NEW
TE
HIGH FIDELITY™
OLUME 33 NUMBER 9 SEPTEMBER 1983

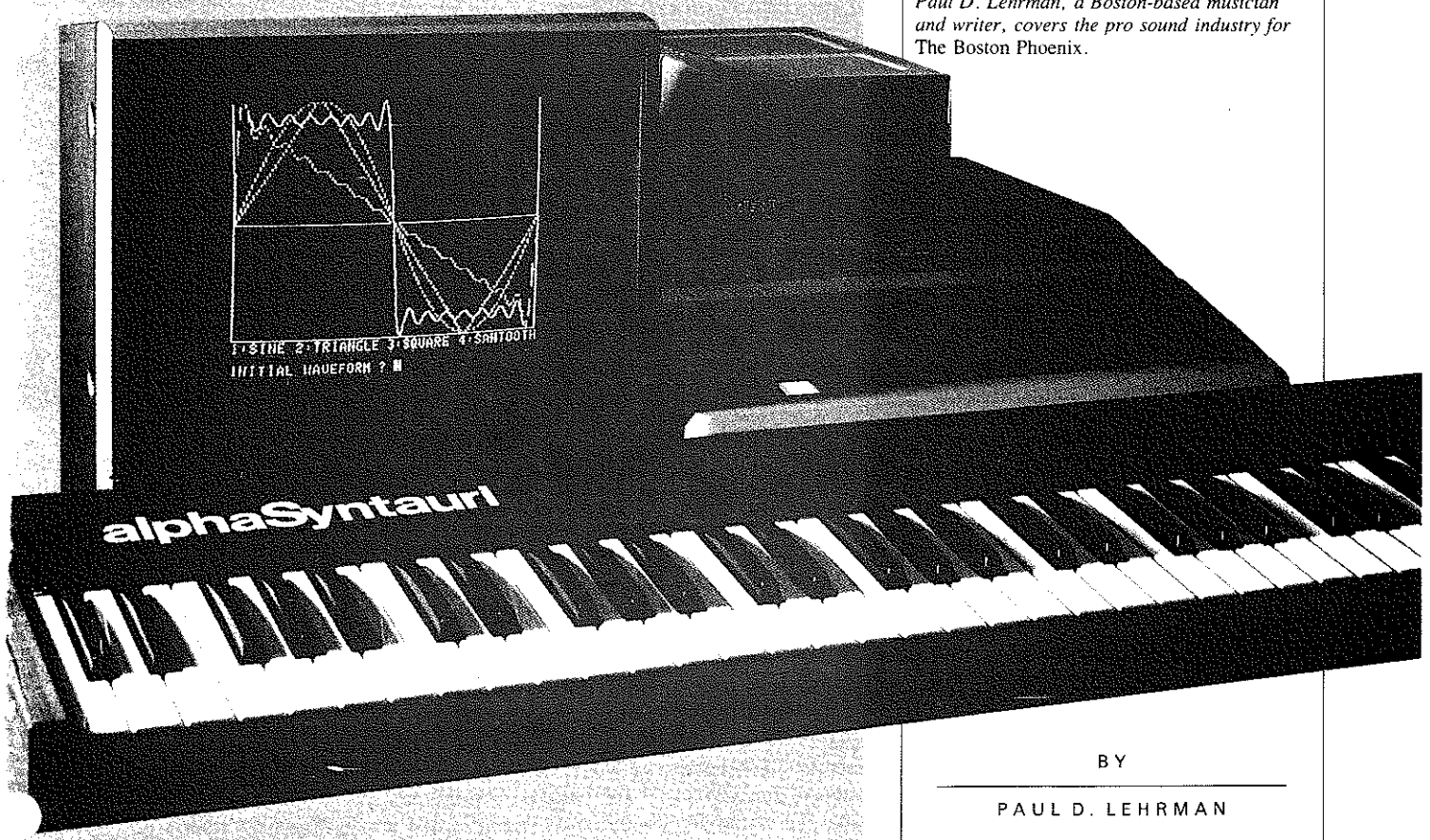
AN AFFORDABLE APPROACH FOR TURNING YOUR APPLE INTO A SOPHISTICATED SYNTHESIZER

TEAM

BARRY MANILOW is hardly controversial, yet a concert he gave last year in London's Royal Albert Hall sparked a movement by the musicians' union in England to ban synthesizers from both the stage and the recording studio. Manilow, it seems, managed to achieve the sound of a full orchestra with just two synthesizer players.

Though Mr. *Copacabana* was using super models that can cost upward of $40,000, you don't need a superstar's bankroll to own a multifunctional synthesizer. For the past two years, Syntauri Corporation of Los Altos, California, has been making

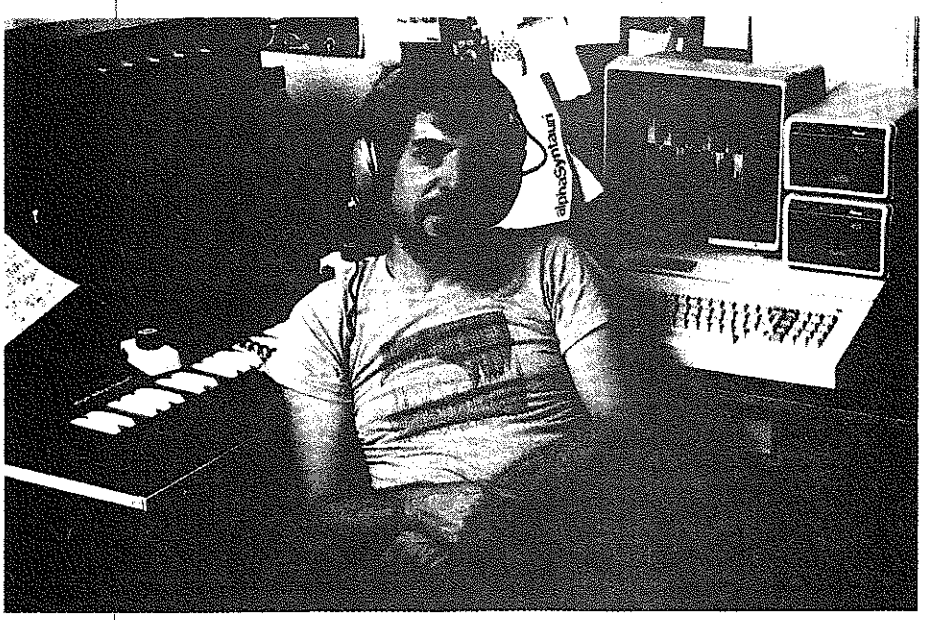
Paul D. Lehrman, a Boston-based musician and writer, covers the pro sound industry for The Boston Phoenix.



BY

PAUL D. LEHRMAN

a sophisticated system that uses an Apple computer as a storage and manipulation device. Known as the AlphaSyntauri Computer Music System, it is not only a versatile performance instrument, but it also records and, with an option called Composer's Assistant, prints music. The Alpha (as it's known) costs about $2,000; with the computer, a single disk drive, a monitor, and a printer, the price approaches $5,000.



MICHAEL ROMANOS

AUTHOR LEHRMAN chose to install the AlphaSyntauri system into his Apple-compatible Franklin Ace 1000 computer. Note the game paddles atop the Alpha keyboard at left. The rotary pots on the paddles govern some of the program's functions.

The Alpha comes with either a four- or five-octave keyboard that plugs into one of the expansion slots inside the Apple. (The five-octave keyboard is velocity sensitive, to boot.) A pair of music-synthesizer circuit cards, manufactured by Mountain Computer, take up two more slots. The programs necessary to run the system are supplied on floppy disks.

The synthesizer cards are what make the sounds. They contain 16 digital oscillators—devices that duplicate waveforms via a complex additive process. Their output is passed to three digital-to-analog converters—one each for frequency, envelope, and overall volume—and the resulting analog waveform appears at a pair of RCA jacks on one of the cards. The signals can be routed to a stereo system, an instrument amplifier, a recording-studio console, or even a pair of headphones.

When you place the disk containing the basic synthesizer program, known as AlphaPlus, in your disk drive and turn on the computer, 10 "instruments" are loaded into the computer's memory. The instrument sound you want to use is chosen via a number key (0 to 9) on the computer keyboard. Every instrument contains two voices—"primary" and "percussion"—each of which has its own waveform and envelope controls. The voices are routed through different audio outputs, giving the system a semblance of stereo.

The envelope parameters—attack, decay, sustain, and release—are displayed on the computer monitor screen as combinations of letters and numbers. For example, "PR" is the attack rate of the percussion voice. The rate is variable over a range of 255 steps, the maximum allowed by the Apple's eight-bit microprocessor. Typing "PR:255" on the computer keyboard makes that voice sound immediately, while typing "PR:40" gives it a gradual entrance. Other parameters that can be adjusted at this stage include pitch (adjustable in quarter-tones over a range of more than eight octaves), touch sensitivity on the piano keyboard (a feature only available with the five-octave keyboard), and number of tone repetitions from one keyboard stroke. In addition, the primary and percussion voices can be tuned to separate pitches, which offers a chorus effect from just one note; each note can be tuned to two distinct pitches over a range from one thirty-second to a major tenth. If you want some vibrato, you set its depth and rate either from the computer keyboard or by dialing it in via the rotary control on a pair of game "paddles."

Built into the system are programs for generating standard waves—sine, sawtooth, triangle, and square—as well as a multitude of more complex forms. Using the program Quickwave, you can call up any waveform, adjust the relative levels of its first 16 overtones, and then store that for future performance or further modification. Using a somewhat slower program called Wave, any of several waveforms (standard or custom) and their harmonics can be layered on top of each other to create a new wave, while the video screen displays a picture of the combined result.

The Alpha stores and loads its instruments in groups of 10. One floppy disk can hold over 200 separate waveforms, and it takes only a few seconds to get to any particular sound you need. For real-time performances, Ensemble lets you trigger up to eight instruments simultaneously with one keystroke; and Timbre Sweep moves each note through several instruments at a rate controlled via the game paddles. There's even an option for splitting the keyboard into eight separate instruments.

There are two foot pedals—one for sustain (if the envelope parameters of the voice are set up for it), the other for glissandos between notes. While in the performance mode, the computer's video screen displays a matrix of flashing bars that show which notes are being played. Though fun to watch, the display serves little practical purpose.

But using the AlphaSyntauri as a

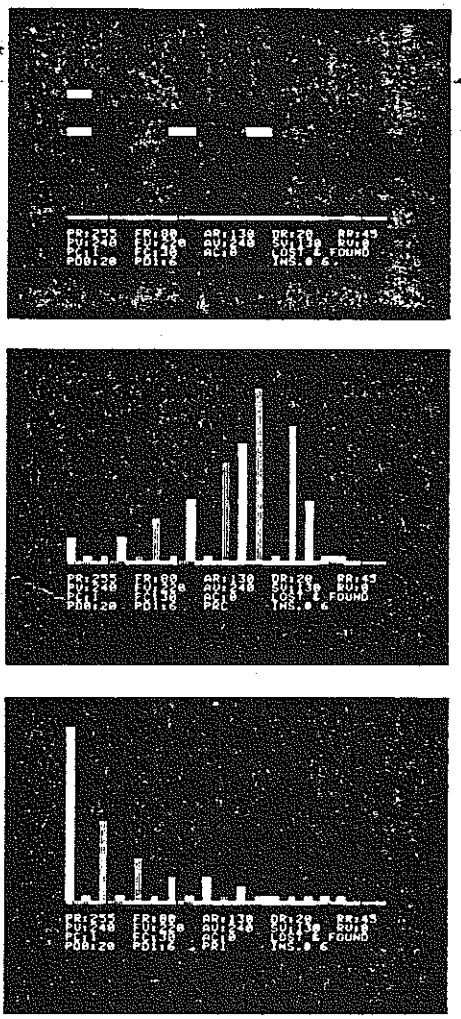
live-performance instrument isn't the whole story. The system's recording program, Metatrak, allows a performance to be recorded, played back, and even "looped." A 16-bar bass pattern can be played on the keyboard, entered into the computer, and saved on a disk. As accompaniment to a melodic line, the bass pattern can be ordered to replay continuously in perfect time.

In fact, as many as 16 separate tracks, each with its own instrument, can be recorded and overdubbed in perfect synchronization—just like in a recording studio. While each new voice is being laid down, you monitor the previously recorded tracks. The volume of each one is adjustable, so that you can perform studio-type mixdowns without a mixer or a tape deck. A metronome function is included in the software to help keep everything together, and each track has punch-in/punch-out editing capability. There are provisions for "fast-forwarding" the playback and for instant return-to-zero. The system lets you change the speed of the playback without altering pitch and even allows for tempo changes within the body of a piece.

There is also a sync-to-tape feature that permits every track in a Metatrak recording to be transferred individually to a multitrack tape deck in perfect synchronization. The system accomplishes this by writing a data word known as a synchro-start pulse onto the tape. When the tape is played back, the computer recognizes the word and locks onto it.

In addition, the AlphaSyntauri has provisions for interfacing with a Roland, Linn, or Oberheim drum machine. The metronome signal is fed through a special cable to the trigger input on the drum machine and acts as a timing pulse for it. The drum machine can be programmed to play any kind of beat, but the downbeat will be synchronized with the Alpha's metronome. This feature is particularly handy because, as the manual admits, percussion sounds are not the easiest to produce on the Alpha.

With the AlphaSyntauri, you can do just about anything that you can on any synthesizer. And fortunately, the designers have made the system very easy to use: A computer neophyte can have it up and running in a few minutes, and anyone experienced in multitrack recording can adjust to the Metatrak program in an afternoon. Of the 100 preset voices that come with it, quite a few are unappealing, but enough of them are sufficiently interesting to engage the mind of a professional synthesist.



A SIMPLE visualization mode offered by the Alpha shows a C major triad topped with a C above middle C as four short horizontal bars (top). The Quickwave routine lets you create sounds by changing the relative levels of a note's first 16 harmonics. A predominance of higher harmonics (middle) gives a nasal, raspy sound. To create a warmer, richer tone, the lower harmonics are emphasized (bottom).

The waveform and envelope generators are a bit more difficult to use. Though the system offers a remarkable amount of creative control, digital control is very different from analog control, and the instrument-synthesis program will seem very clumsy until you've had some practice.

Within a month of acquiring the Alpha, I had recorded two Bach fugues four ways: an organ on which each voice had its own distinct set of stops; a string orchestra (with instruments of my own design); a woodwind quintet; and an ensemble of frogs, crickets, and birds called Nature. A composition can be orchestrated an infinite number of ways in seconds. I also recorded a respectable version of the second movement of Mendelssohn's *Italian* Symphony, a couple of pop tunes I wrote (which several years ago cost me hundreds of dollars to make demo tapes of), and an electronic improvisation. I spent about 20 minutes on this last piece; had I attempted the same thing during my student days at music school, it would have taken me a month.

As if all this weren't enough, the latest addition to the AlphaSyntauri software repertoire is something of a dream come true for anyone who grew up, as I did, trying to figure out a way to make a piano behave like a typewriter and print out compositions in perfect score form. The extra-cost Composer's Assistant is not quite as fast or as elegant as my imagination, but it will certainly do for now.

Composer's Assistant starts by analyzing your prerecorded note files. It then asks you to define some parameters: tempo, key signature, time

signature, and resolution of the smallest note or rest (such as eighth or sixteenth). The computer then analyzes the note file and displays each bar on the video screen, where you can edit if you wish before printing. During the analysis and edit phases, you can tell the computer to print out any or all of the recorded tracks, on either a single or double staff. You can also transpose the tracks, add performance direction such as dynamics or tempo alterations, as well as shift the note values slightly to compensate for keyboard technique.

There are a few limitations with the Composer's Assistant program. It will not beam eighth or sixteenth notes; each note gets its own flag, and all stems point up. If two notes pitched a second apart are played simultaneously, it will not shift the printed position of one of them; instead, it will simply print them on top of each other. Ties are indicated by straight (not curved) lines. And there are only three available time signatures: 4/4, 3/4, and "free-time." This is less of a disadvantage than it might at first seem. In the free-time mode, faint dotted vertical lines appear at each quarter-note division, which allows you to draw in the bar lines after the score is printed out. But even with these drawbacks, Composer's Assistant is a terrific aid to the musician, and the printout is very readable.

Some further deficiencies must be noted. Although the piano keyboard's response is instantaneous, responses to instructions from the computer keyboard are fairly slow. This is because different parts of the software are written in different languages: The real-time music instructions are written in assembly language, which is very fast, while the storage and design programs are written in Basic, which takes the computer a bit longer to digest. Also, the number of notes that can be maintained in any note file is limited. In Metatrak, storage is 3,000 notes (less if you are also storing key-velocity information). A new hardware and software option, MetaExtender, will address this problem by offering a 20,000-note capacity and should be available presently. And the Composer's Assistant program can handle only about 1,000 notes, so longer pieces have to be broken down into 1,000-note segments for notation.

Still, the capabilities of the AlphaSyntauri music synthesizer system are truly amazing, given its price, and overall I'm delighted with it. Moreover, it promises to get better and better: Because the system is totally under software control, improvements can be made easily via updated program disks. Syntauri keeps a list of system owners and offers updates to them at reasonable cost. And finally, unlike synthesizers built around dedicated microcomputers, the Alpha's modular design lets you use your Apple for more mundane chores, as well, such as word processing. In fact, now that I've finished this article on my computer, it's free to start making music again. **HF**

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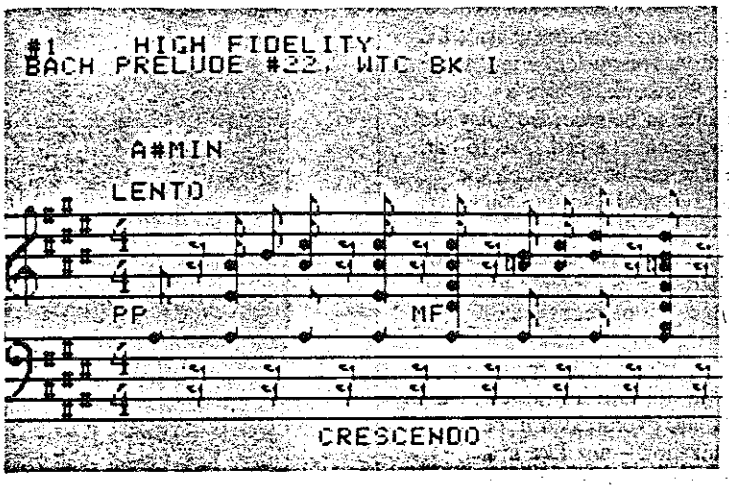
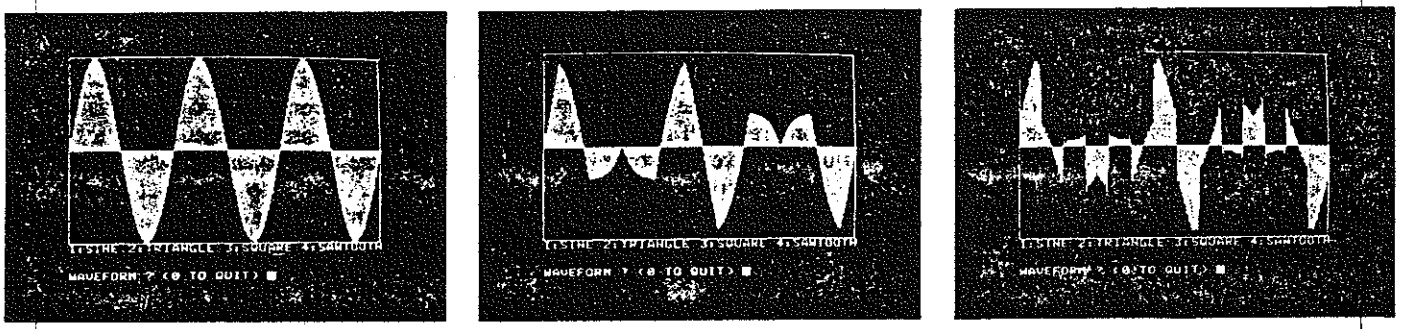


THE COMPOSER'S ASSISTANT program will automatically score a composition entered on the Alpha's piano keyboard. Bach's Prelude in B flat minor is enharmonically changed to A sharp minor in the off-screen photo above.



THE ALPHA lets you create fairly exotic sounds by shaping a note's harmonic waveforms. The off-screen photos above depict some of the additive wave-shaping capabilities, as a sine-wave third harmonic (left) receives a triangle wave at the fifth harmonic (middle) and a square wave at the seventh harmonic.

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alphaSyntauri Music Synthesizer

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Music and computers seem to go together naturally. Indeed, there appears to be some metaphysical link between them. Musical minds take readily to programming concepts, and it's hard to find a coven of computer programmers without at least one musician in its ranks. The idea of making music with computers is almost as old as the computer itself.

But the human interface is always a problem. How do you translate the idea of making music into a computer program?

A musical score is much like a program; it's a list of instructions with various branches and repeats. So the obvious solution is to give the musician a *language* to describe the music. This may then be fed into the computer for the result. Until recently, using slow, batch-mode processing could mean waiting a day or more for the sound to reach your ears. Even worse, the computer needed to know exactly what was desired. But how was the poor musician to know in advance what he wanted to hear? He's heard violins before, but what does a computer sound like?

The dawn of the microcomputer promised a new era in computer music. Suddenly, the machine was yours alone and when you said RUN, it ran. But both the hardware and software of the first microcomputer music systems ignored the need for real-time feedback. Maybe the software allowed the score to be typed into a screen editor rather than with a keypunch, but it still made you wait until the computer was ready to play the music.

The Syntauri Corporation has changed all that. A five-octave music keyboard and a disk of software form the heart of the alphaSyntauri synthesizer. The software allows control of the sophisticated Mountain Computer MusicSystem digital synthesizer hardware from the keyboard, via an Apple II computer. (See "Mountain Computer's MusicSystem," July 1981 BYTE, page 60.) The alphaSyntauri system allows music to be played directly or to be recorded and played back. It allows the changing, storing, and recalling of waveforms, envelopes, and tunings. Most important, because it is based on the Apple II computer, it is possible to change or add to the system software.

User interaction, which is the primary advantage of microcomputer systems, has been extended to play—not just write—music. Immediate feedback links the creation to the sensation of music. For the first time, the personal computer is an instrument, not a glorified music box.

This article reviews the capabilities of the alphaSyntauri synthesizer as a musical instrument and discusses the hardware and software details of interest to both musicians and computerists.

The Syntauri Philosophy

The alphaSyntauri music synthesizer is a software-based system and the brainchild of Charlie Kellner. Aside from the Mountain Computer synthesizer boards, the system uses an interface card and a professional music keyboard. But the system is more than just an Apple peripheral; it is a musical instrument in its own right. Its price and performance clearly place it beside commercial synthesizers made by Moog, Oberheim, Arp, Yamaha, and Sequential Circuits. Its modular design with software flexibility makes it comparable to such digital synthesizers in the $20,000-$30,000 bracket as the Synclavier II and the Fairlight Computer Music Instrument. Obviously, these more expensive synthesizers can produce sounds with higher quality than the alphaSyntauri music

About the Authors

Steve Levine is a microprocessor engineer whose interest in computer music has run the gamut from controlling pipe organs to digital signal processing. He has coproduced the unique Computer Music Festivals in Philadelphia for four years. Bill Mauchly is a recording engineer and musician. Son of the father-of-the-computer, John W Mauchly, his knowledge of computers is genetic. Levine and Mauchly formed Audio Data Consultants in 1980 to collaborate on ideas in digital synthesis and signal processing. Research with the Fairlight CMI, coupled with the production of the Symposium of Small Computers in the Arts this November, has brought them in close communication with many computer musicians.

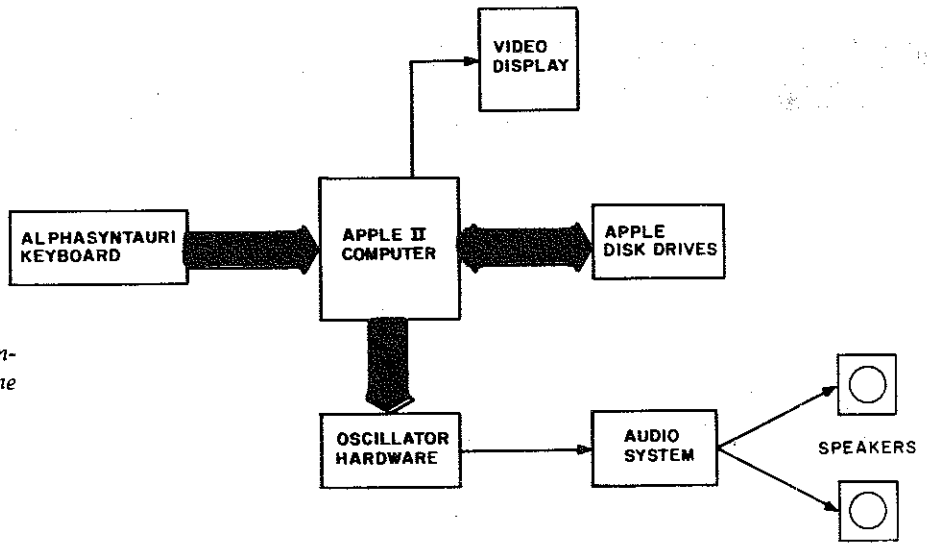


Figure 1: *This shows the hardware configuration and the interaction of the various system parts.*

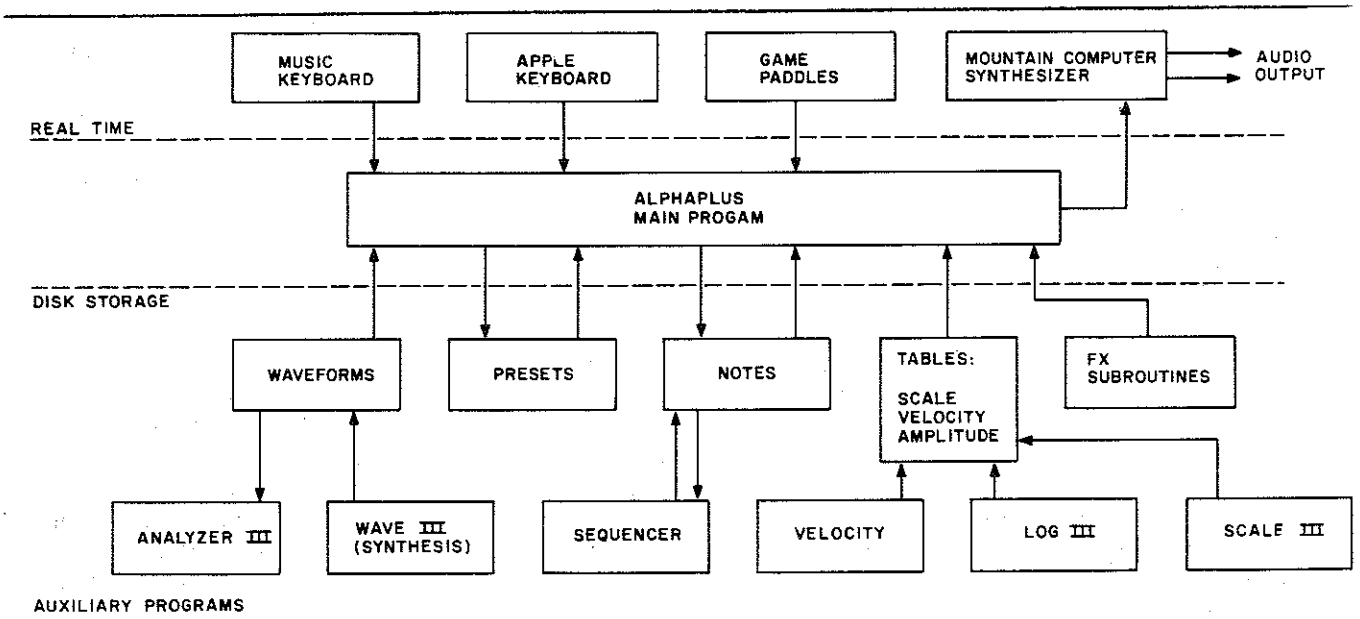


Figure 2: *The ALPHAPLUS program is the main program, with auxiliary programs providing or modifying data for ALPHAPLUS.*

synthesizer. But even these "super-synthesizers" do not allow prying into the operating system. Unique in a world of black boxes, the alphaSyntauri synthesizer is a music system that a user may customize.

The advantage of software functions over hard-wired features is that they are so easily changed. First, the manufacturer can provide updates as new features are developed; planned obsolescence is replaced with upward expandability. Second, the infernal musician, notorious for making his tools do things "they weren't meant to do," has a truly programmable instrument. The alphaSyntauri synthesizer is ideally suited to those stubborn types who aren't always satisfied with the 12-tone scale, who insist on using the Dow-Jones average as a waveform, or who would like to jam against a sequence of notes resembling the Maine coastline played in three-quarter time. Programmability is the single most important advantage of the alphaSyntauri system over all other keyboard synthesizers.

Turn It On

The alphaSyntauri disk boots itself up, asks you if everything is plugged in the same as it was yesterday, and brings the synthesizer up with a group of 10 preset sounds. Presets on the alphaSyntauri synthesizer are preprogrammed instruments or sounds, similar in concept to organ presets. Only one is active at a time, and pressing the number keys (0-9) on the Apple allows selection of different presets.

The preset's name is shown on the screen, along with the envelope parameters which describe its dynamics. The music keyboard is then instantly alive with the sound of vibes, clavinet, clarinet, B3 organ, pickle, bump, or whatever you have selected. Push another number, and

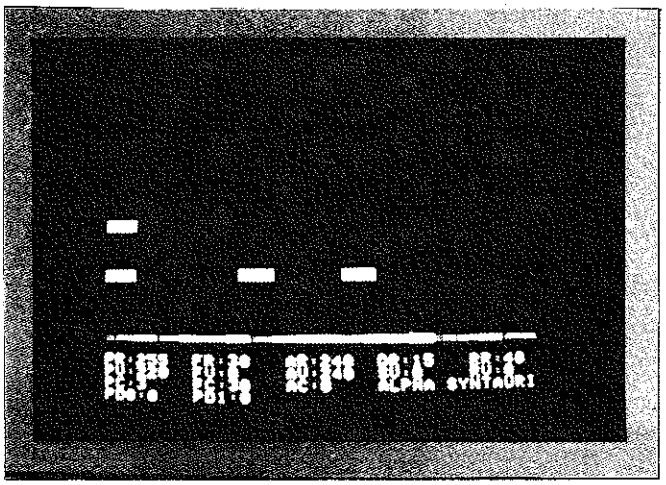


Photo 1: *The Envelope Control Screen is shown with a color display of a C major chord. PD0 and PD1 are live paddle displays of the vibrato and FX controls.*

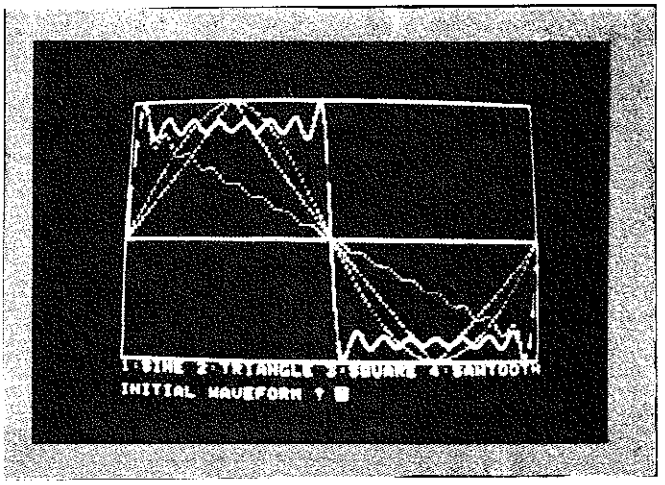


Photo 2: *WAVE III Additive Synthesis Wave Creation Program. When the program first comes up, it displays each of the stock waveforms available and, as they are plotted, the corresponding sound is heard from the amplifier.*

you get another sound. Simplicity and speed make the system easy to learn and elegant to use. For added wonderment, a 12-color graphics display dances across the video screen, following the notes of the keyboard.

Software

The alphaSyntauri software has one main program that provides the personality of the keyboard instrument—plus a library of programs for configuring, analyzing, and generating control parameters which can be used by the program (see figure 2). The system we evaluated (a prerelease version of AlphaPlus) will have been released as an enhancement to Alpha III (the first software revision) by the time this article is printed.

The main program becomes the synthesizer's "control panel," with screen displays for parameters entered with the Apple's alphanumeric keys. Pressing an "A", for example, makes the cursor jump to a field at the bottom of the screen, where AR = 210 might be displayed. This is the Attack Rate, or the speed at which one of the envelopes will rise to its maximum value every time a key is depressed. The value may then be altered, either stepwise using the left or right arrow keys, or by typing a number and hitting return. The result is similar to adjusting an array of knobs; it's a little slow, but more accurate. From this control panel, all of the real-time functions—including music recording, playback, presets loading, and editing—may be accomplished with a few keypresses.

The alphaSyntauri software controls the 16 oscillators of the Mountain Computer hardware by pairing two oscillators per voice to provide an eight-voice synthesizer. If all eight are already playing, then the first voice used is reassigned to the new note. Since all eight sound identical, it is impossible (and irrelevant) to tell which oscillator is assigned to which note.

Both of the two oscillators per voice are available as separate outputs. Although this allows stereo effects, the correct use for most sound involves mixing together monophonically. The two oscillators use different waveforms and different envelopes, but are activated simultaneously (see figure 3). This is essentially similar to two separate eight-voice synthesizers hooked to the same keyboard.

One of the oscillators is designated the Primary, while the other is called the Percussive. These names are actual-

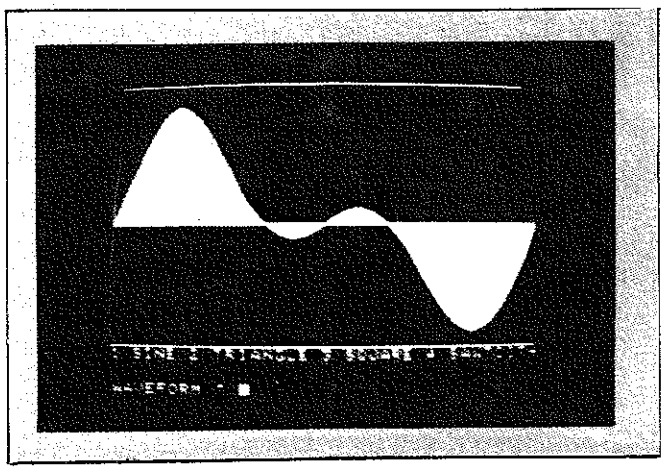


Photo 3: *This is the result of using the WAVE III program. This waveform shows the addition of the first, second, third, and fourth harmonic, with the respective amplitudes of 50, 40, 30, and 20 percent.*

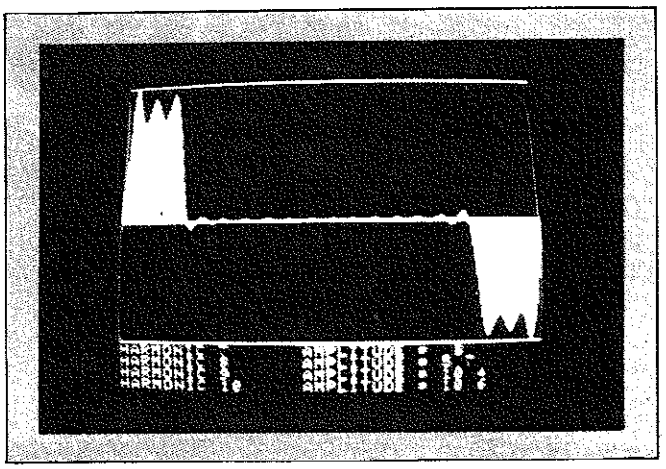


Photo 4: *The ANALYZER III graphic display shows a rich pulse wave which was synthesized with another program, AUTO-PULSE, written by Steve Leonard. ANALYZER III is shown performing an analysis on the wave, with a numerical output for each of the harmonics and their respective amplitudes.*

ly arbitrary, for it is certainly possible to put a very percussive envelope on the primary oscillator. At any rate, the parameters describing the two currently active envelopes are displayed at the bottom of the screen, while a simple Control-W allows you to view the names of the waveforms loaded into the primary and percussive oscillators. Pressing the ? gives a catalog of the disk so that you can see what waveforms are available.

A number of useful waveforms come on the system disk. They include sine, triangle, square, and that old standby, sawtooth. Also, any arbitrary waveform may be created through additive synthesis, to be discussed later.

The primary and percussive waves are offset in frequency by a user-defined amount of 16 semitones per note (ie: 16 possible steps from C to C#). Selection of a great enough offset produces the effect of two notes per one keypress. A more practical use, however, is to slightly offset the two oscillator frequencies to add a *fullness* or *fatter* sound. This works especially well for synthesized piano or organ sounds.

Envelopes

The envelope controls (determining the rise, duration, and fall of each note) are straightforward and easy to use (see figure 4). They are laid out logically, and one or two keypresses will move the cursor to any parameter you wish to change. The letters A, D, and R, for example, select the Attack Rate, Decay Rate, and the Release Rate, respectively, for the primary wave. The letters P and F select Percussion Rate and Fall Rate, which are simply different names for the attack and release of the percussive envelope. One more key press will drop you down to the second line, where the levels are displayed. If you press P, for example, you select Percussion Rate; whether or not you change it, pressing Return will drop you to Percussion Volume.

A few other parameters at the bottom line affect special envelope controls. The percussion channel of the instrument can be turned off, leaving just the primary. This same parameter controls the velocity-sensitive envelope. When on, the velocity with which a key is struck will modulate the attack rate and volume (for the primary wave). The quicker the key goes down, the faster the attack rate. A very nice, expressive quality results once you get comfortable with this control.

Another special feature in the envelope section lets you loop the primary wave envelope so that it is constantly executing its attack and release curves. The result is similar to tremolo; the amplitude is fluctuating periodically. The effect is useful for certain sounds, like putting the *vibe* in Vibraphone.

The frequency control (FC) simply tunes both waveforms by quartertones in relation to some arbitrary zero point.

Vibrato

A last major control panel parameter is vibrato, which is a controlled modulation of the frequency. The Apple II game paddles are used to control the amount or "depth" of vibrato (PD1) and the speed of change or *rate* (PD0). The vibrato is extremely effective in giving a more realistic and dynamic sound to most instrument settings.

Presets

All of the parameters shown on the screen, together describing one preset, may be saved or recalled from disk. Although only one preset is active at any moment, 10 different sounds are loaded in memory and ready to be selected. The entire configuration of 10 different presets may also be stored on disk as a Preset Master. A preset master has the advantage of storing the waveforms that were loaded into each preset. This creates a Waveform Master on the disk. (Ideally, individual instruments should also have an automatic waveform recall; but not in this version of the software.

The preset master feature is very important in a perfor-

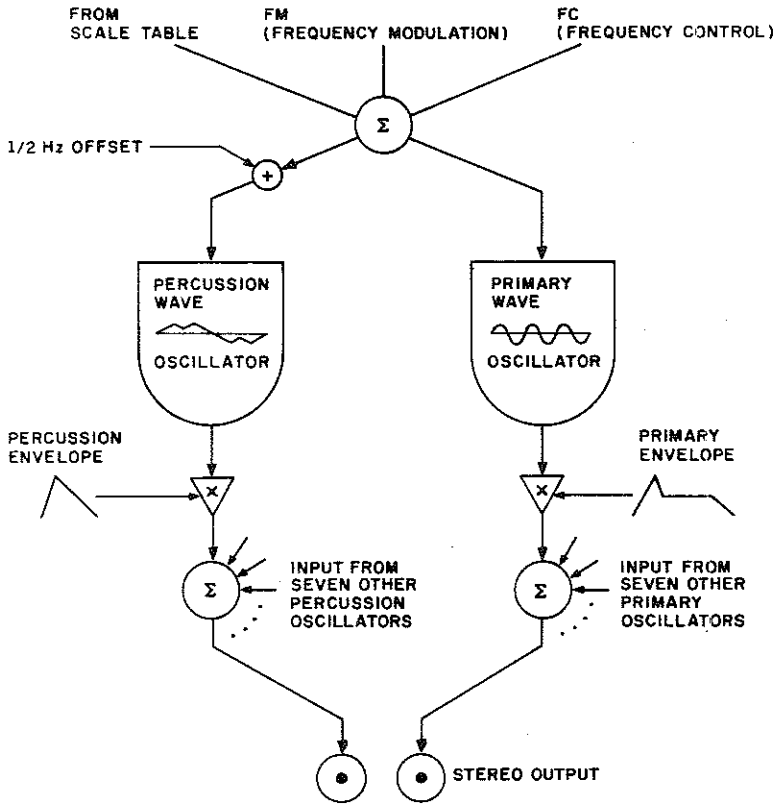


Figure 3: *The flow diagram is a model of the synthesis process for the development of computer-generated music.*

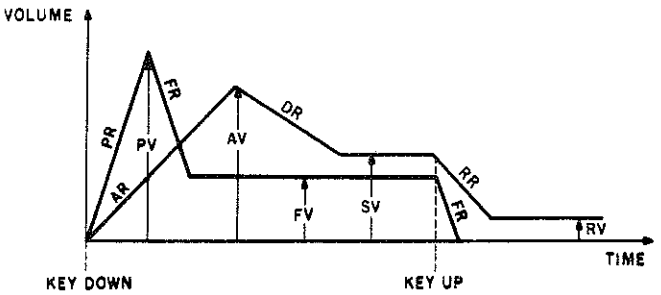


Figure 4: *This example shows the various parameters and their relationships, which determine the sound of a preset. The dual envelopes, produced when a key is pressed, control the amplitudes of the two oscillators. The parameters for the selected preset are displayed as integers from 0 to 255 (255 being the fastest or loudest). When key velocity is fast, AR and AV are increased. When the sustain pedal is depressed, DR replaces RR.*

mance situation, where a particular song may call for five different sounds in quick succession. A preset master for that song might contain the required presets in numerical order. All the performer must worry about then is 1, 2, 3, not preset #42, #13, or tibia 16'. Incidentally, when a composition is recalled from disk (as will be described in the next section), it selects the numbered preset that was active when it was made.

Recording Performances

Like any good computer music system, the alphaSyntauri synthesizer simplifies recording key closures and their associated timing information. This is not unlike an analog synthesizer sequencer, except the music programming is accomplished by playing on the keyboard. Key velocity, pitch, and duration are saved in a memory buffer. Then, with the SAVE command, they are written to a disk file with the prefix Notes. With 48 K bytes of memory, you will be able to store up to 3285 note events.

The sequence of keystrokes to initiate recording is very simple. From the main menu, just press the space bar R for record (the remaining number of notes will be displayed on the screen) and then hit Return. This will return you to the main menu, where the instrument name will be in reverse video to indicate you are in the record mode. The program will wait for your first keystroke before starting to save the notes in memory.

Once you finish the sequence, hit the space bar and then S (Save). You will then be asked to provide a file name for your performance. Hit Return for a saved performance.

An interesting recording sequence feature is Echo. This allows instant, continuous playback of the last recorded sequence. Many musicians find this useful for accompaniment purposes, though a perfectly spliced sequence is difficult to create. When you finish playing the segment, hit the space bar and the sequence will play back with a rest inserted between the last and first notes played. This rest will equal the time between the last note played and the point at which you hit the space bar. For a good splice, it is necessary to hit the space bar just ahead of the next note's downbeat.

The Mountain Computer synthesizer generates an interrupt every eight milliseconds. Syntauri's alphaPlus operating system uses every other interrupt for a watchdog timer. This makes it easy to synchronize the keyboard playback with another timebase for playing along with prerecorded music. Previous releases of the software did not use this timebase and suffered severe slowdown when the keyboard was used during playback. The interrupt system virtually eliminates the problem. In summation, the sequencing ability of the alphaSyntauri synthesizer is a deluxe feature.

Programmability

To now, we have examined the way the system behaves as a conventional synthesizer, with functions that all operate in real time. If we drop out of the main program, however, we may run programs which can create, modify, or analyze data used by the system. This data is in binary disk files which contain tables or lists. These tables are used by the main program and include waveforms, notes, tunings, and functions for mapping velocity and amplitude values. The programs provided, and those created by the user to manipulate that data, provide the programmability that sets the alphaSyntauri system apart from all other synthesizers. Although detailed documentation on the architecture of the programs and a usage map of the Apple II memory aren't distributed with the system, Syntauri is reasonably helpful in assisting the knowledgeable user with customization. (The assembly-language source code is offered for a nominal fee.)

Wave III

This is a slow, flexible Applesoft program which graphically displays the process of building waveforms via additive synthesis. The procedure is simple: you are queried for "Which waveform?" and then "Which har-

At a Glance

Name
alphaSyntauri Music Synthesizer

Type
Sound development system for performing and recording

Manufacturer
Syntauri Corporation
3506 Waverley St
Palo Alto CA 94306
(415) 494-1017

Price
$1500

Hardware
An interface card occupies a slot in the Apple II. The professional music keyboard and foot pedals connect to the card

Software
An operating system is supplied on disk. Several programs allow sounds and music to be developed, changed and recorded

Language
The programs are written in 6502 assembly language, Applesoft BASIC, and Integer BASIC. An assembly language listing is available from Syntauri Corp

Software Format
The disk supplied requires Apple's DOS 3.3

Computer
Apple II or Apple II+ with 48 K bytes of programmable memory, at least one disk drive, and Apple's DOS 3.3. Both Applesoft and Integer BASIC are required

Documentation
Documentation includes a tutorial manual, two quick reference guides, and a technical manual

Hardware Required
Mountain Computer (formerly Mountain Hardware) MusicSystem music synthesizer boards, a stereo amplifier, and speakers are required. (The operating system originally supplied with the Mountain Computer hardware is not used)

Comments
The alphaSyntauri system can also be configured for use with the ALF Music Synthesizer from ALF Products Inc

Audience
Apple II owners who want to compose music, create sounds, or do live performances

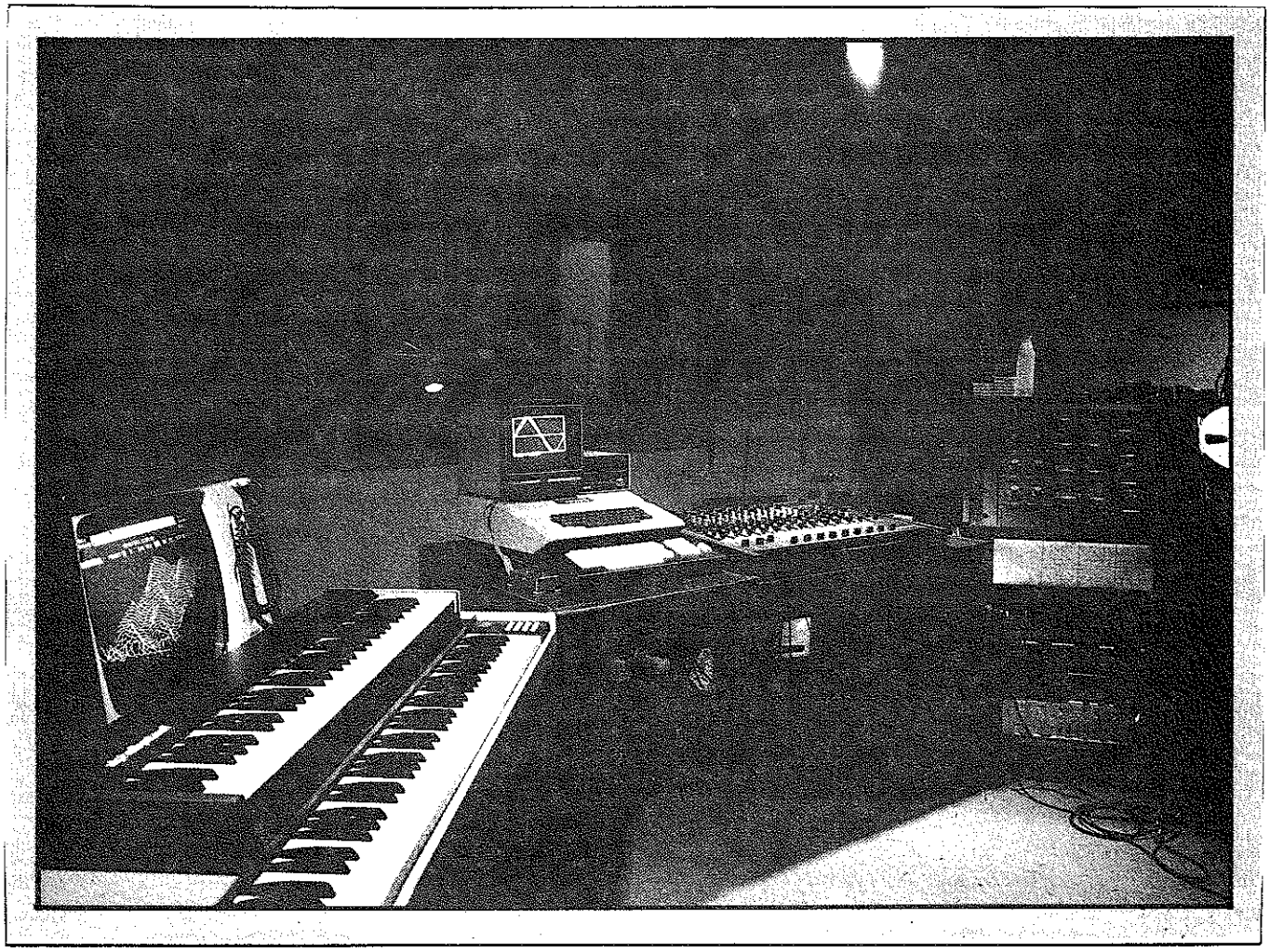


Photo 5: *Bill Mauchly's eight-track Linden Studio in Ambler, Pennsylvania. In the foreground is the Fairlight Computer Music Instrument, the alphaSyntauri keyboard on top of the CMI, the monitor, an Apple II with Mountain Computer music synthesizer boards, the Fairlight ASCII keyboard, The Sound Workshop 12-channel mixing console, an Otari eight-track recorder, and various outboard equipment in the rack at lower right. The studio is a 100-year-old barn, and the research lab is located a short distance away. (Photo by Irene Mohler)*

monic?" until you decide you're done. On each iteration, the resultant wave is played back at a constant pitch for evaluation. The waveforms available for addition and subtraction are band-limited versions of the common analog wavetypes: sine, triangle, square, sawtooth, or any user-specified complex waveform. This program is the most common and useful way of generating wavetables. If Syntauri would rewrite Wave III in assembly language, it would be capable of instant display and, therefore, be a more intuitive feedback loop between the creation of waveforms and envelopes.

Analyzer III

Fourier analysis of a waveform is the reciprocal to additive synthesis of sine waves. The program takes as its input any wave and supplies the harmonic content up to any specified harmonic.

The most creative use for this program that we've heard is by Cretones keyboardist Steve Leonard, who needed to simulate a Vox portable organ. He used an oscilloscope to get a picture of the waveform he wanted, then wrote a BASIC program to draw a line segment approximation of the wave and write it to a binary file. Next, he analyzed the wave with Analyzer III. Using the resultant harmonic specification, he resynthesized the wave with Wave III.

Why didn't he just use the line-segment version of the waveform? Steve knew, as the analysis confirmed, that some very high harmonics were present in his line-segment waveform. When a digital oscillator—like that used in Mountain Computer hardware—tries to create frequencies above half its sampling rate (above 16,000 Hz, in this case), the frequencies fold over and show up as lower, incorrect frequencies within the audio spectrum. This phenomenon is known as "aliasing." (A good explanation of aliasing is given in the *Computer Music Journal*, volume 2, #2 in "Introduction to the Mathematics of Signal Processing," by F R Moore.) These stray aliases usually have little to do with the intended sound and are objectionable. To reduce their presence, care must be taken to limit the strengths of high harmonics in a wavetable.

The other consideration is the fundamental frequency at which the note will be played. A waveform for a bass instrument can get away with richer, higher harmonics. Practically speaking, aliasing can be a useful effect in the simulation of noise and complex nonharmonic tones.

Keyboard Architecture

The alphaSyntauri synthesizer keyboard is a standard, two-bus, 61-note, Pratt-Reed organ keyboard. This keyboard assembly is found in many commercial musical instruments, such as Moog, Arp, and Crumar synthesizers. Syntauri has added CMOS circuitry, which allows the Apple to scan each key's two vertically positioned contacts (lower and upper) approximately once every 10 milliseconds for make or break conditions.

After the entire keyboard is scanned, this information is compared with a memory map of the last scan and is updated if different. A timer, maintained in the computer's memory, counts the number of scans between changes, including the time between closing of the lower and upper contacts of each key. This number (in the counter when the key is fully down) is used as an index in a velocity table, which is in turn applied to the attack rate and the final attack volume. The table contains 32 entries and allows the production of up to 32 different perceived velocities. By altering a value specified in the velocity setup program, the inverse relationship of key velocity to loudness can be made more or less linear on a scale of 0 to 7.99. In effect, this varies the keyboard response to velocity from linear to logarithmic.

The keyboard's tuning is organized by a scale table, which is set up by the Scale program. *Just, well-tempered, international,* or any scale from 1 to 32 intervals/octave may be chosen. The standard scale is *well-tempered* and is 12 intervals/octave. (A very concise discussion of the alphaSyntauri keyboard can be found in a paper presented by Charlie Kellner, Ellen Lapham, and Laurie Spiegel at the 67th convention of the Audio Engineering Society, New York City, November 1, 1980. Reprints are available from Syntauri Corp.)

One other setup program is Log III, which creates a log table for producing attack, decay, and release envelopes. Two envelope log table types are available: linear and exponential. Linear is best for nonpercussive sounds with slower attacks, such as strings and brass. Exponential works well for percussive sounds, like pianos and bells.

The FX Controls

What would a synthesizer be without some kind of performance effects? Syntauri and Laurie Spiegel devised some neat ways to modify the sound while playing; these are dubbed FX. Hitting the space bar and the letter "F", you are asked which effect file is desired. The files are text type and are prefixed with MOD.nnnnnn. (You don't have to type Mod.) Hit Return and you have the newly selected effect. The available FX are Timbre Scan, Pitch Sweep, and Pitch Bend.

The effects like vibrato use the game paddles for control. Timbre Scan actually scans through all the waveforms in the preset master, in a sequence whose rate and pitch are controlled by the paddles. Pitch Sweep modulates the frequency upward into aliasing at a depth controlled by one of the paddles. Pitch Bend allows for dynamic frequency changes through the movement of a paddle with one hand, while the other plays the keyboard. All effects can also be used with vibrato.

Graphics

One of the most captivating features of the alphaSyntauri system is the "Close-Encounters" graphics that accompany the music. A corresponding bar on the screen lights up for each key that is down. A captivating and entertaining effect results, especially when the sequencer is playing back some piece. At a trade show, a spectator was overhead saying to her friend, "I've never seen music before!" While this is not a feature we would spend hundreds of dollars to obtain, it is a great extra as a by-product of performance. When the question "What good does that do?" arises, we mumble something about the ability to visually inspect playing technique. (By watching the blocks, it is quite easy to gauge the amount of roll-over between adjacent keys. Speaking candidly, though, the graphics are just attractive.)

The Manual

The alphaSyntauri manual is very much in the spirit of the Applesoft tutorial manual—friendly and jovial, though a little confusing. It works quite well as a tutorial; you can sit down with the instrument, read through the manual, and apply things that you learn. The explanations of synthesis theory are well illustrated. We found the "Quick Reference Guide" more useful when we had a general knowledge of the system. Neither document has an index.

Applications

We tried to put the alphaSyntauri through its paces and discover what other people were doing with it. Steve Leonard, mentioned earlier, uses his onstage with a rock band and has developed a set of presets to replace a lot of heavier, traditional professional keyboards. We put his instruments into action when the rock group Sister Sledge was working at Linden Studio. No analog synthesizers were available, so keyboard player Steve Gould received a mini-lesson in using the alphaSyntauri synthesizer. Within five minutes, he was playing independently. The Close Encounters theme was heard many times that night.

On the academic side, Stanford University has a computer-assisted instruction project in the works. The curriculum, developed on its PDP-10 by Dr. Wolfgang Kuhn, is being adapted to the alphaSyntauri system to teach basic music theory. This should be very interesting, and I am sure many other universities will implement it.

Laurie Spiegel, a composer who uses the alphaSyntauri system in her work, has too extensive a background in computer music composition and programming to cite here. But we feel that one of her contributions to the alphaSyntauri system is worth mentioning. Laurie has one of the earliest Syntauri keyboard prototypes. Even before there was really a developed product, she was writing her own 6502 programs on her Apple (which is also a prototype), to process and interact with the keyboard in interesting ways.

In a concert series, "Computer in Performance"—presented in New York City during 1980—Laurie used a keyboard program she wrote in Pascal. An effective PEEK and POKE permutation algorithm, it used the keyboard to specify transposition. Melodic and harmonic materials were specified by software. There were several processes running which specified sets of pitches to be played. Laurie selected which sets the program would be permuting, while the alphaSyntauri synthesizer specified the base pitch. The paddles were used to modify the timbre and effects, and the result was musical and interesting.

A more recent program is a composition which she patched into the alphaSyntauri system software. Going to the recorder menu and typing "C" (for compose), she can build lines of music based on written algorithms which are then patched into the main alphaSyntauri BASIC program. For example, a small FOR-NEXT loop is used to build an arpeggio. Her program asks for the number and spacing of the events in the sequence, along with a number of simultaneous notes. It will fill a notes table with a sequence based on the information supplied and the little algorithm which was preprogrammed. This is simply one user's own experiment, not an official release by Syntauri. (This little composing program is just the tip of the iceberg for algorithmic composition.)

Complaints

Game paddles are a drag. They are imprecise, don't stay where you put them, and waste processor time. I really wish the system had a couple of slide potentiometers and a cheap analog-to-digital converter.

The manual has no index! (Syntauri says it's preparing one.) The system takes too long to boot up. (Syntauri's working on that, too.) Depending on your audio quality requirements, the Mountain Computer synthesizer hardware can be a bit noisy (8-bit digital-to-analog converters). But it is the best choice when you compare price to performance.

Conclusions

- The software allows for system expansion. Innovative musical ideas or new methods of analysis can be easily incorporated into the operating system.
- The alphaSyntauri system uses a modular approach for the hardware, allowing for future improvements and upgrading of the system. This means the system can grow, not be outgrown.
- The software—while some may argue the advantages of straight assembly language—is fast when it needs to be and slow and accessible where necessary.
- The real-time interaction with the composer is an important improvement. This changes the synthesizer into a true musical instrument.
- The price is obviously more than the average Apple II owner can afford. For the serious musician, however, the alphaSyntauri's combination of quality sound, good performance, and price make it well worth the money. ■

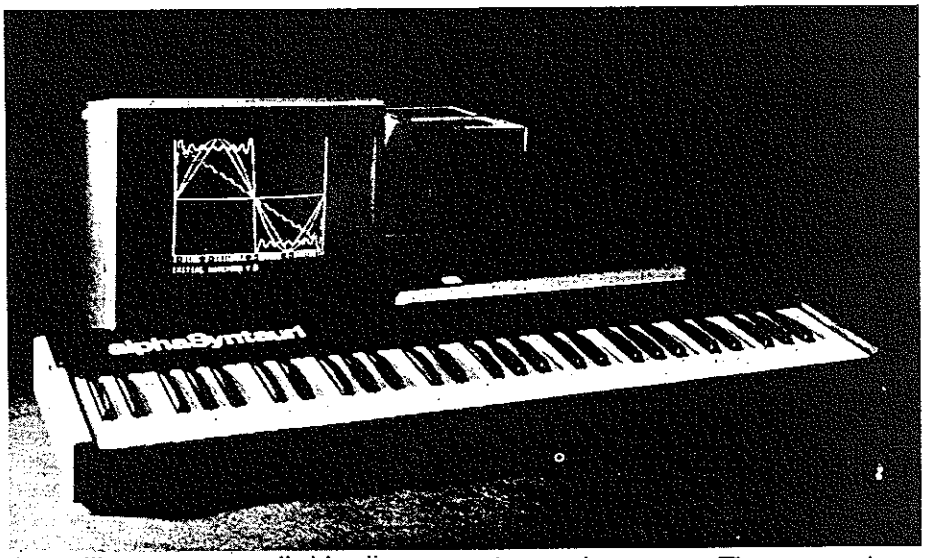
creative computing
$3.95
BUYER'S GUIDE
1983

Making Apple Music

Mario J. Acerra

The alphaSyntauri Instrument System is a digital, polyphonic music synthesizer and keyboard which interfaces with the Apple II computer. I have been using the system for about a year and a half, and have seen it develop and expand.

I am by trade an instructor of media technology and criticism but have a diverse background in music and theater. I work as an independent film/video maker and have scored numerous films with the system. I have done some session work on albums with the alphaSyntauri synthesizer and have played it live in concert and with theatrical revues.



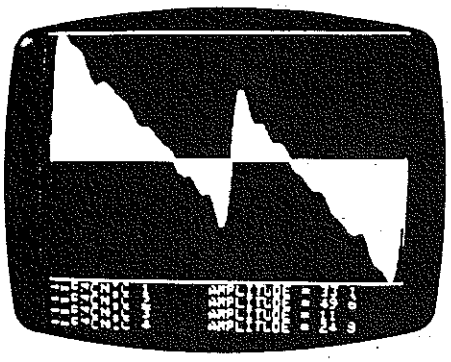
Analog and Digital

I have composed and recorded electronic music for about ten years and, like most musicians, I worked with analog equipment. The transition from analog to digital can be a little confusing from the musician's standpoint so a few words are in order. All sound is ultimately analog but it is the means by which the sound is created that can be described as either analog or digital. Synthesizer music is produced by oscillators. In an analog system the oscillator is controlled by voltages. Various control voltages produce different pitches. In a digital system the oscillators are controlled by discrete numbers. There is, however, another difference between analog and digital systems such as the alphaSyntauri synthesizer and that is in the type of synthesis that occurs.

An oscillator is capable of producing the sounds of different types of waveforms and these waveforms are one of the determining factors governing the timbre or color of the tones produced (i.e. whether a sound is more brass-like, string-like, or bell-like). Popular analog synthesizers use "subtractive synthesis" to produce various waves. That means that a fairly rich, complex wave is fed through a filter which subtracts certain frequencies until the desired sound is obtained. Most synthesizers of this type have three or four standard waves to choose from: the classic sawtooth, pulse, and triangle or sine wave.

Digital systems build from the ground up, adding harmonics to simple waves until the desired sound is obtained. This allows for more exact control of the waveform and a greater diversity of waves from which to choose. It is, of course,

Mario J. Acerra, 511 Lechauweki Ave., Bethlehem, PA 18015.



DRAW WAVE.

possible to produce sawtooth, pulse and sine waves digitally, but you can also produce all kinds of combinations and variations.

There are some advantages to analog systems. Certain effects and sounds such as filter sweeps, white noise and portamento seem easier to produce on analog systems. With analog systems you can experiment and otherwise fiddle innocently with various filter settings and arrive at interesting sounds.

Building waves in the digital system demands somewhat more knowledge of harmonics and the nature of sound. You are less likely to create an interesting sound accidentally by fiddling. In other words, you need a sense of what kind of sound you want before you can create the wave.

Finally, some analog users will argue that analog sound is best produced by analog means. There are, however, several very good reasons to consider digital synthesis.

Once digital techniques are mastered, the precision and variety of sounds are greater with a digital system. A limitless number of sounds can be produced without depending on the rather large chunks that a filter takes out of the sound. Furthermore, digital synthesis eliminates the bane of many an analog synthesist: drifting oscillators and the resultant "out-of-tune" state of the synthesizer.

Digital synthesizers are also far more precise at remembering and reproducing instrument patches. Analog synthesis involves a great deal of knob twisting and wire connecting. It is very tedious and time consuming to reset all of the knobs on an analog synthesizer to an exact setting from a previous session. Digital systems store all of the various sound paramaters as numbers. These settings can be kept in the computer memory or stored on disk. Thus, with the press of a few keys, you can recall a previous patch immediately and exactly.

Finally, as a sequencer, the digital instrument can handle far more information. Most analog instruments can playback or repeat between twenty and forty notes. The alphaSyntauri instrument can handle up to 2000 notes for mono *or* polyphonic sequencing.

Well, in any case I was convinced to convert to digital synthesis. After looking over various systems I chose the alpha-Syntauri synthesizer. I was and still am convinced that, within its price range, the system offers a remarkable amount of capability, even compared to popular analog polyphonic instruments.

Hardware

There are two alphaSyntauri keyboard systems. The alphaSyntauri 5 is a five octave (C to C) velocity-sensitive keyboard. The Plus 4 looks similar but has four octaves and no velocity sensitivity. Both keyboards have eight-voice polyphony with two oscillators per voice and stereo output with oscillator offset control in 32nd tones. This results in a very "fat" sound.

The Syntauri system uses the fine oscillator boards produced by Mountain Hardware. These boards are plugged into two slots in the Apple, and a third slot is used for the keyboard interface card. It is also possible to use the ALF card. For this particular application, however, I definitely recommend the Mountain Hardware cards as they more fully exploit the versatility of the keyboard system.

Ten instruments can be kept in memory at a time and called up instantly.

The frequency range of the oscillators is from 27.5 to 16,000 Hz. The quality of the tones produced is good, from deep bass tones to sweet highs. It is possible to produce unsatisfactory or distorted tones by adding certain harmonics, overextending the frequency range of a given wave, or shaping the envelope incorrectly, but a little attention to these details produces very clean tones.

The design approach of Syntauri stresses plug-in hardware modularity and I consider this an advantage. This means that if a new oscillator board with added capabilities is developed, the keyboard does *not* become obsolete. The system lets you use new hardware as it is developed. This can, in effect, give you an entirely new synthesizer without the cost of replacing the entire system. The same situation exists with software updates.

This expandability is a definite advantage over most commercial analog systems and eliminates the familiar agony of seeing your synthesizer become outdated within a few years or even months of purchase.

Velocity sensitivity is achieved in the traditional manner of having two switch contacts for each note. The computer notes the delay time between the first and second contact and appropriately affects attack rate and volume. The degree of the effect can be controlled by the user. The contact wires are a bit delicate and hard to replace but mine have held up pretty well.

The keyboard is sturdy and well built. It is very portable, being less than three inches high. If you plan any extensive travel with the system I recommend the use of Anvil cases. There are not, to my knowledge, any stands yet available so you need a proper set up procedure.

Hardware accessories include foot pedals for sustain and portamento. One drawback in the current system is that portamento is either on or off and the rate cannot be varied. Other sound modification is controlled by the Apple keyboard (or remote keypad) and game paddles.

I would like to see some kind of pitch and mod wheels developed and perhaps foot pedals which plug into the game port of the Apple to perform some functions now handled by the paddles.

Finally, although overall volume can be manipulated via the Apple keyboard, you must take your hands off the instrument keyboard to do so. Thus I have found a volume pedal a good accessory. A standard volume pedal of the sort available in music stores works well. A two-patch cord converts the stereo output to mono to be fed through the pedal, or you can buy a separate pedal for each channel.

Software

Good software is essential for any system and often proves to be the true mark of excellence. This certainly applies to Syntauri. When you buy the alpha-Syntauri synthesizer you are not simply buying a keyboard; you are buying a total system. The use of a varied line of software, rather than expensive hard-wired modifications, brings an inexpensive flexibility to the instrument.

Currently available software offers a wide range of capabilities from defining and saving sounds to scoring and teaching.

Research and development of new software is an ongoing process. Within the past year several operating systems have been introduced as well as numerous utilities. A different operating system effectively gives you an entirely new synthesizer. The best part of this arrangement is that new operating systems and utilities are offered to owners at what I

consider extremely reasonable rates. Most are available for about the cost of a good arcade game.

Three operating systems are included with the Alpha 5: the original Alpha III standard system, alphaPlus which has some unique playback capabilities and special effects, and SuperPlus which is designed for live professional playing, and offers features such as split keyboard and sound-on-sound recording and playback. All files, patches or instrument banks created with one system are compatible with all other existing systems and utilities.

Capabilities shared by both keyboards include a wave generating program which allows for the creation and saving of unique wave forms. Hi-res graphics show the shape of the wave and reflect alterations as you add harmonics. A reference tone is produced so that you can hear changes as they are made.

Each of the two oscillators assigned to each note can have a separate waveform and each oscillator has its own envelope. The envelope affects such parameters as whether a sound will slowly build, ring out, hold indefinitely or have a percussive quality.

Envelopes are the familiar ADSR type. They control the attack rate and volume, decay rate, sustain rate, and release rate and volume of each note. The user can specify values for all these parameters within a range of 0 to 255. Each waveform is also composed of 256 definable points.

The combination of two waveforms and envelopes creates a completed "instrument." Ten instruments can be kept in memory at a time and called up instantly. Up to 200 may be stored on a single diskette.

Using two separate oscillators per note with separate wave forms and envelopes allows the sound of each note played to change over time. This is similar to the analog process of sending a filter through an ADSR envelope as each note is depressed. Unlimited instruments can be created, but over 50 come already developed for you if you don't want to get into instrument creation immediately. These include very nice strings, decent brass, superb Hammond B-3 and pipe organs, good Rhodes and vibes, and just about everything else from funky "fat" instruments to far out electronic sounds.

A very nice software feature is the ability to transpose what you are playing into any key. Steps are in quarter tones. I found this especially handy when working with vocalists who may want to try a song in various keys.

Vibrato and tremolo are available as well as pitch bend, pitch sweep, and timbre scan in the effects mode. Timbre scan is particularly interesting in its capacity for constantly changing tone colors. The value of some of the other effects is dependent on finding just the right settings for them (via game paddles).

In the recording mode you simply play any note sequence (mono or poly) of up to 2000 notes and the Alpha will play the sequence back exactly as you have entered it, including rests and dynamics. You can playback just once or in a continuous loop for sequencer effects, and you can play on top of recordings or sequences during playback. It was difficult to achieve smooth sequencer loops and to play along with recordings in the earlier operating systems, but this has been rectified in SuperPlus. Here, playback speed is variable from 1 to 800% and you can save any note file to disk with up to 20,000 notes on a single diskette.

During live playing or recorded playback the Apple monitor displays current instrument parameters and also displays flickering bars or squares of color which correspond to each note being played.

There is a very exciting software package due out soon which will digitally convert any piece of music played on the alphaSyntauri into hi-res graphic musical notation.

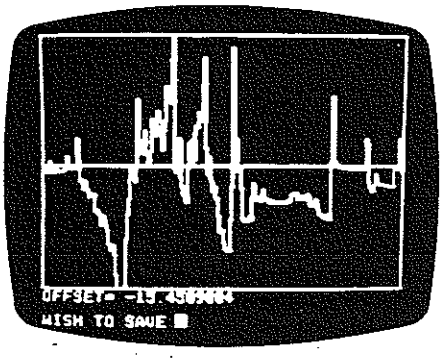
While I have never found a real need for this latter display I suppose it could be fun at parties.

In addition to all of the above, the alphaSyntauri 5 synthesizer has some special software generated capabilities. The split keyboard feature allows up to eight separate instruments with user-defined split points. This is fantastic for things like chording on one end and lead sound on the other.

In the recording mode you have sound-on-sound capabilities with up to eight different instruments simultaneously. You can keep on adding tracks on top of tracks until you reach the memory capacity.

Both keyboards can take advantage of several utility programs created by Steve Leonard. For those new wave aficionados, Steve is the keyboard player for The Cretones and his utilities are very "musician" oriented.

Draw Wave allows you to draw wave forms on the Apple monitor and save them for later use. You can use the game paddles for this and it is easier than



From DRAW WAVE.

specifying harmonics. The program gives digital users some of the experimentation capabilities available to analog dial twisters. I have found that you can sometimes just draw an interesting looking waveform and find that it sounds good too. While this is certainly not always the case, with a little practice you can get pretty good at it.

Auto Pulse allows you to make precise representations of pulse waves with duty cycles between 0 and 50% with a user defined number of harmonics. Pulse waves are a common sound source in electronic music and this software pack makes it very easy to create various types.

B-3 Wave Maker duplicates just about any setting on a Hammond B-3 organ. You can specify each "drawbar" setting and the result is almost indistinguishable from a real Hammond, except of course that the Hammond weighs several tons while the alphaSyntauri synthesizer is very lightweight.

Applications

When playing live, I have found that using my alphaSyntauri synthesizer eliminates the need for carrying around half a dozen keyboards to get various sounds. Most commercial keyboard sounds plus many more can be stored on disk and called up when needed.

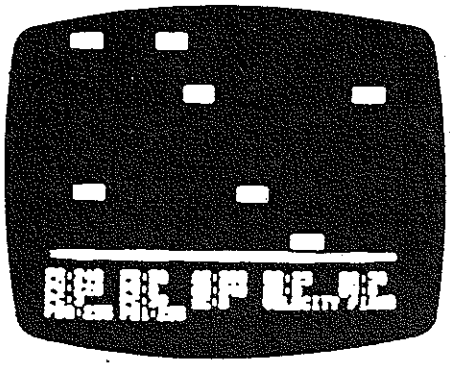
The instrument sounds good live and holds up well, although you must be careful to ground the Apple AC plug and watch for power spikes or interference from light dimmers. Also, on hot stages you must be sure that the Apple does not overheat. I recommend the use of a heavy duty fan for cooling the Apple.

For use in a theatrical setting the alphaSytauri instrument adds a big dimension to a small ensemble. In the recording studio I have found it useful for creating fully orchestrated sounds. With hundreds of sounds to choose from, you can bring versatility to session work and with multitrack recording either at home or in the studio you can achieve very complete, professional recordings. I have scored several film/video works solely with the alphaSyntauri synthesizer.

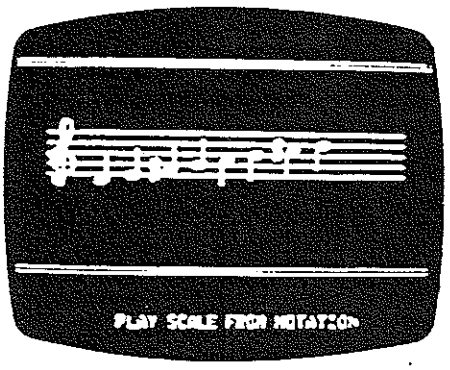
Along with the Syntauri system, I often use a Roland drum computer for percussion and I feel it is a useful addition. The synthesizer, by the way, can send a signal out of the Apple cassette port to trigger drum machines. Since there are some sounds more readily achieved with monophonic, analog instruments, I keep a Sequential Circuits Pro-One around. Actually, there is no reason why further software modifications to the Syntauri system might eventually make this unnecessary. One thing I would like to see is the ability to use more than two oscillators per note on a given voice.

There is a very exciting software package due out soon which will digitally convert any piece of music played on the alphaSyntauri into hi-res graphic musical notation. You can then dump to a graphics printer. This is a marvelous package for musicians that will eliminate the very tedious work of transcribing. You simply play the song and the system prints it out for you.

The sheet music I have seen looks very professional. It is fully polyphonic and prints out automatically in score format with text editing capabilities for lyrics or chords. Variable key signatures, rests, accidentals, measure tie marking and variable time signatures are all supported.



Monitor display listing envelope settings and color blocks during live play.



From CAI program.

Finally, I should mention one more application: music education. Syntauri offers an excellent CAI program for music theory and ear training. *MusicMaster* was developed by Drs. Wolfgang Kuhn and Paul Lorton, pioneers in the use of computers in music education. Briefly described it is an interactive teaching aid for learning musical basics such as intervals, scales and melodic dictation. It is organized in modules with student record keeping, performance analysis, and a teacher management system.

Conclusion

Are there synthesizer systems that are better than the alphaSyntauri Instrument System? Yes, but they cost three to ten times the price of the Syntauri. The alphaSyntauri synthesizer is close in quality and certainly in capabilities to these higher priced systems and, when you consider the price, it is a very worthwhile system.

For under $1000 the Plus 4 is a great bargain for all kinds of synthesizer work.

At $1795 the alphaSyntauri 5 is an excellent choice for demanding professional use. (Both of these prices include the Mountain Hardware oscillator cards.) Even when you add the price of an Apple II computer, disk drive and language or 16K RAM card (all are necessary to run the synthesizer), the entire system is still very cost effective and superior in versatility to commercially available analog systems in that price range and even comparable to the much more expensive systems.

The documentation is very complete and contains a decent tutorial that even a novice can follow. Inexpensive software packages and hardware modularity ensure a system that will not become obsolete but will allow an affordable state-of-the-art system.

My musician friends are generally amazed at the capabilities of the system, although one of them recently remarked that it was the first time he had seen someone show up for a gig with a computer terminal. I'm sure we'll be seeing many musicans doing just that in the very near future.

Syntauri Corporation, 3506 Waverly St., P.O. Box 50578, Palo Alto, CA 94306.

16-Track Recording System

By the time this review is published there will be a 16-track digital recording system available for the alphaSyntauri. Metatrak is a true multi-track system in that each track is isolated from the others and can be recorded over or changed independently.

Features include per track independent control over volume, instrument selection and vibrato. After recording, pieces may be mixed and remixed with new timbres and tracks any number of times. Any of the ten instruments in memory may be assigned to any of 16 tracks and it is possible for two or more instruments to play the same notes simultaneously. A built-in click track provides multiple outputs and control at 1 to 280 beats per minute.

Because the alphaSyntauri implements recording digitally, Metatrak provides features and capabilities not possible on conventional tape based systems. Such features include absolutely no S/N ratio degradation, the ability to change instruments on already recorded pieces, the ability to change playback speed without pitch change, and special sequence recording modes.

Future additions to the system include punch in/punch out, fast forward, velocity recording and an expansion kit that would increase recording storage to 20,000 notes (about half an hour of music).

Metatrak is available as part of a total system or as an add on to the alphaSyntauri 5 synthesizer. It is more expensive than other software updates (about $250) but it is worth the price.—*MJA*