpful feature. Printer outputs of the performance records are also available. The ECS programs use only the built-in speaker or the cassette output jack of the Apple, with results that can be imagined. (A spokesperson from Electronic Courseware explains, "We specifically designed these materials to be available to people without expensive peripheral equipment. We do not see this as a weakness, [but] as a strength. . . . While we understand the gross limitations of built-in speakers in the Apple computer, we are making sound programs available to people who cannot afford other peripheral devices.")

The Intervals drill plays intervals of up to an octave, and the student can choose to hear these with the notes in ascending order, descending order, or simultaneously. The Apple speaker does seem to be adequate to sound two notes at once without confusion. We found ourselves wishing that this program offered students the option of hearing an interval again if their first guess is wrong. This would have significantly improved its educational value. The same defect is apparent in the other Aural Skills Trainer packages, Basic Chords and Seventh Chords. In these, another peculiar limitation rears its head; the student can choose between root-position chords and inversions, but there is no level of testing that includes both root-position chords *and* inversions! This is particularly galling in the Seventh Chords drill. The root-position drill includes all seven different seventh chords, but the inversion drill includes only the three inversions of the dominant seventh chord! The drills are far from worthless, even as they stand, but there seems to be no reason to limit them in this way.

Clef Notes is a drill in which students are to move a whole note shown on a staff display so that it falls on the line or space corresponding to a letter name. Options include tenor and alto as well as treble and bass clefs. Again, this kind of drill is definitely worthwhile, but the software design leaves something to be desired. The routine is set up so that the student has to make ten correct answers *in a row* before being allowed to exit the system. This is sure to frustrate the beginner. Even more frustrating, while hitting the "H" key for help does give the user a display of the line and space names for any clef, it also terminates the test run! Surely a system that allowed the student to consult the help display when necessary during a run and included the number of help requests in the instructor's record would have been far more useful.

The final package from ECS is a game called Ear Challenger. This generates a random sequence of notes, adding one note at a time to the end of the sequence on each run-through and requiring the student to match the sequence using the top row of keys on the Apple keyboard. (Those of you who have played with Mattel's Simon game will be familiar with the principle.) In theory, this is a perfect way to teach melodic ear-training to youngsters while they're having fun. Ear Challenger, however, doesn't quite live up to its promise. It contains only one octave of white keys (C to *B*), though there is no reason in theory why it couldn't offer the student a choice between white-keys-only and a chromatic scale. (We're told that an updated version called Super Challenger, which offers chromatic exercises as an option, is now available.) A more serious defect is that students get no chance to compare the correct version of a melody with their mistaken version. Make a mistake and the computer says, "Oops, you missed," and that's the end of the run. No instructor record-keeping or high-score tabulations here. Viewing a program like this is a frustrating experience, because it falls so far short of what is possible even within the limitations of the Apple speaker.

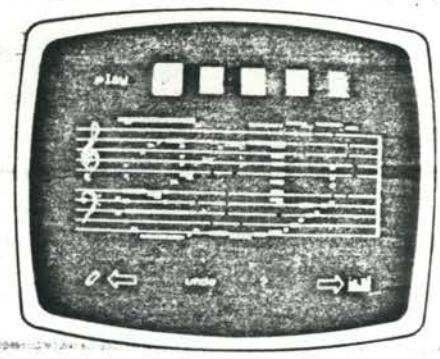
One of the best-developed lines of educational software we encountered was the Micro Music Software Library from **Temporal Acuity Products**. Their packages range from a preliminary aural discrimination training program for children ages 3 to 8 to harmonic and rhythmic dictation drills that would tax a college freshman or even the average instructor. Many of the programs contain teacher utility options, allowing the teacher to set the level of difficulty, look at records of student performance, arrange the drill materials in sequential or random order, or even add new melodies to the drill repertoire. The sound-generating task is handled by Micro Music's own board, which has no digital oscillators at all — it's a straight digital-to-analog converter addressed by the Apple which puts out four simultaneous voices and several simple waveforms. There is audible aliasing at some pitches, and when two notes are sounded together in the low register it is sometimes difficult to tell what interval is being played, but the intonation is perfect and the organ-like tone colors are quite pleasing. In addition to their educational software, Micro Music has a straight composition program called Music Composer that can be used for building four-part pieces to be played by the DAC board. This could also be used for educational purposes, but like many composition programs, it's fairly slow to operate (slower, for example, than the Music Construction Set, as it is operated by giving keyboard commands rather than by moving a graphics cursor).

If you have youngsters who are just discovering music, we would highly recommend Micro Music's Toney Listens To Music. This package can be operated by the child who is too young to read, as long as he or she can find a few keys on the Apple keyboard. A cartoon character called Toney plays a simple melody, after which the child can audition two other melodies in screen "boxes," one of which is identical to Toney's while the other is different. The program tests this "same/different" discrimination ability on a number of levels. The simplest offers the opening phrases of two familiar nursery rhyme melodies and asks the child to distinguish between, for example, "Mary Had A Little Lamb" and "Row, Row, Row Your Boat." As the child progresses, the discrimination required is in different areas of musical perception — tempo, rhythm, timbre (!), interval size, and the existence of a wrong note or two within a melody.

Interval Mania is a quiz on intervals, which may be displayed on a staff at the same time they are sounded, or sounded but not displayed until after the student makes the correct response. This program automatically repeats an interval if your first guess is incorrect; if you still can't get the right answer, it supplies the answer for you. The computer makes a random choice of whether the interval will be sounded one note at a time or simultaneously (unisons are always sounded sequentially). We would have liked to see this choice available as a user option. Harmonious Dictator is a unique and very useful program that tests the student in the ability to listen to a chord progression and then identify the chords by Roman numerals and figured bass functions. The simplest level of testing involves only I, IV, and V chords in root position, but as students master these the program will automatically promote them to higher levels (higher levels can also be chosen initially by more advanced students). The most advanced progressions include both major and minor keys, seventh chords on all roots, and secondary dominants. If you can't remember an entire six-chord progression, you can press a key and

A melody played and displayed by Sebastian, from Temporal Acuity Products' Micro Music Software Library.

The keyboard display from Syntauri's Simply Music program. Small rectangles appear on the keys to indicate which notes are being played by the user or by the computer. Options in the menu at the bottom lead to other display pages.



The Timbre Painting display from Syntauri's Music Land composition program. Horizontal bars will be played as notes by the oscillators, while the five colored rectangles at the top represent the timbres with which the bars can be 'painted.' Selecting the left or right arrows in the lower corners takes the user to Music Doodles or Sound Factory.

Educational Software An Overview

audition it again, but the record-keeping program will subtract points from your score for this. If you'd like to improve your memory for chord progressions, this program will give you plenty of material to work with.

Sebastian is a Micro Music program that plays a melody and shows it on the staff, but with one pitch or rhythm played wrong. Students have to find the wrong note. This may be different the next time this particular melody is called up — or there may be no wrong note at all, which helps keep listeners on their toes. Sebastian includes a utility that allows the teacher to input new melodies and specify up to nine errors of their choice, among which the computer will select randomly, providing a different error on each run-through. While the process for inputting melodies is somewhat slow, it's a valuable addition to the software, insuring that students in a classroom situation will continue to have new challenges. Sir William Wrong-Note does a similar kind of testing with simultaneously sounded four-note chords. One note in each chord sounds a different pitch than that displayed on the staff. Students have to identify the wrong note as the soprano, alto, tenor, or bass voice and then choose from among four alternatives the wrong pitch that was sounded. Students can choose which chord types they want to work with, ranging from simple major and minor voicings to half-diminished sevenths and augmented sixths. This kind of drill on advanced chords would be ideal for college-level ear-training; in fact, it was something of a challenge for our staff.

The only disappointing item we found in our examination of selected Micro Music materials was the package called Music Symbols. This tests students on their knowledge of the names of various common (and not-so-common) symbols. The major difficulty, aside from the small number of symbols represented, is the fact that the computer is not instructed to accept alternate terms for given symbols. One graphic representation was of three quarter notes with staccato dots over them, and we answered, dutifully, "staccato quarter notes." This, however, was graded as a wrong answer. The machine wanted the answer "staccato notes," and was not prepared to accept anything else. Similarly, "diminuendo" was not recognized as a synonym for "decrescendo," 2/4 and 3/4 had to be specified as "meters," not as "time signatures," and the familiar "C" with a vertical line through it could only be correctly identified as "alla breve," not as "cut time." Fortunately, the computer provides you with the desired answer if you can't get it in three tries. Presumably there would have been more space on the disk to specify valid alternative answers if so much memory hadn't been taken up with a silly series of audio "reward" melodies which serve no purpose other than congratulating students on right answers. This kind of psychological manipulation has an important place in educational software (Toney, in Toney Listens To Music, wiggles his eyes and nose and does a little dance when a kid gets a right answer), but it is properly an adjunct to, not a substitute for, an effectively designed set of drills.

Review copies of Micro Music's excellent software are available to qualified educational institutions.

Syntauri has two main packages of educational software, Simply Music and Music Land. Simply Music is a multi-part series designed for use in conjunction with books of beginner materials from Hal Leonard and Cherry Lane, while Music Land is a fun-oriented non-keyboard educational program that imparts some surprisingly sophisticated concepts. We had a great time playing with Music Land, so we'll save the best for last and tell you about Simply Music first. Both these programs require a pair of digital oscillator boards from Mountain Computer. To run Simply Music, you also have to have the alphaSyntauri synthesizer keyboard.

Simply Music is a play-along-with-the-computer system that offers students access to a number of options through the computer keyboard. They can choose from a menu of ten different instrument timbres at a time (from a disk containing 100 sounds) and direct the monitor screen to display either a four-octave music keyboard, a treble-and-bass staff, or a bunch of colored bars (which don't teach you much but are fun to look at). When you play notes on the keyboard, they will be displayed on the screen, either as note heads on the staff or as rectangles on the keys. A number of disks full of prerecorded songs are available as an option, and the display will also show the notes being played by the computer.

The simplest materials in Simply Music are the Medley Way Music "Fun"damentals (*sic*) books. These contain about what you'd expect of beginning piano books, and the computer renditions of the tunes are very straightforward. One of the menu pages of Simply Music gives you the option of muting any of the parts in a recording (you can also omit any of them from the display if you like). This allows students to practice, for example, a right-hand part while the computer plays the left hand. A metronome beat, which can also be muted, starts a bar or two before the tune and runs clear through it, which is a very helpful addition. The playback/record menu page offers some other possibilities. You can loop a single tune to play over and over with only a brief pause and a new metronome countdown. You can turn on the "match" feature, which requires students to play the correct melody notes along with the computer. If you play a wrong note, the machine will stop and wait for you to find the right one. This page also lets you record your own parts and play them back along with existing tunes, transpose to a new key, change the tempo settings, and so on.

The Nelson Varon Adventures In Music series, also a part of Simply Music, is again designed for beginners, but it is directed more toward the home organ market, and the musical examples recorded on disk contain extensive accompaniment patterns not notated in the books. These can be muted if desired, or you could choose to mute the recorded melody and do some heavy one-

finger playing along with the accompaniment. We're a little concerned that beginners might become confused by the complexities of some of the counterpoint lines, especially when they extend above the melody. But it's easy enough to go to the orchestra page in the menu and adjust the volume levels of the melody and accompaniment so that the melody is louder than anything else.

Another package offered as part of Simply Music is the Improvisation Series —three disks of more complex rock and jazz material in which several of the instrument timbres from the basic orchestra menu are heard simultaneously. This is potentially a very good educational use for the computer, allowing intermediate performers to rehearse and improvise with the kind of bass lines and chord patterns they would encounter playing in bands. The fact that students can record their own parts in the computer's sequencer memory, play them back, and listen to various syncopations and chord voicings adds considerably to the educational value. Unfortunately, the value of the Improvisation Series is severely undercut by the absence of documentation. There are no chord charts for the tunes! And since virtually all of them are originals rather than well-known titles, the novice attempting to learn from them is bound to be at a serious disadvantage. There are also some minor problems, such as a seriously arhythmic walking bass (lurching bass, we would have called it) on one number. In sum, the Improvisation Series is a great concept that has not been developed with anything like the clarity or comprehensiveness needed.

The innovative approach taken in Syntauri's Music Land is sure to appeal to those of you who would like to give your kids some exposure to atonality and advanced compositional concepts in an entertaining way. Music Land doesn't use a piano keyboard at all, only a joystick or Koala Pad. This input device is used to move a graphics cursor around on the screen, pointing at various menu items and drawing doodles on a music staff — a very easy interface for kids to use. The program has four parts: Music Doodles, Timbre Painting, Music Blocks, and Sound Factory. In Music Doodles, you draw any sort of squiggles you like on a bass-and-treble staff. It's difficult to control the cursor well enough to get traditional melodies this way, but if you like pseudo-Schoenberg, you'll have a great time. (You can construct traditional melodies more easily using a somewhat roundabout method explained in the manual.) Once you've finished a doodle, you can do several things with it. Selecting "transform" allows you to specify any portion of a doodle as a motif. The motif can then be moved around as a unit on the staff. It can also be lengthened or shortened in time, and its intervals can be expanded or contracted. Carrying either of these processes far enough will give you a retrograde or an inversion of the original. You can layer as many versions of the motif onto the staff as you'd like. When you're done, you can move to another display and paint the notes in your passage with your choice of five different timbres. At every stage, you can get a playback and rework what you've done. If you want to change any of the timbres, you can move on to the Sound Factory, where you can alter the loudness envelope and harmonic content. The latter can be done in two ways — by adjusting the height of bars in a bar graph corresponding to sixteen harmonics, or by drawing a waveform directly. It's difficult to control the cursor well enough to get a good smooth sinusoidal wave, so everything you get with this option tends toward the buzzy end of the spectrum, but it's easy to change the width of a pulse wave, for example, and as the tone is sounding continuously while you do this you get a good feel for what waveforms sound like. If you like the new sound you've created, you can choose to bring it back to Timbre Painting with you. The timbres you create will still be loaded into the machine the next time you start it up, but you can get back to the original factory presets if you want to.

The final aspect of Music Land is called Music Blocks. This gives you a choice among five different score blocks, each with its own doodle. (These may be doodles you've done yourself if you like.) By pointing to any block and moving it up into a work area, you can build a composition by stringing together up to 15 blocks. You can reshuffle these freely and have them played back in any order. This is a simple way of getting longer pieces of music than are possible on one doodle staff, and it reinforces the concepts of movable motifs and compositional structure.

Unlike most drill-oriented and performance-oriented educational programs, Music Land is strictly for fun. Nobody is keeping score, or telling the kid that some sounds are correct while others are mistakes. At the same time, it gives the beginner a real sense of what it is like to compose, working with musical materials that are malleable rather than fixed. Complex polyphonic textures can be realized without manual dexterity, and no knowledge of notation is required. If you already have an Apple and the Mountain Computer oscillator boards, we would definitely recommend that you buy Music Land for your kids. Or even for yourself.

Passport Designs offers several ear-training programs that also utilize the Mountain Computer boards. Some of the options make use of Passport's Soundchaser synthesizer keyboard, while others can be run from the computer's keyboard. The available disks include Intervals, Chords, Melodic Games, and Matching & Tuning. There is also an Ear Teacher disk which has extensive utility programs for instructors, allowing them to monitor students' progress, control which drills each student will have access to, and so on. Each student keeps cumulative records of their own performance on a separate disk.

Melodic Games is another of the Simon-type melody dictation and recall drills, in which students use computer keys 1 to 8 to play back a machine-generated pattern. As this is happening, the screen flashes "Do," "Re," "Fa," and so on in large colored letters. We found ourselves wondering why there was no staff display, no option for playback from the music keyboard, and no choice of chromatic melodies or melodies that span more than an octave. You can use the music keyboard if you like in the Intervals drill, and you get a staff display, but even so, this program suffers from some limitations. It will play an ascending or descending interval or two notes simultaneously, display the first of the two notes on the staff (you may choose between top-note-displayed and bottom-note-displayed when listening to both at once), and ask you to find the other note. But don't make the mistake of playing the first (displayed) note before or along with the second (target) note. This will be recorded as a wrong answer. If you do select a wrong target note, the keyboard doesn't automatically play your choice so you can compare it with the right answer — it just keeps repeating the right answer at you. And while you can choose between simple intervals and compound intervals (those greater than an octave), the machine won't mix the two together in a more complex drill.

The Chords software is the most complex of Passport's tutorials. It plays four-note chords, and allows you to choose which types of chords you want to be drilled on from a menu that includes all four triad types and all eight seventh chords. You can choose whether to have all the chords in the drill occur on a fixed root or whether to let the root vary randomly. You can choose whether to be tested only on chord types, or whether to add inversions (bass notes) and top notes to the quiz. You can hear the chords played with all four notes together or arpeggiated in either direction. As you get to the higher levels, this program will definitely give your ear a workout. An *Amaj7#5* in the second inversion, for example, sounds exactly like a *D♭* major chord with an added flat 6th. The computer displays on the staff the root of the chord you're trying to find, and when you see an *A* root and hear a major-sounding voicing, you'll have to do some quick thinking to realize that it isn't some sort of *A* major chord. When you play a four-note voicing on the keyboard, the computer displays the notes you chose as hollow note-heads on the staff. If any of them are correct, they then change to solid note-heads. If you're testing on inversions as well as chord types and you get the right chord but the wrong inversion, the lowest note you played will stay hollow. (This staff display feature works only if you're using the music keyboard. Working from the computer keyboard, you merely type in a choice of chord type, first, second, or third inversion, and root, 3rd, 5th, or 7th as top note.)

This kind of drill is definitely useful for improving your ear, and as far as it goes the program is a success. It suffers, however, from some minor problems. For a second or so after the sample chord is played, the keyboard is dead. Thus you can't listen and then hit a chord immediately to hear a comparison of the two. There is some potential confusion for students in the fact that the machine only tests what you ask it to test; it doesn't actually test your ability to play back a selected chord voicing. In other words, if you're only drilling

Educational Software An Overview

on chord types, *any Gmaj7* voicing will be considered a correct answer to the machine's *Gmaj7*, even if the notes are all in different octaves and relative positions. The computer will let you hear an arpeggiated version of a chord rather than a simultaneous version if you like, but in the case of simple triad voicings this leads to more confusion. The machine wants to see a four-note voicing as a correct answer, but in the case of triads it only gives you a three-note arpeggio. Thus you can ask for an arpeggio, listen to it, play back the same three notes it played for you, and not be seen as having given an answer at all. You need to add a fourth note *not* heard in the arpeggio to be correct. This kind of inconsistency is fairly irritating, and could easily have been avoided. By the way, these Passport programs are being made available in a format that is compatible with Passport's MIDI software, allowing you to use any MIDI-equipped external synthesizer as the sound source.

If you have trouble tuning your guitar (yeah, this is a keyboard magazine, but we know you guitar players sneak a look at it once in a while too), or if you own an analog sequencer and can't seem to get all those knobs perfectly in tune, you might be very happy to learn about Matching & Tuning, Passport's micro-interval discrimination test. This disk has two programs. If you select Matching, the computer plays two tones for you one after the other. Your task is to judge whether the second tone is higher, lower, or the same as the first, and to raise or lower it in tiny increments if necessary to bring it to the same frequency. You can choose seven different levels of difficulty for this test, with the higher levels breaking the semitone up into more and more segments. We're told that the smallest difference the machine can generate is about 4 cents (1/25 semitone). In the Tuning drill, you can choose between the four types of triads, after which you are presented with an out-of-tune closed-position triad (all three voices sounding at once) and have to adjust the middle and top notes to the required pitch. The tricky aspect of this is that the machine wants you to create *equal-tempered* triads, and it's possible to set up, for example, a just-intonation major triad that sounds more in tune (has less beating) than the correct triad. Matching & Tuning doesn't have enough features to make you an effective piano tuner. There's no drill on beat-counting, for example. But it will certainly improve your ear.

We also received educational software from **Alf Products**, **Maestro Music**, **Conduit**, **Notable Software**, and **Merry Bee Communications** which we don't have space to discuss in detail.

* * * *

The skills involved in music perception and performance are complex, and as we should expect, devising computer programs that will teach these skills effectively is just as much of a challenge. The programs in existence today suffer from several types of problems. Some, like the Music Construction Set, do violence to the conventions of music notation by failing to come to grips with the peculiar behavior of accidentals and rhythmic notation. Ear-training programs sometimes neglect to give the student an opportunity to compare a wrong answer aurally with the right answer. Melodic dictation programs are often too simplified, providing too little information to the beginner and too little challenge to the intermediate student. The tone quality of the sound-generating systems being used is generally marginal. Documentation covering the operation of the program and the nature of the concepts being taught is frequently substandard.

The good news is that music tutorial software is a fertile field for development, one in which we're certain to see giant strides during the next few years. Programmers have only scratched the surface of the computer's ability to look at a pupil's keyboard performance and rate it for accuracy. Better tone-generating boards will put less strain on the undeveloped ears of the novice ear-training student. And as personal computers get faster and more powerful, programs that let the composer assemble a piece on a monitor screen's staff display will open up new horizons of creativity to intermediate students without confusing them with the makeshift programming strategies that currently abound.

As making music demands more skills in formerly peripheral fields like electronics and business law, getting a solid grounding in the basics becomes easier to neglect, while remaining just as vital to the well-rounded artist. We're going to be making more music with computerized instruments; we may as well use computers to help us make better music. ■

MANUFACTURERS OF MUSIC EDUCATION SOFTWARE & RELATED PRODUCTS

Alf Products, 1315F Nelson St., Denver, CO 80215.
Conduit, Univ. of Iowa Oakdale Campus, Iowa City, IA 52242.
Electronic Arts, 2755 Campus Dr., San Mateo, CA 94403.
Electronic Courseware Systems, 309 Windsor Rd., Champaign, IL 61820.
Koala Technologies Corp., 4962 El Camino Real, Los Altos, CA 94022.
Maestro Music, 2403 San Mateo N.E., Suite P-6, Albuquerque, NM 87110.
Merry Bee Communications, 815 Crest Dr. Papillion, Omaha, NE 68046.
Notable Software, P.O. Box 1556, Philadelphia, PA 19105.
Passport Designs, 625 Miramontes, Half Moon Bay, CA 94019.
Sweet Micro Systems, 50 Freeway Dr., Cranston, RI 02910.
Syntauri Corp., 1670 S. Amphlett, Suite 116, San Mateo, CA 94402.
Temporal Acuity Products, Bldg. 1, Suite 200, 300 120th St. N.E., Bellevue, WA 98005.