POLYPHONY™

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ISSN: 0163-4534
Nov./Dec.
1978

ELECTRONIC MUSIC & HOME RECORDING

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SOFTWARE: Keyboard Operating System

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CONTENTS

ISSN: 0163-4534

VOLUME 4, Number 2
November/December 1978

FEATURES

CONSTRUCTION

COLUMNS and REGULARS

ON THE COVER:
A close-up study of the ubiquitous octave on a mechanism with which we are all familiar-- the keyboard.

Editorial

Aha! Another issue, more changes, (hopefully) another stride ahead. I think we've really got some goodies lined up for you this year.

First, my apologies for the extreme lateness of the last issue. Last fall was not exactly an easy season for us. The press broke down, new employees needed to be trained, the new word processing system needed to be set up and checked out, and on and on. But, as you can see, we had already started on this issue and pushed it through "in quest of the holy deadline" before the last one was even off the press. Hold on, we'll make this thing bimonthly yet!!!

You should note several interesting changes and additions to the POLYPHONY format starting with this issue. MORE COLUMNS. We have several new columns this time which will become regular features in each issue. Craig Anderton (the proverbial 'No introduction is needed') will be talking to you each issue about HOME RECORDING (more about that later); David Ernst will present a COMPOSER PROFILE with biographical info, pictures, and discographies in each issue so we can all expand our interests a bit; Gary Bannister will offer EXPERIMENTERS CIRCUITS, along with IC ap notes, and bunches of experiments for all the hard-core hobbyists. We will continue our regular columns: POLYPHONY REVIEWS (with an even heavier emphasis on home recorded and self produced music), INDUSTRY NOTES, LAB NOTES (with more frequent software) , LOCAL HAPPENINGS, and PATCHES (with more patches for more types of synthesizers). In addition, we are working on other possibilities for future columns. If you have suggestions for topics of new columns, or authors you would like to have do a column, please let us know. Possible columns include THE SCIENCE OF MUSIC, dealing with such varied topics as acoustics, math and music (microtone systems, etc.), and properties of physics which apply to synthesis systems; perhaps a column on VIDEO SYNTHESIS; COMPUTER BASICS so you can learn how to write your own music programs; and who knows what else. Let us know what you want!!

Some of you may have noticed on the last issue that the newly added by-line on our cover reads "Electronic Music and Home Recording". This may warrant a few words of explanation. Anyone who has been even moderately active in the field of synthesis or electronic music realizes that tape recording and tape techniques are an integral part of the electronic music process. Additionally, most synthesists have done their studio work by themselves -- engineering, producing, arranging, and so on. Regardless of whether your work was done on a 24 track machine with computer mixdown or a portable cassette recorder, this "do it all yourself" atmosphere is what the new home recording craze is all about. Synthesists, by nature, have been "home recordists" for years. It seems natural, then, that POLYPHONY, the applications oriented magazine for synthesists, should be one of the first magazines in the country to acknowledge the increased interest in the subject and begin providing regular columns and features for the advancement of this artform. Last issue we featured Larry Fast talking about how he did "Cords"; all the basic material was done in his home studio. This issue we start a regular column on Home Recording by Craig Anderton. Craig is the author of "Home Recording for Musicians", one of the industry's few handbooks dedicated to the person who wants to do his own recording on a limited budget. In the future issues we are lining up additional features about setting up home studios, equipment considerations, recording techniques, marketing your music, and much more. POLYPHONY is happy to welcome our new crowd of 'recording' readers.

I hope all of you had a good holiday season and are ready to jump into a new year. I don't know what it is, but something tells me that 1979 is going to be a really intense year for electronic music. Here we go.....

Marvin

POLYPHONY REVIEWS:

by Marvin Jones

This particular REVIEWS column is especially exciting for me. With only minimal mention that POLYPHONY wanted to do more reviews of self-produced music, we have recieved a lot of response from those readers/artists who have, indeed, managed to get their own music released. While we have always tried to review every self-produced release sent to us in the past, this is the first issue where EVERY RELEASE was recorded in a home studio, or released on the artists own label, or where the artist in some way put much more of himself into the project in an attempt to communicate to others through his music. I hope we will continue to recieve more of these types of releases in the future. As far as I'm concerned, I would love to see this whole column devoted to self-produced music each issue. So keep giving me something to review!!!

Electronic Music From
The Rainbow Isle
by Don Slepian
Available only on cassette, $6.00 from Don Slepian, 2519B La'i Road, Honolulu, HI 96816, or from Synapse Tape & Record Sales.

Electronic Music... is one of the best arguments for home produced music that I've had a chance to hear in some time. All tracks were recorded in various bedroom studios on a 3340. A wide variety of equipment was used, some being home made and some being borrowed for a specific part. The music, most importantly, represents a wide variety of electronic music "styles" and techniques. The time span of the compositions and recordings stretches from 1971 to 1977, and helps provide a diversity and sense of development not usually found in the typical "two-month" commercial albums. In general, Don's style seems to meld the best aspects of free-form sound sculpture compositions with a very strong sense of traditionally structured tonal music in such a way as to provide an excellent introduction to electronic music for those not yet familiar with the medium. Still, the techniques and effects presented are ambitious and effective, providing good listening for the seasoned synthesists as well.

Perhaps the two most accessible compositions are "Horizon" and "Glimmerings", which were appropriately selected as the first cuts on each side. "Horizon" opens the tape with a heady fanfare on a Yamaha CS-80 and Electric Grand. Acoustic (nylon and steel) guitars and tubular bells are the only non-electronic instruments on this cut, but additional processing with flangers, Harmonizer, multi-speed recording, and filtering tend to transfigure even these into electronic mirage. "Glimmerings" is the light but solid introduction to the second side, and provides a good example of the power available to the solo performer with a minimum of equipment. Each of the three tracks of "Glimmerings" was done "live-on-tape"; no overdubs or reprocessing of the initial tracks. The extremely long rhythm sequence was produced by using two 16 X 3 analog sequencers (an EML 400/401) in a permutation patch where one sequencer alters the timing and tuning of the other during each cycle through the sequence. The result is an impression of an extended sequence from a microprocessor, or a real time performance. The other two tracks provide a hand-filtered Odyssey bass line, and a lap steel guitar with echo for chordal accompaniment. The overall feel of the piece is very fast paced and uplifting.

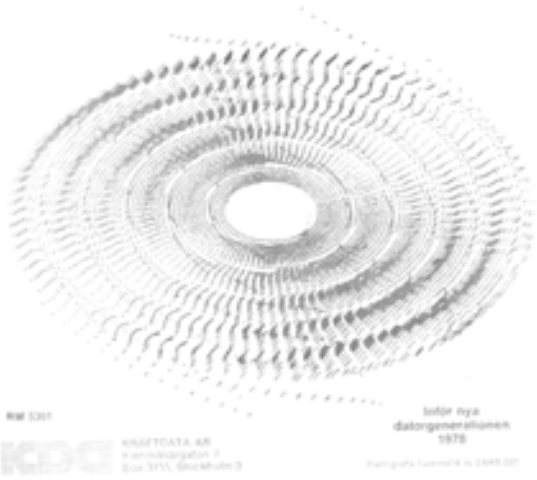
The second cut on side two, "Flight Over Swampland", is a good interpretive piece which starts out with true reel-flanged white noise to represent the beginning of the flight (how long since you've taken the time to do that!). Once the flight is off the ground, the composition mellows into a piano part utilizing echo on one channel and pre-echo on the other. The result is a stereo echo panning effect which also adds a rhythm structure to the line.

"Evolution" is the only remaining song on the first side, and is quite long. Originally done as a sound track for an experimental video tape on Hawaiian TV, "Evolution" is heavily based on a recurring rhythm structure produced by ringing and frequency shifting resonant filters with LFO square waves from two unsynched sources. The 'evolution' of the piece is done entirely with melody lines and harmony created with an EML 101 and Countryman phaser.

The last two songs on side two are "Halloween Piece" and "March of the Spirits". The first is the most free form piece on the tape, with much of the song structure generated by sampled ramp waves controlling VCOs. The flanged vocal part which starts the piece is very effective in setting the mood of the entire song. "March of the Spirits" is an experiment in simulating the slightly dischordant folk instruments of foreign cultures. Arp 2600 was patched up for most of the melody and percussion voicings, while an RMI piano provided the bass. The outstanding gong at the close of the album was created by recording a 'plink'from a toy piano, slowing it down three

octaves, and splicing it together backwards and forwards. This is but one interesting example of the highly creative and experimental work found on this tape. For anyone involved in any aspect of electronic music or home recording, I recommend this tape.

D 21 — IN MEMORIAM — D 22



In Memoriam
by Goran Sundquist
7" 45 RPM EP
Kraftdata Records RM 5301

OK folks, this is going to be a bit harder to review than most records, so bear with me. The entire jacket for the record is written in Swedish, and I know nothing about Swedish. I was able to pick out a few words which, in conjunction with the letter Goran enclosed with the record, should allow me to provide a satisfactory explanation of what is happening on this record.

Goran works for Kraftdata, a company with a computer services bureau for the Swedish electric power industry. The material presented here was programmed and performed on their "late" computers, a SAAB D21 and D22. The material on side 2 (using the D22) was performed real-time through a 2 channel DAC in stereo. The output was sampled at 10KHz, so no time was allowed for envelopes. Although the large computers are gone, Goran saved the software he wrote, and hopes to modify it for operation on a smaller hobby computer soon.

Side one contains four pieces. "Arvet fran D2" is a simple melody line accented with percussion from the instantaneous DAC transitions. (All of side one is in mono.) "Julvisor" advances to a two part composition which is accomplished through trilling, or alternation of the DAC output between the two notes. The last two songs on the first side are based on Mozart's Dice Waltzes; these compositions use a "library" of single measure patterns which, when randomly selected, can produce a nearly infinite variety of waltzes. When initially written by Mozart, the dice waltzes were set up as a 'game' where a pair of die were thrown to select the various composition options. I would guess that Goran has programmed the computer to provide the automatic random selection of phrases, yielding a program which could play nearly forever with little duplication or repetition. The first of these presented is "Ein Musikalisches Wurfelspeil", which is trilled into two parts as in the previous piece. "Wurfelspeil Andra Forsoket" is a similarly based composition, but using a 'latched' conversion which generates two continuous harmony parts.

Side two starts with a short "Stereotest" to balance output throughout the DACs range. All of side two is in stereo. It seems that certain frequencies have been assigned locations throughout the stereo spectrum, causing motion and depth as the compositions traverse their range. A lengthy version of the Dice Waltzes again appear, this time with computer maintained harmonic structures on each of the voices. A chart on the record sleeve shows the harmonic ratios used for the various voices such as flute, trumpet, oboe, and others. The computer also has tempo control here, which relieves much of the mechanical feel of the first side. Side two closes with "Bist du bei mir" by Bach, performed with much the same style as the previous cut.

This seems to be an interesting way to adjunct your job if you are working with large computers. I don't know how many companies would mind if you work with music programs on their machines, but it can't hurt to ask. It is also an interesting way to pay homage to an obsolete or upgraded computer. And with the way technology is rolling, we all know there are plenty of them!

I am not sure about the availability of this record. Since it has obviously been pressed, there must be copies for sale. I would guess that $5 would pay for the record and overseas mailing, although you may wish to contact the record company first. Contact: Kraftdata AB, Kammakargatan 7, Box 3155, Stockholm 3, Sweden.

Voice of Taurus
Gold Records 11061
and
The Sound of the UFOS
Gold Records 11058
by Bruno Spoerri

Music from overseas always seems to fascinate us. Many times the equipment used is quite different from what we have available in the US. Almost always, the influences and backgrounds are radically different. These two albums from Switzerland also are interesting in that they encompass one artists work in two entirely different modes of performance. "Sound of UFOs" is all live performance with the only additional musician being a drummer, Reto Weber. The "Taurus" album is mostly studio work, with two cuts being taken from live performances. On "Taurus", two studio drummers help out on various cuts, but much electronic percussion is also used.

The opening cut of the

studio album, "Hymn of Taurus", is a strong leading cut and makes one aware of the understanding Bruno has of the equipment he is working with. The vocoded parts throughout this cut are superimposed on a well planned signal with pitch inflections and interesting harmonic content. The bass is very hefty and punches through all the top end activity, a tribute to mixing and European pressing as well as the synthesist. The synthetic percussion and rhythm used impart a disco flavor, and flute parts carry the melody. The first side also holds "Hallo World", another disco piece with Vocoding and strong rhythm.

The "Space Cantata" which opens side two presents some good string and choir voicings in a 2001 type opening which later segues into an R & B oriented body with organ, drums, and lead synth. Also on side two is "Saxellite", a live recording which features Bruno on saxaphone with tracking harmony controlled by an EMS frequency to voltage converter. The tracking is good, and the voices selected complement the sax very well.

The remainder of the album is mostly down tempo music with mellow voicings, free form tempo, and drifting sound effects. A very wide variety of voicings are used, as is an extensive list of equipment. With some careful listening, one can pick out which instruments are doing which parts. In this respect, the album is very good as a type of demo album for various types of equipment.

The live album, "UFOS", unfortunately suffers a bit from the emptiness generally associated with live electronic music. However, many places on this record sound much less empty (for one guy) than what many three or four man electronic ensembles generate live. Again, a wide array of equipment is available, and some preprogrammed material is used. All this helps. Additionally, Reto Weber is a very versatile drummer which adds a lot of drive to the sound as well as a number of special effects from his extensive drum package (gongs, bells, cymbals, talking drums, singing saw, and others). If you like live jazz or older Weather Report type material, you would probably like "The Sound of the UFOs".

American distribution of these albums is under negotiation at the time of this writing. For those enthusiasts interested in ordering these directly from Switzerland, contact:Studio for Electronic Music, Bruno Spoerri, Schneckenmannstr. 27, CH-8044 Zurich, Switzerland. The cost of the albums is $10 each prepaid including postage.

Cellutron & the Invisible
Green Mountain Records GMS 4015
by Robert Greely

"Cellutron and the Invisible" was recorded in Robert's home studio on a Teac 3340 with the help of some friends. The album makes extensive use of sequencer generated patterns for all parts- melody, rhythmic structures, and bass lines. There also tends to be an overpowering use of reverb throughout. Beyond these points, the album is a free form sound structure with a wide variety of patches used. Side one contains "Alien Activity from the 45th Parallel" and "John 3:16". "Alien Activity" is an extended piece with the near overuse of sequencers and reverb mentioned earlier. Many of the more interesting sections of the composition are found in the performers preoccupation with modulations of all types- key changes, ring modulation, and timbral FM work. "John 3:16" closes side one with an interesting change of pace. The primary instrument here is electric guitar, with a droning accompaniment performed on the synthesizer. The short song ends in a flurry of sequenced activity.

Side two starts with "Parisian Frequency Shift", a suite with 8 indistinguishable sections. While many of the same compositional structures are repeated here, this work offers more variety in the techniques used and sound structures presented. Tape processing, speed changes, and editing are prominently featured, as are electric and acoustic guitar parts and a section with vocal recitations over the free form sound background. The remaining cut is "Reap the Whirlwind". This cut appears to use much more real time patch and programming alteration than any of the other three. This provides a smoother musical statement, and more interesting mood control than instantaneous patch changes or tape editing types of construction. Unfortunately, sequencers and reverb appear through much of this song as well. Cellutron seems to offer the most to those interested in hearing a great number of variations on a few basic themes.

This album can be obtained from Energy Center Studios, PO Box 65, No. Stratford, NH 03590.

LETTERS!

LETTERS!

LETTERS!

FORUM ON TAPE EXCHANGE

The response to the "Tape Exchange Proposal" letter in the issue before last has brought more mail than any other letter we have printed. I would like to share a couple of the responses in order to get additional feedback on these proposals. If we are to form a truly universal exchange and communication program, we should have as many comments and criticisms from as many of the prospective "exchangers" as possible. So, let's hear from you! M.J.

Dear Marvin,

I found the July/August issue of Polyphony particularly significant because of your editorial and the tape exchange idea proposed by Chuck Larrieu in the letters column. Reading the two items was like finding the missing piece of a jigsaw puzzle. At last I was able to put into perspective some deeply held ideas I had about using synthesizers in creative home recordings and then being able to reach an audience of listeners.

Until the July/August issue, I became increasingly annoyed that Polyphony was excessively technique oriented. It was all right to know how modifications could be made to equipment to achieve a certain effect but for what purpose? One could easily tire of the effect once the novelty wore off. Sure it was great to build the equipment and tinker with circuitry. Some of the sound effects were interesting and even amusing. But again, for what purpose? Beyond the obvious learning process involved with building the circuit and creating the sound effects there should have been, it seemed to me, some meaningful application. Hopefully now, with the apparent change in editorial philosophy, Polyphony can become more instrumental in not only delineating user application but also in coordinating a peer group tape sales/exchange network aiding in the distribution and/or selling of subscriber compositions.

At this point I'd like to develop first, my idea of how a tape exchange could be implemented and secondly, how the tape exchange concept could be expanded to include other artists in the so called "home recording" category.

In order to get the tape exchange into operation we have to assume that those involved with collecting, cataloging, and duplicating materials would do so on a voluntary basis. Once the exchange was operational then a fee structure could be worked out to compensate those involved.

Organizationally, centers or holding libraries could be located in three zones of the U.S.: East, Central and West. Theses libraries would then compile a list of the material they have and send these lists to Polyphony. The zonal libraries would act as screening agents and make recommendations to Polyphony regarding the general quality of the recordings submitted. The purpose would be to reduce the workload of Polyphony in reviewing material. At the same time, the readership of Polyphony would have access to the list of materials held by the zonal libraries simply by requesting the current list of materials available by including a self-addressed and stamped envelope to Polyphony. The resulting lists from the zonal libraries could then be compiled into one catalog listing all the materials available. A brief description of the material would be given along with either the selling price or exchange option asked by the composer. The composer's address would also be listed unless requested otherwise.

It is assumed the composer has taken the necessary steps to protect his material by copyright. Neither the zonal libraries or Polyphony can be held responsible for any duplication which might result after the recorded material is sold or exchanged. The composer who has his material in the marketplace, so to speak, solely must be responsible for the protection of his material! The composer must also be prepared to duplicate his own material for sale or exchange unless he makes an arrangement with a zonal library to duplicate his tape in return for a percentage of the selling price. However, the zonal library must not put itself in a position of assuming any debts or liabilities incurred by any composer. To do otherwise would jeopardize the existence and success of the tape sales/exchange network.

Up to this point the thrust of my discussion has centered around the home recording synthesist and the exchange and/or sale of his material to other like-minded individuals. But I think the growth potential is much greater and rewarding (not only individually but more importantly, commercially) if we open up the tape sales/exchange network to include other artists/composers. In other words, an interdisciplinary approach.

I'd like to bring to your attention an individual who has been working to further the expressive qualities of stereo recording through the creative use of narration, music, and electronic sound effects. He is Lawrence Russell, an instructor in the Creative Writing Dept. at the University of Victoria in British Columbia. He is also the editor/publisher of D.N.A. Stereo Tape Magazine (currently defunct).

The possibilities of applying synthesizer music to the type of creative sound work that Lawrence does has endless variations and it is for this reason that I want others to know about his work. In a utopian gesture Lawrence offers a free duplication service for the many creative tapes he and his friends have composed. Upon request he will provide a listing of the tapes available along with a brief description of each. Then, when you have selected the tapes you want, all you need to do is provide reel to reel or cassette tapes to cover the program material you want along with

return postage. Lawrence will dupe the requested tape selections free of charge and return the material to you. His address is: Lawrence Russell, D.N.A., 3218 Bellevue, Victoria, British Columbia , V8X 1C1. Lawrence explains his free duping by writing:

"The fact that DNA material is offered gratis is not through any revolutionary social principle; it is simply a means of exploiting the magnetic tape medium to its fullest without an absurdly expensive overhead. The idea of trying to sell the avante-garde has always struck me as being next to futile; the land is full of small literary magazines who sell to nowhere but the public libraries and sit with embarrassing anonymity on the shelves of the occasional bookstore."

One should listen to Lawrence's tapes with an open mind and glean new creative insights from them. Freshness of thought and expression as well as the compelling use of sound is the whole point and therein lies the value and enjoyment of these tapes.

Another type of sound artist that could be included in the proposed home tape sales/exchange network would be the practitioners of text-sound art. An overview of the well-known artists in the medium as well as the frustrations of not having a viable public outlet was described by Richard Kostelanetz (a text-audio artist himself) in the Winter 1978 issue of the "Performing Arts Journal". He concludes:

"Text-sound art, it is clear, is interesting and consequential -- it is a distinct artistic category, with a small army of practitioners; but the greatest threat to its survival -- not to speak of its development -- is, simply, its unavailability.

...What is needed at the beginning, of course, are selective anthologies, not only to make everyone aware of what is being done, but also to prompt current practitioners to move onto something else.

...Until records and various printed materials become readily available, North America text-sound will remain a private art that will have public existence only in second-hand forms, such as this essay; and that unavailability becomes, to be frank, an example of de facto censorship that is no longer tolerable."

There are probably other groups who, like Russell and Kostelanetz, are attempting to use sound in a creative manner. They, as well as the readers of Polyphony, would benefit from the interchange of ideas that would come from the coordinated effort of a centrally directed tape sales/exchange network such as I'm suggesting. It certainly remains to be seen whether or not the network concept will work. But I think the current restrictive corporate controlled system of sound marketing can be circumvented by the determination of those desiring an open and far reaching sales/exchange network for the so-called "home" recordist, whatever his area of emphasis.

I think the success of the proposed network would have an impact on the mass market. It would mean, for example, people would have a personalized choice in creative sound selections. We would not be locked into format programming such as the ubiquitous Top 40 concept. Interestingly enough, at the First Annual Conference on Radio Programming, coordinated by the National Association of Broadcasters at the Hyatt Regency Hotel in Chicago, August 20th through the 23rd, Jack Thayer of NBC noted that radio programmers should be aware of new trends in communication. He believed that young people were in effect turning inward and becoming interested in "interior exploration". At the same meeting, Joseph Smith, chairman of Elecktra/Asylum, stated that it was his experience that it was difficult to persuade radio stations to play new kinds of music. However, he revealed that record buyers were indicating a desire for more innovative styles of music, much beyond what the radio stations were offering. In other words, people are ready to accept new and different types of music beyond what the corporate system can or is willing to offer. The message, as I see it, is loud and clear; provide what appeals to them instead of being force fed through the mass media.

If catalogues, such as might be developed through the home tape sales/exchange network, were made available through existing retail record stores, or even new stores, then contact could be made with a larger segment of the public. Accordingly, if this were successful, you could be sure the mass media people would fall in line.

Even though I may be somewhat of a visionary in my thinking, I still believe the tape sales/exchange network can be made to work at the grass roots level. I, for one, would volunteer my time to establish the zonal library for the West Coast if others agreed to the organizational concept I've presented in this letter. I solicit your comments and criticisms. The end goal is too important not to pursue a workable alternative to the current restrictive corporate system. Perhaps, in the end, the idea of trying to sell the avante-garde may not be so futile after all.

Sincerely,
Will Nordby
San Aselmo, CA

Perhaps the most important statement in Will's letter is the next to the last sentence, "The end goal is too important not to pursue a workable alternative to the current restrictive corporate system." What do you think? Anybody willing to be a zone library? M.J.

MUSIC DISTRIBUTION

Many musicians composing in electronic music have at one time wanted to 1) distribute their music to wider number of people, and 2) have the option of listening to music by others working the same field. The following plan is a proposed means to the above end. While any course of action cannot satisfy all needs, I do feel the proposed system is better than the one we currently have and could make a positive contribution to a wider dissemination of creative music.

First, we need to examine the present system and its flaws, as well as some simple (but possibly incorrect) solutions.

FLAWS IN THE PRESENT SYSTEM

The present distribution system is geared towards mass marketing, and the selling of albums in the hundreds of thousands or millions. Realistically speaking, although

continued on page 12....

VOICE FREQUENCY TO VOLTAGE CONVERTER

By: John Blacet

Synthesizers are controlled predominantly by keyboards. The reasons for this have to do with the historical acceptance of the keyboard as a practical and musically interesting man-machine interface. The disadvantage of relying on this means of control is that it limits the performer's abilities on a machine that was originated to remove limits. The keyboard is also a finalized type of device that has acquired a certain prejudice on how one should play it. These playing procedures are apt to ignore some potent keyboard - synthesizer information exchange possibilities.

The search for alternative and supplemental means of synthesizer control has involved many interesting areas, including brain waves. But the hands, feet and mouth are the most important areas of consideration. A look at the various non-electronic instruments controlled by mouth will point out the importance of this area. Note also that the hands are nearly always used in conjunction with the mouth and that examples of mouth only musical instrument control are hard to find (harmonica).

This brings us to a problem that synthesizers have in common; a lack of subtlety in their sound. This is due, in part, to the relative lack of synthesizer virtuosos, and in part to a reliance on various automatic circuitry to provide complex sounds. The "human" quality of music that is so important to its success and enjoyment is best delivered by the performer in a real time interactive process with his instrument. The subtle changes that a sensitive musician can introduce into the various parameters of his sound can have a powerful effect on the ear-mind of the listener. This effect is often most successful when the change is so slight as to be unidentifiable on a conscious level.

The mouth, tongue, throat and associated area are a particularly versatile source of sounds and can be controlled in very subtle ways by the attached organic computer. It seems obvious to take advantage of this to introduce information into the synthesizer, and thus realize a range of nuances that surpass non-electronic instruments.

Various approaches to utilizing the voice are gaining interest. The three most common involve amplitude to voltage conversion, frequency to voltage conversion, and vocoding. Examples of these techniques are appearing on records. (Vocoding - Herbie Hancock's Sunlight, Columbia JC34907; amplitude to voltage conversion - Patrick Gleeson's Star Wars, Mercury SRM-1-1178.) It is obvious from these and other examples that the vocal interface has great potential. A special need is in the polyphonic synthesizer, to replace hand control of pitch bending, etc., in the event both hands are being used on the keyboard.

CIRCUIT DETAILS

This particular design is a frequency to voltage converter using readily available parts. It is not expensive, but works quite well and will allow you to explore the possibilities of voice control.

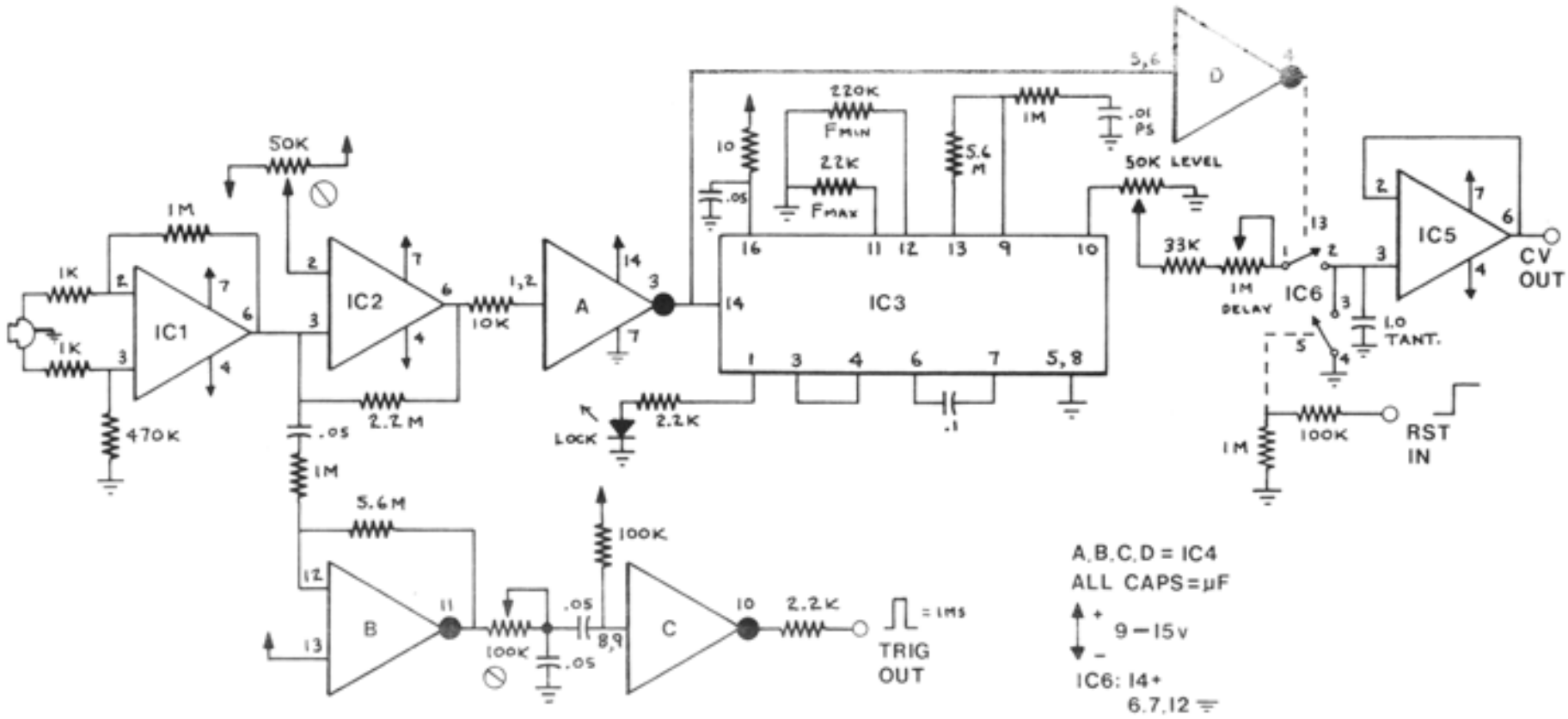
Referring to Figure 1, IC1 is a BIFET op-amp configured as a mike preamp for an inexpensive dynamic element. The differential setup allows good hum rejection. The 1K resistors should be well matched -- use 1% if you have them or find a close pair using an ohmmeter. The 1M feedback resistor determines gain. In this application, we want to avoid significant output from external sounds other than the performer, such as in a loud concert situation. In practice, you have to be very close to the mike to cause an output great enough to trigger the next stage.

IC2 is a Schmitt trigger-comparator with the trimmer determining trip level. IC4A serves to improve the rise time of the square wave output of IC2 for better results with IC3.

IC3 is a unique CMOS phase lock loop. Other PLLs do not have its capabilities and will not work in this application. In operation, the PLL locks onto the input frequency by detecting the phase difference between the outside signal and its internal VCO. It corrects any difference by changing the input voltage to the VCO. The 0.1 uF capacitor at pins 6 and 7, and the resistors at pins 11 and 12 control the frequency range of the VCO. For this use, the range is about 50Hz to 3KHz. Pin 10 supplies a voltage linearly proportional to input frequency. The 50K pot gives control over the maximum output level. With a 15 volt supply, about 12 volts is maximum. For some control inputs, you may wish to restrict this range using the pot.

The 1M Delay pot controls the charging rate of the 1.0 uF tantalum sample and hold capacitor, which is buffered by BIFET op-amp IC5. IC6 is a 4016 quad analog switch. One section, controlled by IC4D, switches rapidly on and off at the input frequency when a signal is present, and samples the voltage from the PLL. The other section dumps the sampled voltage to ground when activated. This provides a quick means to turn off the CV appearing at CV Out. The sample and hold function is a necessary addition to this design to avoid the control voltage sweeping down to zero in the absence of an input signal. Various settings of the Delay pot give the performer step or sweep functions and thus better control over the output voltage.

IC4B is a CMOS 4011 NAND gate configured in a linear amplifier mode. This provides sufficient signal level to activate one-shot IC4C and produce a trigger pulse. The 100K trimmer controls the trip level of the one-shot. This can be adjusted so that only a strong signal at the microphone will produce a trigger. Changes in the control voltage should be easy to produce without retriggering.



A,B,C,D = IC4
ALL CAPS = µF
+ 9 – 15v –
IC6: 14+
6.7.12 ⏚

FIGURE 1

CONSTRUCTION AND OPERATION

Various prototyping boards are the quickest way to assemble this device; either temporarily on one of the plastic protoboards or on a regular PC board type for permanent use. Be sure to use a few .05 uF ceramic capacitors to bypass the power supplies. A couple of 10 uF electrolytics where the power supplies enter the board are also a good idea. The power supplies can range from ±9 to ±15 volts.

All of the ICs are static sensitive and sockets are a good idea. In any case, use a grounded or isolated soldering iron and avoid static prone clothing. If you're just a bit careful, it is very hard to zap an IC.

The TL071 op-amps have several substitutes. The RCA 3140, National LM356, or Texas Instruments TL081 will all work. The advantage of the TL071 is low noise.

Some thought should be given as to where you want the microphone. I have a large upright module cabinet on top of my keyboard. Figure 2 shows the setup. With the mike placed at mouth level, it is a simple matter to lean a few inches to use it. Of course, if you are using synthesis modules with a guitar, mounting the mike on a regular stand might be a better idea. In case you are wondering how to ground a mike element having only two connections, this

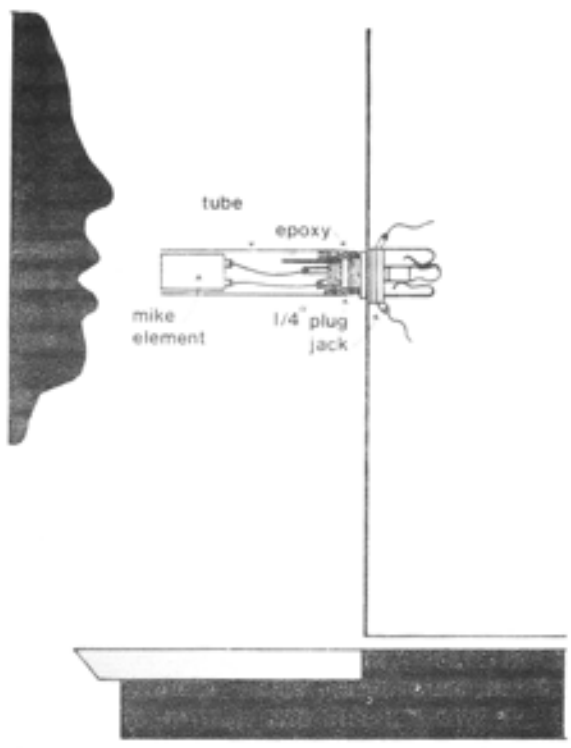


FIGURE 2

is for the metal part of the mike (if there is one and it is isolated from the mike outputs), and/or the shield of a connecting cable. If the run is only a few inches, shielded cable is not necessary.

After construction, be sure to check everything before applying power. Proper orientation of ICs, electrolytic capacitors, diodes and power supplies is vital. Apply power and patch the CV out to a voltage controlled module with a steady signal input. Use a VCF if possible. Sing a steady tone into the mike and observe the Lock LED lighting. If it fails to light, adjust the IC2 trimmer. Adjust this for the most steady lighting of the LED at low frequencies. At one extreme, IC2 will be on constantly and will lock the sample and hold closed, resulting in the control voltage sweeping to zero.

Adjust the Delay control and observe the increased sweep effect as you sing higher and lower.

Connect the Trig Out to a module and adjust the 100K trimmer for an output only with a strong blast of air at the mike.

Attach the RST In to an appropriate source (or touch the input with your finger) and observe the control voltage jumping to zero.

USING THE MODULE

Although useful results can be obtained almost immediately, some self education in the skill of singing (and in using the voice in general) will provide a greater variety of effects. Don't limit yourself to regular types of sounds. Experiment with anything and have fun noticing what happens. Chances are no one will be able to hear what you are singing directly. This is great for anyone who is a bit hesitant about their vocal abilities. The previously mentioned records can provide some ideas as to types of effects that can be produced. In addition, the work of people such as Urszula Dudziak, who have experimented with synthesizer

LETTERS:

....continued from page 9

some "electronic musicians" (and by this I mean to include experimental rock and jazz types) make music that appeals to a wide number of people, a lot of our music has less potential for pleasing a mass audience. However -- much of this music could probably find at least 1,000 interested pairs of ears, and possibly many more.

Due to the need for mass marketing, a record company will prefer to put money into promoting someone with a track record instead of an unknown who may be onto something, but is unproven in the marketplace. Additionally, greatest hits albums and repackages are on the increase -- no new studio time is required, the records are inexpensive to produce, and the albums feature well known artists. All these factors contribute to a rough scene for launching musicians who do not fit in with the "commercially acceptable" mainstream.

Unless some electronic music group manages to capture the public's fancy on a mass level (which is always possible), major record companies will continue to be cautious about promoting something which is thought of as non-commercial.

TAPE EXCHANGES

Realistically speaking, the idea of individual composers forming tape exchanges is appealing, since it allows direct communication between like-minded people. But I feel there are two serious problems.

One, this type of operation severly limits the amount of music that can get out in the world. It makes advertising difficult, and it would be very hard to reach those members of the general public who are interested in this type of stuff.

Second, a system like this is hard to turn into a profit-maker; as a result, it means that the operation is somebody's part-time job. I think it's mandatory to set up the proposed distribution system as a business; this would offer incentive to those willing to put out the products, allow for advertising, and insure royalties to musicians for their work.

continued on page 29....

processed vocals, can be valuable input.

As an example of non-keyboard use, try triggering a sequencer and controlling a flanger of filter on the output of the VCOs controlled by the sequencer. Depending on the application, different levels and methods of introducing the control voltage may be tried. For example, when pitch bending or FM modulating a VCO, introduce a fairly small amount of control voltage via a 0.1 uF capacitor, for a typical effect. The accuracy of the converter is typically 1% over short ranges. This is not really as accurate as we would like for direct VCO control, especially if we are using multiple oscillators, but should pose few problems for other uses.

In the future, two additions to this module will be covered; an amplitude to voltage converter and a 4 channel control voltage switching and level control function. In the meantime, I'm sure you'll have fun exploring voice control.

PARTS LIST

IC1,IC2,IC5 TL071 BIFET op-amp (Texas Instruments)
IC3 4046 CMOS PLL
IC4 4011 CMOS NAND
IC6 4016 quad analog switch

RESISTORS (1/4 watt, 5%)

1	10 ohm
2	1K 1%
2	2.2K
1	10K
1	22K
1	33K
2	100K
1	220K
1	470K
4	1M
1	2.2M
2	5.6M
1	50K trimmer
1	100K trimmer
1	50K linear pot
1	1M linear pot

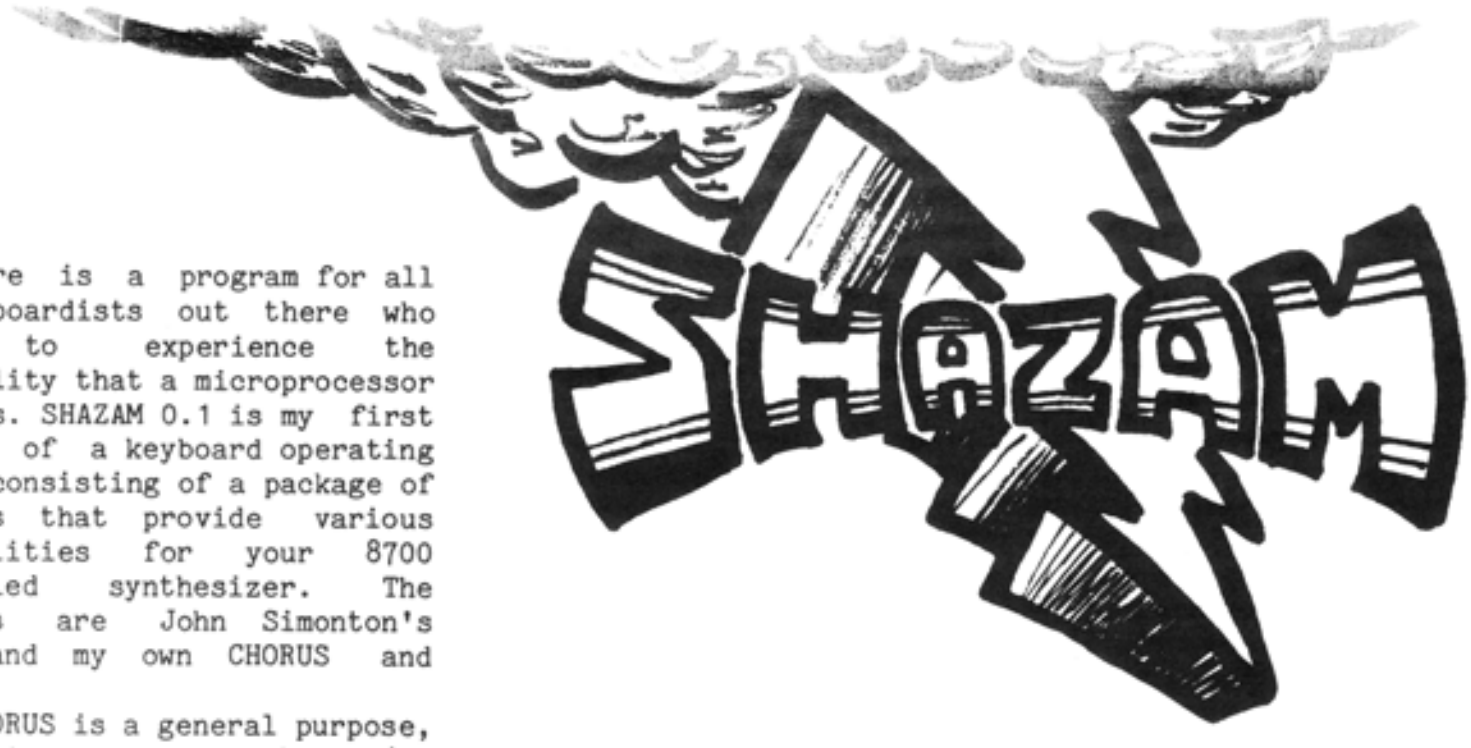
CAPACITORS

4	.05 uF ceramic
1	.01 uF (10,000 pF) polystyrene or mylar
1	0.1 uF mylar
1	1.0 uF 16v tantalum

MISCELLANEOUS

1	LED
1	Dynamic microphone element (Radio Shack 270-093)

Suitable jacks, tubing, epoxy, wire, circuit board. ——— ●



(or "Maestro, a little software, please")

By: Bob Yannes

Here is a program for all you keyboardists out there who want to experience the flexibility that a microprocessor provides. SHAZAM 0.1 is my first version of a keyboard operating system consisting of a package of programs that provide various personalities for your 8700 controlled synthesizer. The programs are John Simonton's POLY, and my own CHORUS and SPLITZ.

CHORUS is a general purpose, monophonic sequential (or circular) assignment in which successive notes are assigned to successive output channels in sequential order (sequential assignment) until all available voices are used, in which case the assignment wraps around to the beginning again (circular). The unique feature of this routine is that it allows notes to continue decaying on one channel while the new channel is playing (even if you hit the same key several times). This produces a rich pseudo-reverb or chorusing effect that greatly enhances monophonic brass and string patches. The problem with ordinary monophonic synthesizers is that if you play too fast and don't allow the envelope generators to reset, the attack portion of the envelope is bypassed which can totally ruin string sounds (ie: instead of a slow swell, your violins become percussive and go "BONG"). While the sequential assignment helps reduce this problem, the amount of reduction is dependent on how many voices you have (the more the better) and how fast you play. In general, the more voices you have, the longer you can make the final decay on each voice and still use slow attacks. CHORUS also has some other features which I'll cover in detail later.

SPLITZ is a general purpose keyboard splitting program which allows you to split the keyboard up arbitrarily into as many voices as you have (or want).While this is best utilized with larger keyboards, I still find it useful on my three octave. The important thing to note is that you are free to place the split points wherever you want and make the split sections of the keyboard as short or as long as you want (thanks to our friend, the microprocessor). A split keyboard is useful for playing polyphonically with different patches on each voice. I'm sure that those of you who have tried to coordinate different patches while running POLY have found it a bit difficult. The problem is that your timing must be exact when pressing the keys down, or your bass line will come out as a soprano patch and while your mind is trying to sort out what happened (and that can take some time if you're playing a complex polyphonic passage) POLY will continue to assign things wrong until you straighten it out. This isn't a fault of the algorithm, just human imprecision, but it only has to happen once to ruin a live performance. With SPLITZ, I use a brute force approach to overcome this problem. The keyboard is split up into various, non-interacting sections, with each section always being assigned to its own output channel. The program doesn't care when you play a note relative to other keys, if you play within a certain split section, that note will always be assigned to the same output channel. If you had a five octave keyboard, you could elect to split the keyboard up into five octaves, with each octave being assigned to its own voice. You could then patch the synthesizers up in order--channel one with a bass patch, channel two with a lead patch, channel three with a counterpoint, etc. While this is flexible and allows you to coordinate a large number of different voices, you must remember that the split up keyboard is rather small now (in the previous example, you would be limited to playing in only one octave for each voice) and even with the ability to separately transpose each voice this is a pretty big limitation, hence the program lends itself best to a few large splits (like on STRINGZ & THINGZ, you could split your keyboard to provide an octave of cellos and two octaves of violins). A popular set-up would be to give yourself an octave of synthesizer bass and two octaves of lead line patch, that way you can play your bassline without having to buy a new keyboard.

CHORUS, SPLITZ and POLY are tied together as a single package and use the 8700 keyboard to provide a tuning function, a clear function (for removing transpositions, glide or wrong channel assignments) and to select any one of the three programs (while in one program it is possible to jump to either of the other two at the touch of a button). One nice feature of this is that you can jump to any of

the other programs with no noticable glitch, hence in the middle of a chord, you can jump to sequential assignment without the synthesizer going BRAAAAK (just shift the gears, don't worry about the clutch!).

Now that you know what it can do, let's see how to use it. If you look at the program you'll find that it is written to reside in page 1 of your computer. If those of you who are familiar with the operations of the 6502 have regained consciousness, let me assure you there's no problem here. Although page 1 is dedicated to the stack, the program conveniently puts the stack out of the way and, unless you make an error in loading the program, you won't have any problems. The reason I wrote it for page 1 is to make it applicable to those who don't have the expanded memory option for the 8700 (pages 2 and 3). If you have the extra memory, feel free to load the program into page 2 or 3, the only thing you have to change is the absolute address of subroutine CLEAR in the JSR instructions at ADDR 013D and 018A and the jump at 01B9. This will simplify things somewhat. If you have to load the program into page 1, be sure to set the user stack and the monitor stack far, far away before trying to load the program (either by hand or off cassette) by changing ADDR 00FE and 00ED (the user stack pointer and monitor stack pointer, respectively) to $FF. This places the stacks at the same location starting at the bottom of page 1. Once you have the program in, the first thing you should do is save it on cassette, cause if you did make a mistake, I can almost guarantee that the stack will take a bite (byte?) out of your program.

One thing I should mention is that the MUS-1 PROM is an absolute necessity for this program. It provides all of the housekeeping as well as the entire POLY routine. Actually, MUS-1 is the most important part of the system if you intend to write any software--it's well worth the price, but remember to watch out for it's zero page variables when you're writing software (that's why SHAZAM won't fit on page zero!).

Okay, the program's in (and ostensibly correct), let's run it. First be sure to set the MUS-1 operating parameters; the Control Word at 00E8 (use $40 to test for now), the QuASH settling delay at 00E9 (I use $20) and the number of voices you have at 00EA. Incidently, I'm assuming you have an entire synthesizer for each voice, which is what true polyphony is all about. If you're using a polytonic synthesizer (ie: multioscillator monophonic) these programs won't be realized to their fullest extent, but experiment anyway. Set each of your synthesizers to the same patch for testing purposes and run the program from 0100. SHAZAM starts up running POLY. This gives you the option of tuning your system--just touch key 1 on the 8700 keyboard and while holding it, tune your oscillators. You can now play with POLY if you want--in fact it's a good idea to check out each program thoroughly before going to the next. Press key 0 on the 8700 and see that everything is cleared (the system should also clear itself when you first start running the program). Begin playing POLY and be sure that it responds to the proper number of voices and that the channels are assigned correctly (the displays should also be counting). Check the transients if you want, by changing the control word. When you are satisfied that POLY is working correctly, press the "PCH" key on the 8700. The displays should stop counting and display the number of voices. Begin playing monophonically and see that everytime you play a key, it comes out a new channel. Turn up the final decay to see what CHORUS is all about. Note that when you play the same key a number of times in a row, it is still assigned to different channels, unlike POLY which specifically avoids this. This can be very effective in creating simulated echoes by rapidly pressing and releasing the same key (especially with glide on). As I stated before, CHORUS is monophonic and provides a low-note priority. Unlike some other low-note synthesizers, pressing a lower note while holding the previous note will not result in a slur, instead the new note will be articulated and upon release of the second note, the original note will be re-articulated. Hence fully articulated, sequencer-like trills can be produced by holding down a note and rapidly pressing and releasing a lower note. A strumming effect can be achieved by pressing down a number of notes at once and rapidly releasing them in sequential order from the lowest to the highest.

When you've tired of CHORUS (hopefully it should take a while) you can return to POLY by pressing "TAPE" on the 8700 keyboard, or you can jump to SPLITZ by pressing "PCL". Upon entering SPLITZ, the program is waiting for you to enter your split points, so don't start playing yet! You have to load a number of split points that is one less than the number of voices you specified. Actually, you don't have to worry about this, the program will only let you enter that many. You enter your split points by simply playing them on the keyboard, one at a time, from lowest to highest (the displays will keep track of how many you've loaded by counting down from the number of voices). Once you've entered the last one, the next note you play will start the main part of SPLITZ running and the note will be sounded from its appropriate channel. For example, suppose you have three voices specified (at 00EA), SPLITZ is waiting for you to enter two split points. You decide you want to split the keyboard at the Cs (this will provide three independent 1-octave keyboard sections, one for each of your three voices) so first you press the second C on the keyboard, which causes the displays to show 03 for the number of voices and enters that note as the first split point (ie: all notes below that point will be assigned to channel one). Now you release that note and press the third C on the keyboard, the display decrements and that note are entered as the second split point (ie: all notes below that point, up to and including the first split point, are assigned to channel two). The program will automatically assign any remaining keys to the highest available channel (ie: any note from the second split point on up, which on a three-octave keyboard will provide an octave for channel three). After releasing your second split point, the program is ready to run, and the next note you play will automatically be sounded from it's proper channel (ie: if you now pressed low F, it will be

sounded from channel one, as it is within the channel one split region).

Verify that you can play a note within a split section and that there is no interaction or improper channel assignments, no matter when you hit the note relative to other notes you are playing in the other split regions. I should point out that while there is no priority between split sections, within a split section high-note priority prevails, so if you hit more than one note within a single split section only the highest will be sounded and, unlike CHORUS, the articulation will be slurred (ie: the note won't retrigger). To fully realize the potential of SPLITZ, change the patches (and tuning if you desire) so they are different for each voice and see how easy it is to coordinate your bass and lead, etc. Something you should bear in mind is there is no reason why the voices should be in order, pitchwise. By using the oscillator tuning knob and/or the transposition capabilities of MUS-1, you can easily make the split points which are higher on the physical keyboard, lower in frequency than those split sections below. This could come in handy if you need to play a complex bass line with a simple melody and you have more finger facility in your right hand. You could also tune each split section the same, allowing you to play the same note or close chords on different channels. Another technique you shouldn't overlook is that, with each channel patched differently, a form of limited instant patch switching can be achieved by simply changing your playing from one split section to another. The limitation is that your range within any patch is limited by the size of the split section. Perhaps some of you software wizards out there can come up with an easy way to split the keyboard into separate polyphonic sections which would overcome the monophonic (within a single split section) limitations.

If at any time you want to change the split points while running SPLITZ, simply press the "ENT" key on the 8700 and the program will jump to the beginning and await entry of the new split points. I should warn you that you must release a split point before entering a new one (the program ignores you if you hold more than one key down during the split selection) and the points must be pressed in ascending order (if you don't press them in ascending order, during play, those improper split points will cause the associated channel to be ignored). If you make a mistake, just press "ENT" when the program is running and try again.

During the development of this program, I originally had the program sound the split points as they were played, however, this feature was rejected as undesirable for live performance. If you desire to have the points sounded, you must insert a new line of code STA (NTS), Y--91 99 between 0181 and 0182--in other words, you'll have to reassemble the whole program. Good luck.

MISCELLANEOUS:

Oh yeah, while running SPLITZ, the displays will count just like POLY. Once you've tired of SPLITZ, you can return to CHORUS by pressing "PCH" or POLY by pressing "TAPE". If you want to use less than the maximum channels that you have, just enter whatever number you want to use in 00EA, the program automatically compensates. Please note that, although NTABLE can maintain 16 voices, KTABLE will only keep track of eight keys, so don't try to use more than eight channels for either CHORUS or SPLITZ (or POLY unless STGs are selected). Also, CHORUS will always play the first key pressed from channel two. If the programs don't seem to be working, look at the zero page variables and see if you can pinpoint anything that isn't what it should be, then go back to the program near the point where something went wrong and check for bad bytes. If the whole program blows up when you run it, load it back off cassette and check it closely before running it (remember, watch out for that monitor stack!). If you need to use the breakpoint routine for debugging, you can replace the first three bytes of the program with the breakpoint vector, just remember to set the stack pointer to $FF (at ADDR 00FE) before running the program. If at any time you want to select glide or transpose a channel, stop the program (RESET) and load the desired transposition factor in the appropriate location in TTBL (00C0-00CF). For example, if you wanted to turn the glide on for the first two channels, load 00CF and 00CE with $80. Before running the program, set the status register at 00FF to 00 to assure that HEX addition will take place, then run the program from 0111 (this assumes that the program has been run at least once from the beginning and NTS is loaded with the proper value). If you forget and run the program from the start, INIT will clear TTBL and you'll have to start over. Likewise, if you press key 0 on the 8700 during POLY, TTBL will also be erased, which is an easy way to turn glide off.

For you programmers out there, I'd like to point out a little trick which simplified these programs immensely. It involves the use of indirect, indexed addressing and redefining the start of NTABLE with respect to the number of voices used. Normally a program would keep track of how many voices were filled by counting down from the number of voices specified. Upon reaching zero, we know that they are all done so we branch or something. Unfortunately, NTABLE (and therefore the output channels), are in descending order starting from 00DF to 00D0, so the voice counter cannot be used as a storage pointer to NTABLE. This means we need two loops, one counting down from the number of voices to zero, and one counting down from the top of NTABLE to be used as a pointer. This really gets messy when we have to keep track of those two numbers while jumping to subroutines that blow up the X, Y and A registers. Instead of using two loops, I simply redefined the start of NTABLE based on the number of voices by subtracting the number of voices from $DF (the highest position in NTABLE) and storing it in NTS (NTABLE Start). The rest of the program uses this reference for NTABLE via indirect addressing (which is why location NTS+1 must be set to 00).

NOTE: For those of you who want to retain split points while jumping back and forth between programs, simply change ADDR 0136 to $53 and ADDR 015B to $2E. This causes these instructions to become "BEQ PERF" instead of "BEQ SPLITZ". Now any time you jump to

the split program, it will immediately start running using the previously loaded split points. If you haven't loaded any yet, or if you wish to change the previous split points, just press "ENT".

CONCLUSION:

If you're wondering why I call this program version 0.1, it's simply because I have much bigger plans for the future. A fully polyphonic version of CHORUS is under development (well, it almost works) which will certainly become my favorite assignment algorithm as it combines all the best stuff of POLY with all the best stuff of CHORUS--and none of the limitations! If you think SHAZAM 0.1 is enough to satisfy you, just wait! Remember, the advantage of the 8700 is that you are free to produce any kind of bizarre algorithm you want, tailored to your specifications. I can think of some neat algorithms which SHAZAM doesn't even touch on. How about a channel assignment algorithm in which whatever channel the full keyboard is assigned to is determined by the 8700 keyboard. You could attach a number of differently patched synthesizers and switch patches instantly by selecting another channel, and this time you have a full keyboard (monophonic) to play with. Granted this is hardly cost effective compared to a true programmable synthesizer (like Oberheim's OB-1) but if you have the hardware already, it could be a nice change of pace from polyphonic playing! In the end, we intend to have all of these routines linkable so that, for example, a sequencer can be fed to the sequential assignment to give CHORUSing to a digital sequence. This could form a complex operating system similar in many respects to operating systems on big computer systems. What hath PAIA wrought?

SHAZAM 0.1

A Keyboard Operating System For The PAIA 8700 Computer

By: Bob Yannes

October 1978

```
ADDR   CODE        LABEL     INSTRUCTION      COMMENTS

0100   A2 FF                 LDX #$FF         GET THE STACK
0102   9A                    TXS              OUT OF THE WAY.
0103   A9 DF                 LDA #$DF         GET NTABLEMAX POSITION...
0105   38                    SEC              PREPARE TO SUBTRACT...
0106   E5 EA                 SBC OUTS         WELL, SUBTRACT THE NUMBER OF VOICES
0108   85 99                 STA NTS          THIS IS THE START OF NTABLE NOW.
010A   A9 00                 LDA #0           ASSURE ADDR HIGH IS ZERO (PAGE)
010C   85 9A                 STA NTS+1        FOR USE AS INDIRECT ADDR.
010E   20 21 0D     OPTN      JSR INIT         WIPE'EM OUT!
0111   20 71 0D     PLOOP     JSR POLY         ASSIGN NOTES ACCORDING TO POLY.
0114   20 C3 0D               JSR TRNGN        DO TRANSIENTS IF SELECTED.
0117   20 2B 0D               JSR NOTE         PLAY THE NOTES.
011A   A5 BF                 LDA CLK          BELLS AND
011C   8D 20 08               STA DISPLAY      WHISTLES.
011F   20 00 0F               JSR DECODE       SCAN 8700 KYBD.
0122   C9 01                 CMP #1           IS IT TUNE?
0124   90 E8                 BCC OPTN         NO, IT'S LESS--MUST BE CLEAR.
0126   D0 07                 BNE MORE         NO, GO SEE WHAT IT WAS.
0128   A0 5C                 LDY #2nd C       YES, GET NOTE TO TUNE WITH...
012A   20 52 0D               JSR FILL         PUT IN ALL CHANNELS...
012D   F0 E2                 BEQ PLOOP        AND PLAY IT.
012F   C9 14        MORE      CMP #"PCH"       IS IT PCH?
0131   F0 06                 BEQ CHORUS       YES, GO TO CHORUS,
0133   C9 15                 CMP #"PCL"       OKAY, THEN IS IT PCL?
0135*  F0 32                 BEQ SPLITZ       YES, GO TO SPLITZ.
0137   D0 D8                 BNE PLOOP        NO, TWAS NONE OF THEM, KEEP ON POLY.

0139   A5 EA        CHORUS    LDA OUTS         GET THE NUMBER OF AVAILABLE VOICES.
013B   85 98                 STA COUNT        USE AS COUNTER/POINTER.
013D   20 BC 01     IN        JSR CLEAR        TURN OFF ALL GATES.
0140   A5 E7                 LDA KTBLMAX      GET LOWEST NOTE.
0142   F0 0C                 BEQ OUT          IF ZERO, SKIP ASSIGNMENT.
0144   C5 97                 CMP OLDKEY       IS IT THE SAME KEY YOU JUST HAD?
0146   F0 04                 BEQ SAME         YES, KEEP OLD CHANNEL ASSIGNMENT.
0148   C6 98                 DEC COUNT        NO, GET NEW CHANNEL ASSIGNMENT.
014A   F0 04                 BEQ OUT          IF ZERO, SKIP ASSIGNMENT.
014C   A4 98        SAME      LDY COUNT        GET POINTER.
```

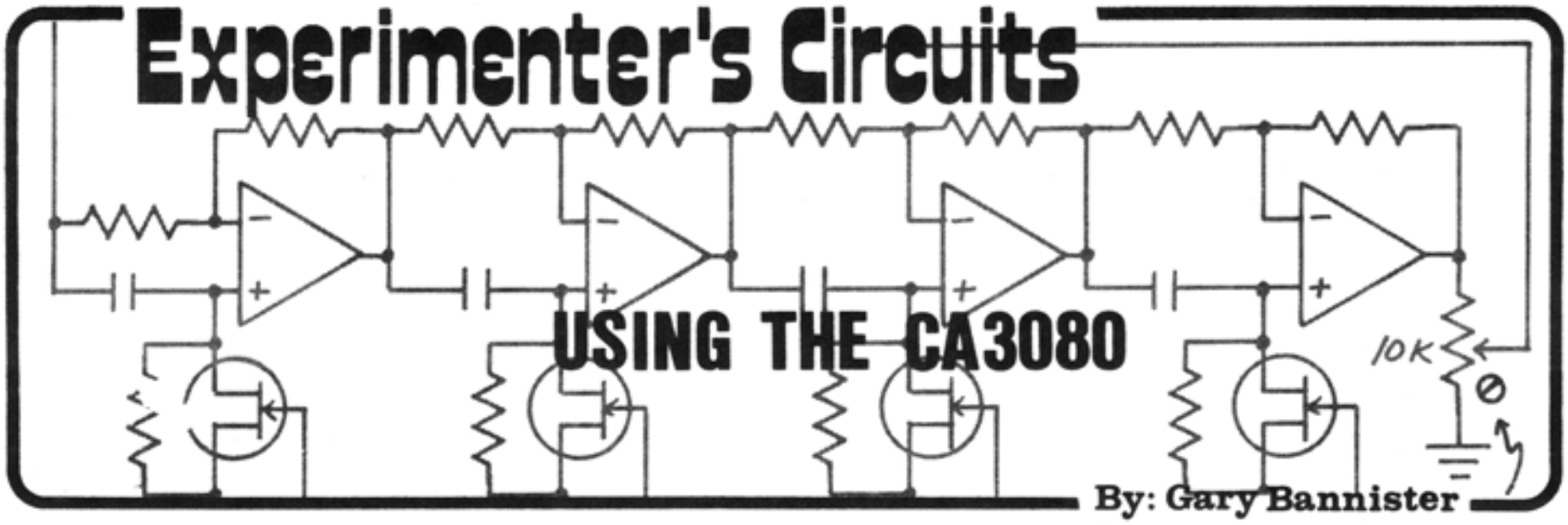
```
014E    91 99          STA (NTS), Y    ASSIGN VOICE TO CHANNEL Y.
0150    85 97    OUT   STA OLDKEY      ALSO, STORE IT FOR LATER.
0152    20 2B 0D       JSR NOTE        PLAY THE NOTE.
0155    20 00 0F       JSR DECODE      SCAN 8700 KYBD.
0158    C9 15          CMP #"PCL"      IS IT PCL?
015A*   F0 0D          BEQ SPLITZ      YES, GO TO SPLITZ.
015C    C9 16          CMP #"TAPE"     IS IT TAPE?
015E    F0 B1          BEQ PLOOP       YES, GO TO POLY.
0160    A5 98          LDA COUNT       GET COUNT.
0162    F0 D5          BEQ CHORUS      IF ZERO, START OVER.
0164    8D 20 08       STA DISPLAY     IF NOT, GIVE US A LOOK...
0167    D0 D4          BNE IN          AND KEEP ON CHORUS.
0169    A5 EA    SPLITZ LDA OUTS       GET THE NUMBER OF AVAILABLE VOICES.
016B    85 98          STA COUNT       USE AS COUNTER/POINTER.
016D    85 97    SELECT STA OLDKEY     STORE THE PRESENT NOTE FOR LATER.
016F    20 2B 0D       JSR NOTE        REFRESH QUASH AND LOAD KTABLE.
0172    A5 E7          LDA KTBLMAX     GET LOWEST NOTE.
0174    F0 F7          BEQ SELECT      IF ZERO, TRY AGAIN.
0176    A4 97          LDY OLDKEY      GET LAST NOTE.
0178    D0 F3          BNE SELECT      IF NOT ZERO, YOU'RE STILL HOLDING IT.
017A    A4 98          LDY COUNT       IT'S A NEW NOTE--GET COUNTER/POINTER.
017C    8C 20 08       STY DISPLAY     SHOW THE COUNT.
017F    99 9A 00       STA SPLIT, Y    STORE THE NOTE AS SPLIT POINT Y.
0182    C6 98          DEC COUNT       NEXT SPLIT POINT.
0184    D0 E7          BNE SELECT      GO BACK UNTIL ALL SPLIT POINTS ARE IN.
0186    A9 FF          LDA #$FF        DUMMY SPLIT POINT...
0188    85 9B          STA SPLITMIN    STORED AT END OF TABLE.
018A    20 BC 01 PERF  JSR CLEAR       ALL SPLITS ARE IN, TURN OFF ALL GATES.
018D    A2 08          LX #8           PREPARE TO TEST KTABLE.
018F    B5 DF    NXTNOT LDA KTBL, X    GET NOTE X FROM IT.
0191    F0 0C          BEQ NXT2        IF ZERO, DO NEXT.
0193    A4 EA          LDY OUTS        GET COUNTER/POINTER.
0195    D9 9A 00 NXTO  CMP SPLIT, Y    COMPARE NOTE TO SPLIT POINT Y.
0198    90 03          BCC NXT1        IF LESS THAN, GO ASSIGN IT.
019A    88             DEY             NEXT SPLIT POINT.
019B    D0 F8          BNE NXTO        KEEP ON UNTIL YOU'VE CHECKED ALL.
019D    91 99    NXT1  STA (NTS), Y    ASSIGN NOTE TO CHANNEL Y.
019F    CA       NXT2  DEX             NEXT KEYBOARD ENTRY.
01A0    D0 ED          BNE NXTNOT      KEEP ON UNTIL ALL KEYBOARD DONE.
01A2    20 2B 0D       JSR NOTE        PLAY THE NOTES.
01A5    A5 BF          LDA CLK         MORE BELLS AND
01A7    8D 20 08       STA DISPLAY     WHISTLES.
01AA    20 00 0F       JSR DECODE      SCAN 8700 KYBD.
01AD    C9 14          CMP #"PCH"      IS IT PCH?
01AF    F0 88          BEQ CHORUS      YES, GO TO CHORUS.
01B1    C9 13          CMP #"ENT"      IS IT ENT?
01B3    F0 B4          BEQ SPLITZ      YES, GO GET NEW SPLIT POINTS.
01B5    C9 16          CMP #"TAPE"     IS IT TAPE?
01B7    D0 D1          BNE PERF        NO, KEEP ON PLAYING SPLITZ.
01B9    4C 11 01       JMP PLOOP       YES, GO TO POLY.

01BC    A4 EA    CLEAR LDY OUTS        GET POINTER/COUNTER.
01BE    B1 99    NANO  LDA (NTS), Y    GET NOTE BEING PLAYED ON CHANNEL Y.
01C0    29 3F          AND #$3F        TURN OFF ITS GATE...
01C2    91 99          STA (NTS), Y    AND PUT IT BACK.
01C4    88             DEY             NEXT CHANNEL.
01C5    D0 F7          BNE NANO        GO BACK UNTIL DONE.
01C7    60             RTS             RETURN.
```

LOCATION	NAME	PURPOSE
0097	OLDKEY	CONTAINS PREVIOUS NOTE FOR COMPARISON W/NEW NOTE.
0098	COUNT	VOICE COUNTER/POINTER.
0099	NTS	START OF NTABLE FOR GIVEN NUMBER OF VOICES.
009A	NTS+1	(=0) SPECIFIES ZERO PAGE FOR INDIRECT ADDRESS.
009B	SPLITMIN	DUMMY SPLIT POINT, ASSURES HIGHEST NOTE ASSIGNED TO LAST CHANNEL.
009C-00A2	SPLIT	TABLE OF SPLIT POINTS.

*See text.

Experimenter's Circuits

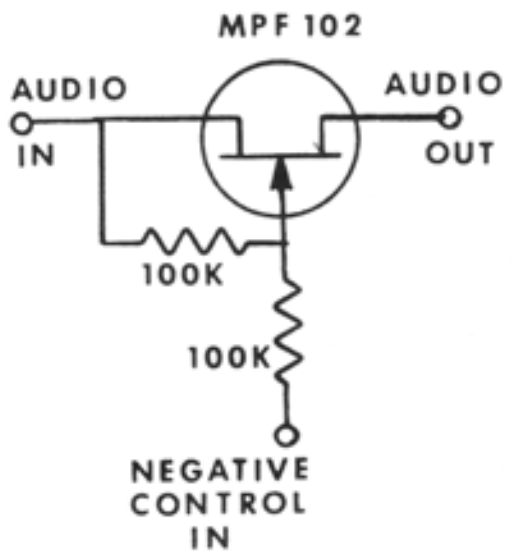


USING THE CA3080

By: Gary Bannister

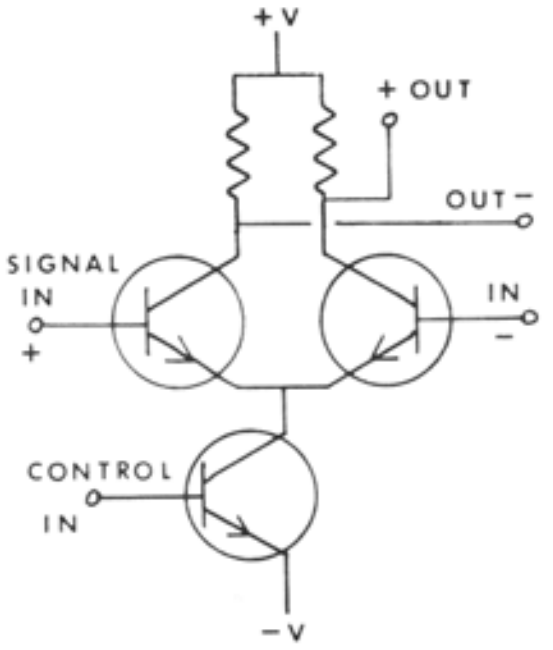
The whole secret of the synthesizer is its ability to produce a given result for a given set of voltage inputs. This ability is called voltage control. The question is how do we go about producing voltage control?

There must be as many different ideas on voltage control as there are synthesizers. Some units use Field Effect Transistors (FET) as voltage controlled resistors. The technique is rather simple, but lends itself well to non-critical applications such as phase shifters (see POLYPHONY, Vol. 3, #4) and non-tracking filters. The technique is so simple it bears inclusion here, although this article isn't really intended to discuss FETs.



Note that the control voltage must be negative. This will require a simple inverter on the input. Certainly this is not complete, but will have to do for the time being.

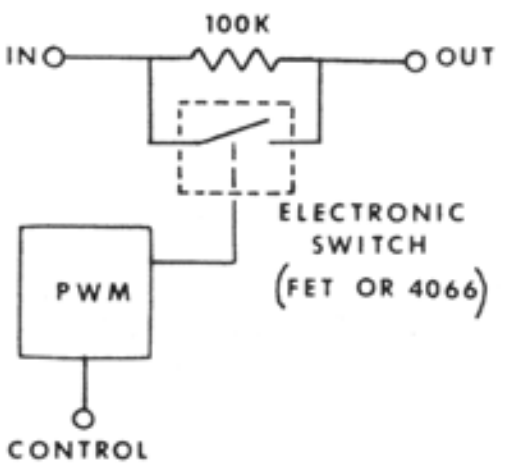
Another approach is the differential amplifier route. We've all seen this in VCAs from various manufacturers:



You'll find that you can't totally fault this approach, either. The differential amplifier is the basis for most of the op-amps available. Grab a Linear Data Book and see! In addition, it has served Bob Moog for many years, being the very heart and soul of his equipment.

The list grows. If you have a PAIA 4710, you know how it may be used as a VCA. You may already be getting ideas about how it may be used in other areas as well.

One company has even made a success of the high-speed, pulse width modulated switch.



This uses a high-frequency oscillator (50K Hz to 100K Hz) and a pulse width modulator. If you think of the switch as always open, the resistance is 100K ohm. If you think the switch is always closed, the resistance is 0 ohm (shorted out). If the switch is on 50% of the time (50% duty cycle) the resistance is 50K ohm, etc., etc.,...

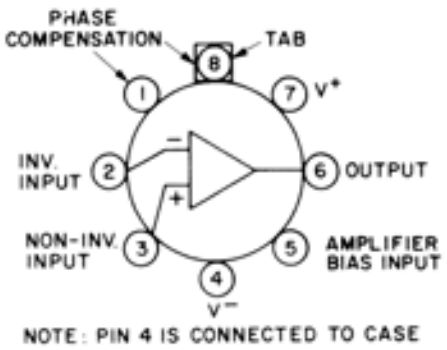
There is one IC available that really suits our purposes to a "T". It is the CA3080 Operational Transconductance Amplifier (OTA for short, thank heavens). Those of you with 4730 filters should recognize it immediately. What you may not recognize is its extreme versatility.

Before we get too heavy into building something, we should know something about how the 3080 behaves. When properly used it can be invaluable. When improperly used it can be a source of terrible distortion.

The following is a pinout diagram of the 3080. Hopefully this will allow you to at least get the pins hooked up right!

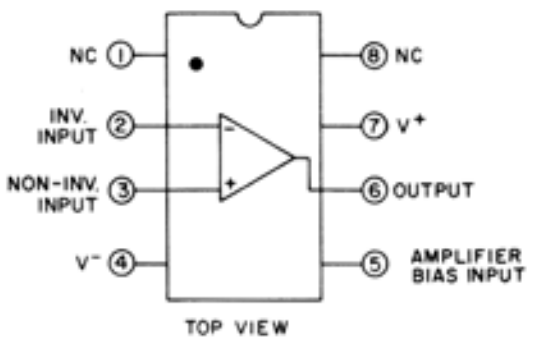
At first look it seems to resemble a common LM301 or LM748. Indeed, the pinouts are the same.

Well, almost. Notice pin 5 the "IABC" terminal. This is the secret. "I" is the most universal symbol for current. ABC is Amplifier Bias Current. The relationship between IABC and output is simple: With NO current there is no output. As the current increases, so does the output. Very simply, what we have is a resistor that responds to changes in current. Voltage to current is a simple trick, so with some minor changes, we can easily come up with a VOLTAGE CONTROLLED RESISTOR. HOORAY!!!



NOTE: PIN 4 IS CONNECTED TO CASE

TO-5 Style Package



TOP VIEW

Plastic Package (CA3080E)

But not so fast. The 3080 is easily misused. We can not simply plug in an input, stick on a control voltage, and expect it to work. There are certain rules to follow.

1) The input voltage on pin 2 or 3 cannot exceed 100 millivolts. There seems to be some confusion on this by the way. Some sources recommend no more than 10 mv, others up to 200 mv. My experience has been that 100 mv won't hurt.

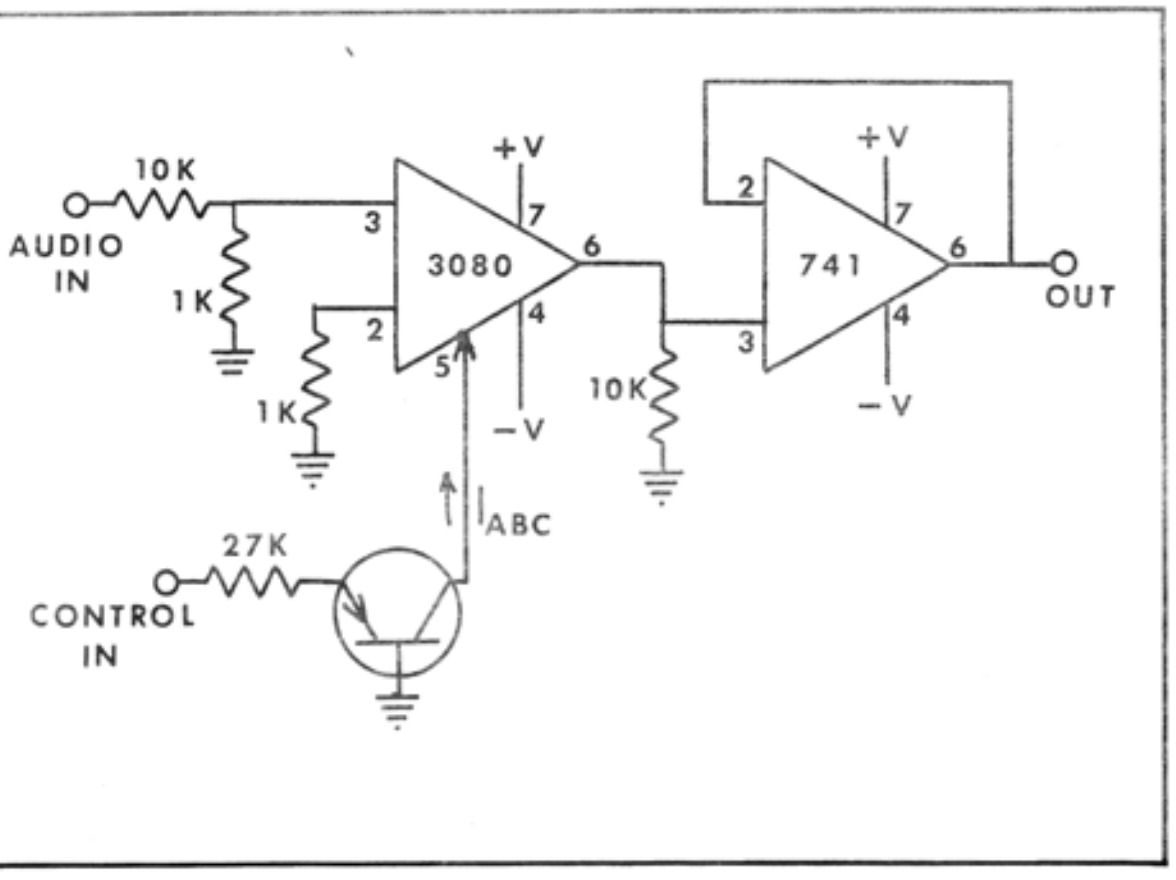
2) The IABC must be limited in some way. This means a resistor in series with pin 5.

3) The output is a high impedance current, quite a change from the low impedance regular op-amp. Care must be taken not to load down the output. Incidentally, the spec sheets claim that the output can sustain an indefinite short to either supply voltage or ground. This is fortunate for all of us butter fingers!

Keeping these in mind, we're going to try to use this thing! Let's try to get something useful before we go.

This is a SIMPLE VCA. Nothing fancy, just something to get you going with the CA3080. The 10K and 1K resistors on pin 3 divide to signal to the required 100 mv. The resistor on pin 2 is to balance the resistor on pin 3 (logical, huh?). The 10K resistor on the output is a load resistor since the output is a current, not a voltage. The 741 is a follower circuit to give the desired low output impedance. It may be a compensated 748 or 301 as well.

Remember, this is only a SIMPLE circuit. It may or may not have a unity gain output (1 volt in equals 1 volt out), and it will probably thump. No problem. Play with this for mow, and we'll get to an advanced version in a future column.



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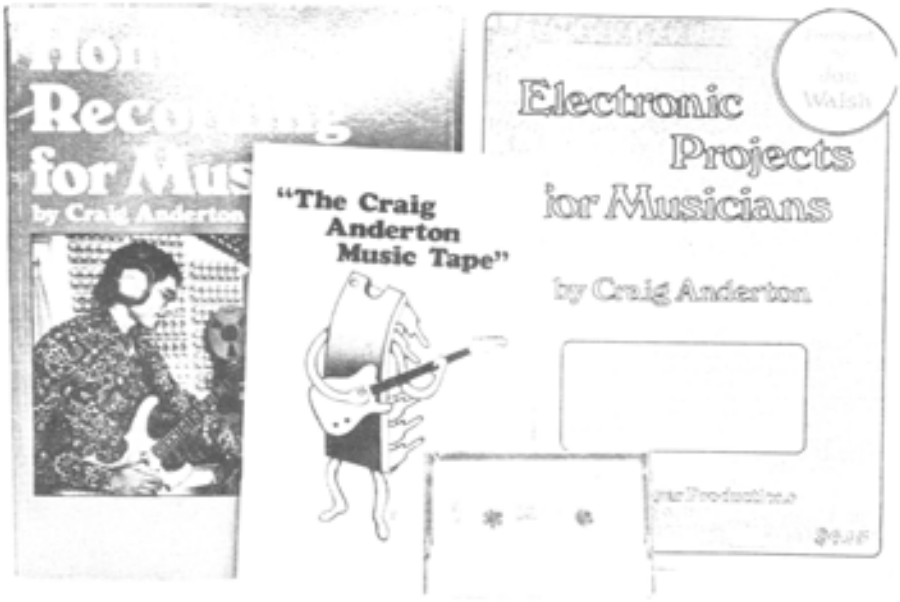

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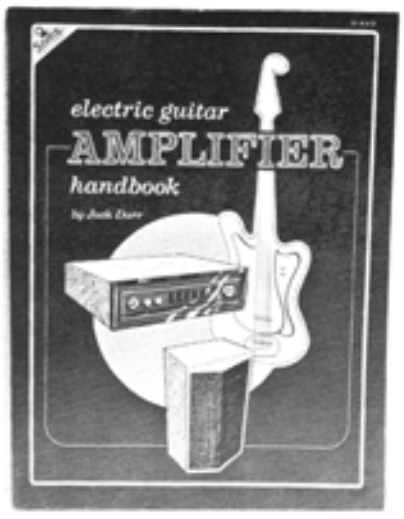

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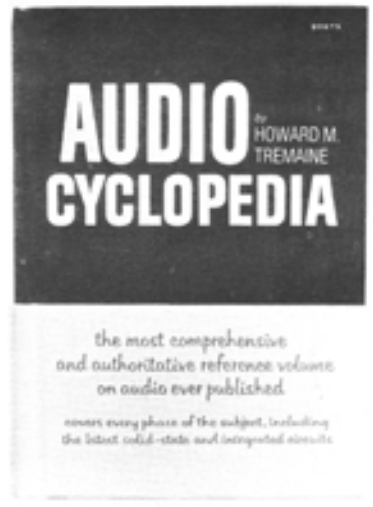

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THE SOHLER KEYBOARD

By: Mel Sohler

Let me introduce and explain a new and simplified musical keyboard called "The Sohler Keyboard". Its design offers the musician a logical and practical means of playing a keyboard instrument and has many advantages over the conventional AGO keyboard. See Figure 1.

The Sohler Keyboard is a rearrangement of all the keys into a symmetrical order and where each octave contains four groups of three keys. Each three-key group consists of two flat keys (similar to conventional white keys), and one raised key situated between the two flat keys. Since the entire keyboard is composed of continuous three-key groups the flat key note "C" in each octave is colored or marked for reference. The basic design of the Sohler Keyboard is shown in Figure 2. The design of Figure 1 however, improves the playing convenience by having the addition of a second auxiliary set of raised keys located adjacent to the backboard and coupled to the primary front set of raised keys. The length of the octave span is essentially the same as the conventional keyboard (approx. 6-1/2 inches), as well as the front to back dimension (about 5-1/2 inches), thus it is easily adaptable to existing keyboard instruments, fitting exactly into the keyboard space area formerly occupied by the conventional keyboard.

The symmetry of the Sohler Keyboard lends itself to "repeating patterns" which is one of its main features. This allows for easy interchangability of chord patterns and scales thus enabling the musician to easily "get around" the keys (transposing, modulating, improvising). For example, all twelve major scales can be played with only three memorized patterns. Likewise, three patterns will get you all twelve major triads. Figure 3 shows this repeating effect for one of the major triad patterns. This same principle applies to any scale or chord. This concept, which might be dubbed "pattern thinking" is emphasized by the Sohler Keyboard.

Another feature is that the full width of each flat (white) key is available in front of, and directly behind the main row of raised keys. This availability of flat key surface area optimizes the playability, while utilizing the keyboard area to its maximum potential.

Music in the Western part of the world divides the musical octave into twelve different notes, known as the well tempered, or chromatic scale. The conventional keyboard does not have these twelve notes within an octave arranged into a symmetrical form. Instead it uses seven of the twelve notes

(derived by the formula for a major scale), and lays them out in successive octaves, which forms and comprises the white keys of the keyboard, and are known as the diatonic or C major scale. The five remaining notes left in the chromatic scale are the black keys and are known as the sharps and flats to the basic diatonic scale, and forms the pentatonic scale. A chord or scale may be built on each of these twelve notes, but because of the keyboard's irregular arrangement it is necessary to learn a different chord hand shape and scale fingering pattern for each key.

Figure 4 shows how the Sohler Keyboard and the conventional keyboard compare. Looking at the Sohler Keyboard, notice that within an octave between two C's will be found four raised keys (instead of five), which forms the diminished chord. In a sense the space of one black key was moved into the white key section which causes the width of the flat keys to be slightly narrower, but still within normal finger capability. In addition, the rearrangement necessitated the change of some former black keys into white key notes, and some white keys into up-raised keys. Thus E and G are now raised keys, while D#, F#, and G# have become flat (white) keys. As mentioned earlier, each raised key note has two sections with which to depress the lever action to sound the tone; the main front row and the shortened auxiliary rear row. Having the double row of raised keys permits a more natural hand shape to be assumed in the playing of any chord or passage. This makes it unnecessary to double the fingers under to play the main row of raised key in some chord or melodic run configurations.

The way in which the symmetry is manifested in the Sohler Keyboard is significant. Its design is based around the diminished 7th chord, and the diminished scale. The raised keys alone (a continuum of minor thirds), produce the diminished 7th chord, which for purposes of modulation, is unmatched by any other chord for versatility. In Jazz and Rock the diminished 7th chord is very often manifested in the Dominant 7th chord. They're the same except that in the Dominant 7th the root of the chord is lowered a half step. As

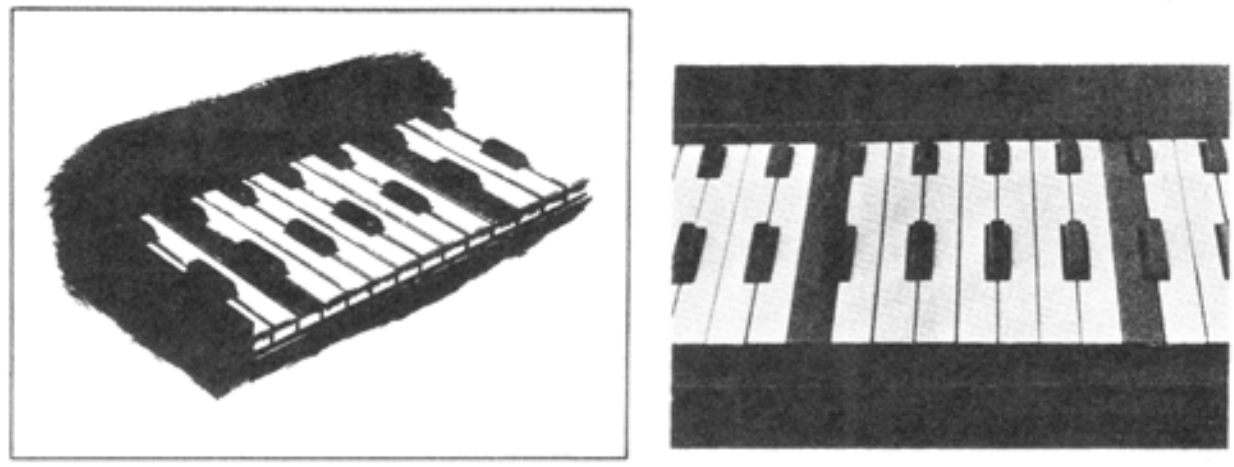
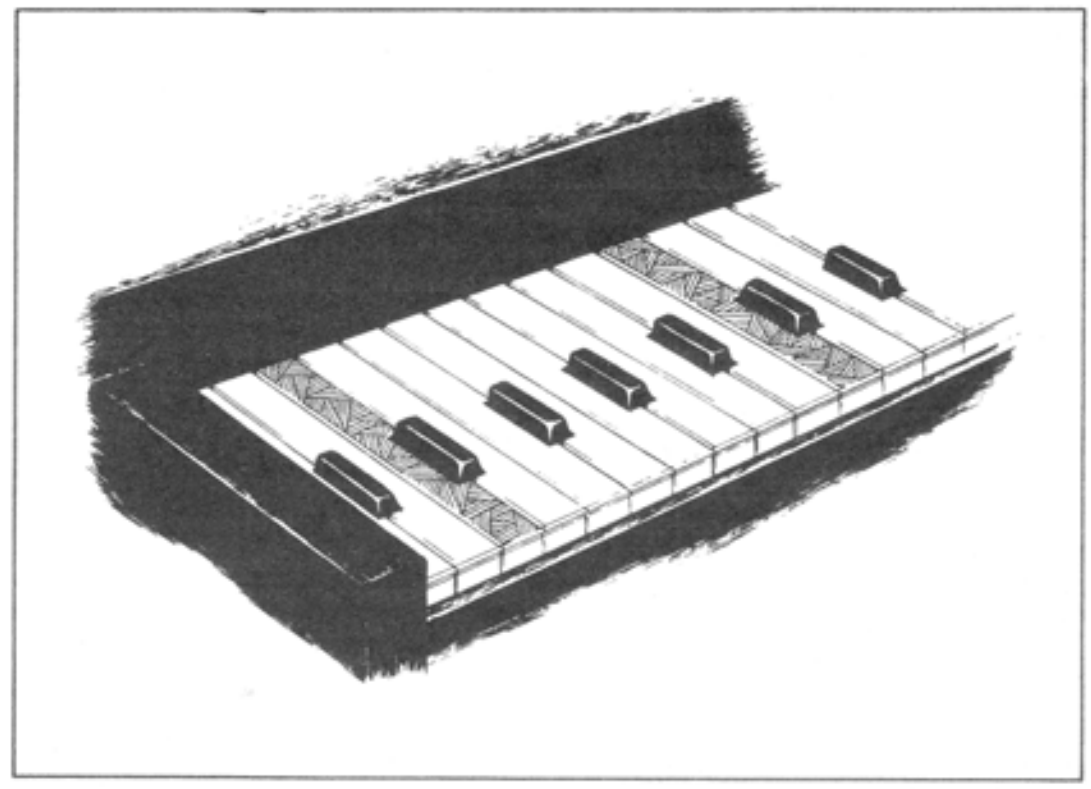


Figure 1



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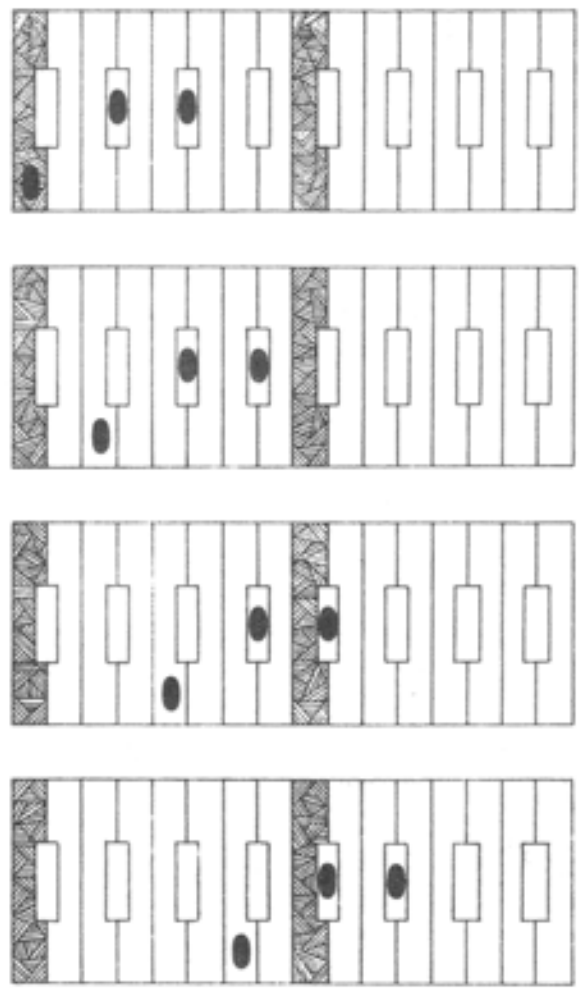

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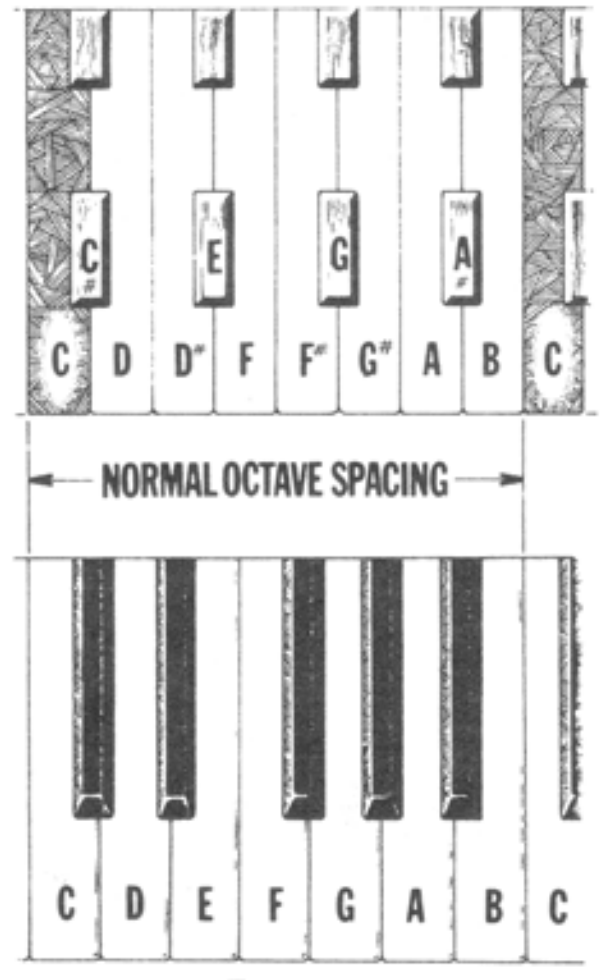

Figure 4

an illustration of this principle -- depress and sound the four raised keys beginning with C#, then lower the C# one half step to C. A C7th chord is thus easily produced. In classical music the diminished 7th is seen not only as an extension of the Dominant 7th, but also as a very flexible modulating chord. The lower white key section, which alternates between whole and half steps, forms the diminished scale which is also extensively used in classical music and jazz improvisation. (See Tom Coster's Rock Techniues column in the 1978 Sept. and Oct. issues of Contemporary Keyboard Magazine for some very comprehensive information on the use of diminished scales in jazz-rock). The keys, being arranged and accessable in this manner, might be looked at and thought of as a different type of tuning, similar to the way a guitarist tunes his guitar to an open chord. This design permits the opportunity for the keyboardist to use a very logical and harmonically based alternate grouping of keys and fingering patterns. As an alternate controller for electronic music systems it is ideal.

The Sohler Keyboard, not being based on the C major scale, uses another method of notation which simplifies sight reading and the identification of notes. It eliminates the need for sharp and flat symbols since there is a designated place on the staff for every note. Also, there is a distinct visual and physical relationship between this system of notation and the keyboard itself.

The Sohler System of Notation uses a basic four line staff on which a complete chromatic scale is represented. An exaggerated diagram of this is shown in Figure 5. The four lines represent directly, the four raised keys located within an octave between two Cs. A note on a line always designates a raised key, thus a note on the first line represents the first raised key; a note on the second line represents the second raised key, and so on. The flat key notes between the raised keys are notated in the spaces between lines on the staff. The lines are spaced substantially further apart than the height of a note symbol, so that the note can be placed against the upper, or lower line of a pair, with a clear separation from the other line. A note against the underside of a line designates the flat key immediately below (in scale), the raised key which is identified by that line. Similarly, a note resting on top of a line designates the flat key immediately above the raised key identified by that line. For convenience the actual music is written on a double four-line staff in each clef to encompass two octaves and avoid an excess of separate notes and lines (ledger lines), outside the basic staff. In the double staff, the first and fifth lines from the bottom are made heavier for visual reference, or a color line may be added on or below these lines for visisbility. The bass clef is identical to the treble clef, thus no rememorization of space and line notes is necessary. Figure 6 shows the complete staff and its relation to the keyboard. It can be seen that every note on a line of the staff represents a raised key and that there are two notes between each pair of lines to designate the flat keys. This notation is consistent throughout the keyboard and the written music so there can be no confusion as to the identity of notes. It is not necessary to know the name of the note in order to know where it is on the keyboard. In sight reading a piece of music, particularly by an inexperienced player, this has been found to be very helpful in clarifying note identification.

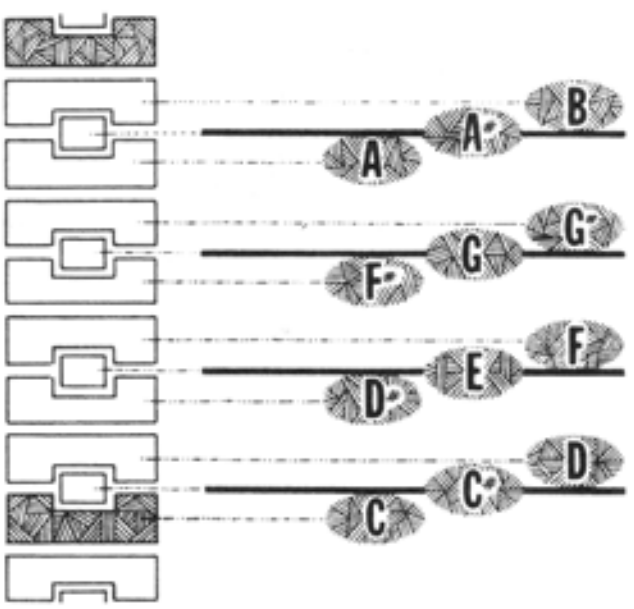

Figure 5

The creative and innovative musician will find the Sohler Keyboard is just the tool he has been looking, and waiting for. It offers the aspiring musician a quicker and easier route to mastering the keyboard, and it provides the accomplished musician with a means for fully exercising the manual dexterity needed for the rendition of the most complex musical compositions. It is a superior design employing all the good features the conventional keyboard has to offer, plus the aforementioned advantages. Where before, only the most accomplished keyboardist could

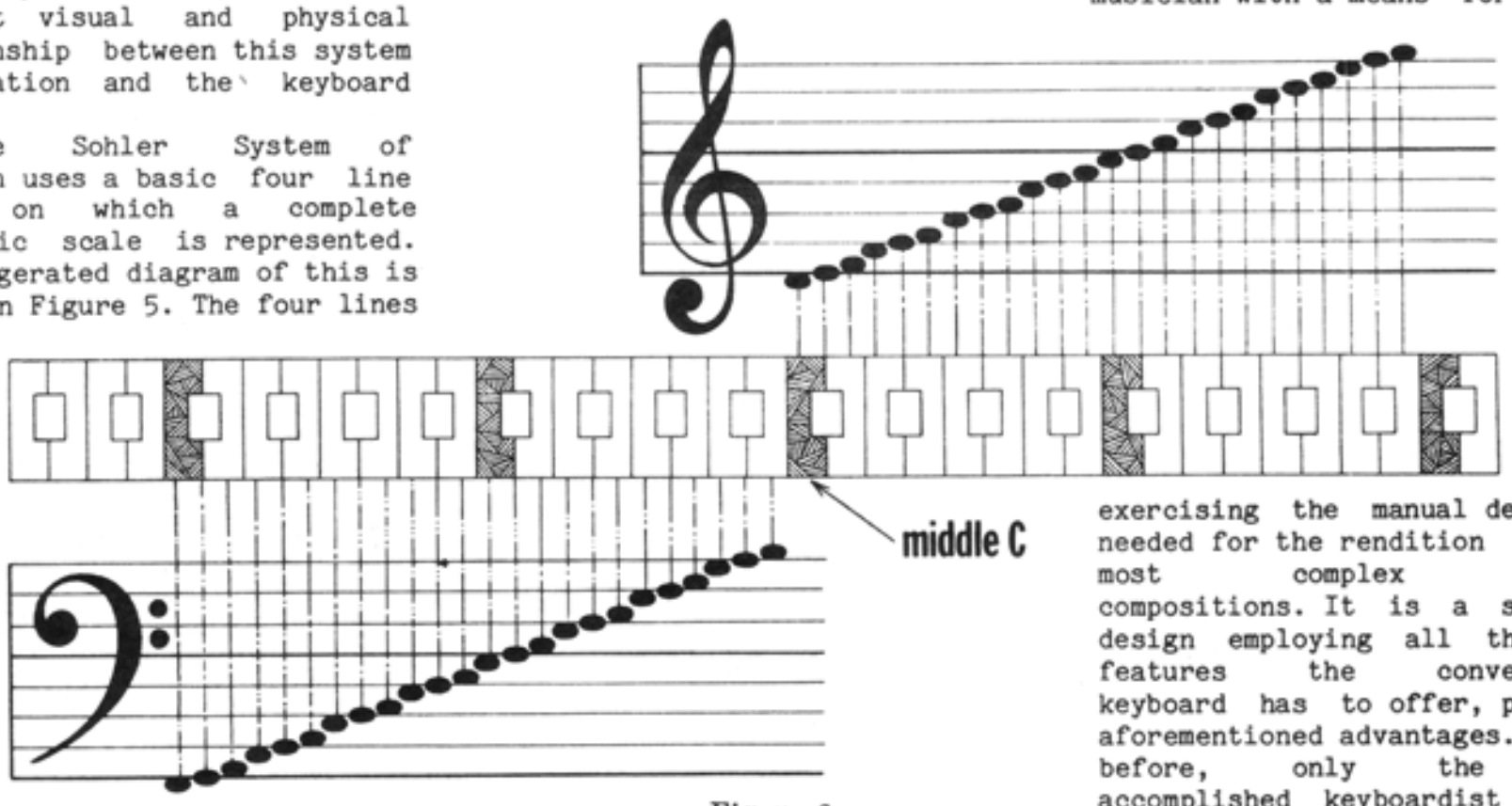

Figure 6

keep up with the chord changes and transposition of difficult melodies, as in a rock group or band, now it will be the guitarists and other instrumentalists who will lag behind the keyboardist in his ability to change key signatures easily and at will.

Those who are willing to experiment, change, and take a chance with new innovations and ideas such as this one will be among the first to benefit by them. To be sure, the Sohler Keyboard is a revolutionary idea, bucking against an established keyboard and notation system that has been around for several hundred years. I am convinced however that many people will see the merits and benefits of my keyboard, and will use it. Those are the ones who I'm trying to reach.

I should mention that I have obtained a U. S. Patent and a British Patent on the Sohler Keyboard and Notation System -- #4,054,079. Also, I have built four working models of it, three on upright pianos, and the fourth on a portable electric piano. The models required only that the keyboard section alone be changed, leaving the linkage, strings, hammers, etc., or the electronic guts, unchanged.

Besides myself, two of my friends who each have one of the models, have told me how easy it has been for them to learn and play it, and that not only has their understanding and grasp of music theory been accelerated, but also their understanding and grasp of the conventional keyboard as well! In addition, other musicians I've showed it to have expressed their keen desire to obtain a model of it.

I am searching for a manufacturer who would like to market the Sohler Keyboard, however, I will make it available myself if necessary.

I welcome all letters and correspondence from manufacturers and individuals who are interested in it, and I especially welcome inquiries from individuals wishing to experiment with, or obtain the Sohler Keyboard, as the more inquiries I receive, the sooner it will be possible for it to become available. Please write to: Mel Sohler, P. O. Box 32, Pinos Altos, New Mexico, 88053. ●

LETTERS:

....continued from page 12

EXISTING INDEPENDENT LABELS

There are several independent labels; however, they seldom pool their efforts in creating a unified front (there are some noticeable exceptions I know of in the Bay Area), and operate at a relative distance from each other. I feel a better way is to combine electronic musicians of all persuasions under one company, so that listeners can have a rich library of possibilities to choose from. This will also allow people to expand their tastes -- rock fans

continued on page 38....

Lab Notes

Blessed are the SEQUE.

By: John S. Simonton, Jr.

Last time, we looked at the live performance features of SEQUE 1.0. Now we turn our attention to the studio-oriented options offered by this "universal" monotonic sequencer program.

Some of the distinctions between stage and studio use are somewhat arbitrary.

For example:

EVENT PROGRAM

The real-time SCORE melody programming mode that we examined in this first section of this piece can obviously be used in a recording studio as well as it can on stage, providing that you're interested in recording only those things that are within the limits of your physical abilities. But the real promise of a small studio (or a big one, for that matter) is that it allows us to produce music that we don't have the chops to do in real time. After all, not everyone has the hours per day that it takes to gain physical mastery of a keyboard - but that doesn't mean that we don't have valid musical ideas, only that we need a little help in expressing them.

If a recording studio is a single thing, it's a time machine that allows days or weeks of work to be compressed into a few minutes of music. One of the programming modes that we have available (EVENT) is specifically designed to operate in this type of time-compression environment. In this mode we enter the music not so much as a melody, but as a series of notes and rests. A series of events which, when reproduced by the computer, turn out to be a melody (maybe).

There is of course nothing new about this mode of operation, this is the way sequencers have always worked. About the only new part is that instead of entering the events as positions of a knob or a series of numbers, we have an AGO keyboard on which to program.

Touching the command keyboard's PROGRAM EVENT pad puts us in this programming mode. (See Figure 1.) Melody lines are entered much as they were with the SCORE mode, except that the computer is no longer watching for how long we hold a key down or how rapidly the notes are played. It is now only interested in whether a key is up or down.

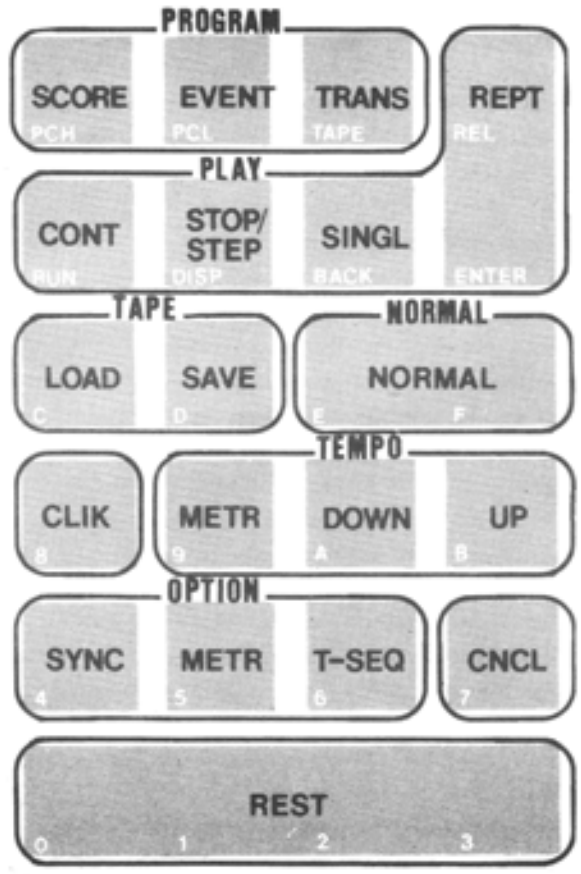

Figure 1

One of the major implications of this is that notes in the melody are "jammed" together in time, and on playback will come out exactly equally spaced, one note per beat. While this is OK in some cases, as a general rule it is unacceptable; because it is unacceptable, we have a REST pad on the command keyboard. The REST pad provides for syncopation. It is a means of "extending" an event so that it takes more than a single beat.

If you're familiar with the operation of the rest key on something like PAIA's Programmable Drum Set, you already have a good idea what's going on, but there still are some surprises here.

Your first thought may be that when you press and release a key on the AGO keyboard, that constitutes an event. Actually, it's two events as far as SEQUE 1.0 is concerned - the first when the key was pressed and the next when it was released. It's important to keep in mind that the REST pad can extend either of these events.

For example, this simple phrase:

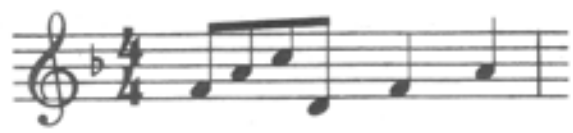

Figure 2

would be entered from the keyboard by pressing F and releasing, press A and release, press C, release, press D, release, press F and while holding the F key down, hit the REST block on the keypad, release the F key, tap the REST block, play A, touch the rest block before letting up the A key, release the key, and hit the rest block once more. The measure is now completely entered, and may be played by using the REPEAT or SINGLE keys as described last time. Note particularly that on the fifth note (the second F)

where we wanted to extend the note to a full beat, the REST pad had to be touched twice; once to extend the "key down" event and again to extend the "key up" event.

At first, having to enter two RESTs when we actually want to extend a note for a single beat may seem a pain in the neck (undeniably, it is) but the slight inconvenience buys us a number of things. For example, the ability to slur notes.

In the above example, the D could have been slurred into the F by first touching the REST pad before releasing the D key. This will lengthen the note to occupy the time normally used when the key is released. Then press the F key before releasing the D. This will cause the D to be entered in the next time slot without any articulation (triggering). Now, while holding the F key, touch the REST pad to lengthen it to a quarter note as covered earlier. After releasing the key, enter the additional REST required and proceed as usual.

Having each REST pad activation correspond to a "half" event (kind of) also allows us to produce dotted notes as the exceptions that they are rather than having to make specific tempo provisions for them which must be carried over to all notes in the sequence.

It is also possible to generate articulation changes whenever a note is extended beyond a basic "dual" event. If, for example, you are generating a series of notes where each note uses a key depression plus a REST and a key release plus a REST (four events), these notes can be performed in three different manners. If entered as listed above, the note has equal time allotted for note performance and release. For a staccato style, the note could be entered with a key depression, release, and then two RESTs. For legato styles, the two RESTs could be entered while the key is held down, yielding three "on" events and one "off" event. Each of the above would occupy the same execution time during playback, but would reflect the different articulation styles.

Once the melody is in the computer's memory, it makes no difference whether it got there with SCORE or EVENT programming modes as far as the playback and options are concerned. All of these features (real time or programmed transpositions, single or repeat play, tempo up and down, and tape saves or loads, etc.) work the same.

CLICK TRACK SYNCH

Even more powerful in the studio than the EVENT programming mode are the features added by two other command pads; CLIK and (in the option box) SYNC. These provide a means of synchronizing multiple tracks of sequencer operation.

Once you start using a sequencer for recording, you begin to find more and more places where it can be used to relieve a lot of tedium. The problem in the past has been that it is, for all practical purposes, impossible to manually synchronize a sequencer to a track that's already on tape. Even slight differences in tempo soon build up to an intolerable variation in when a note is supposed to happen and when it actually does happen. Maybe there are people who could manually twiddle a tempo knob and keep things locked together, but that's a hassle.

Most of us are familiar with the classical "click track" approach in which a metronome-like "tick" is recorded on one track of a tape so live musicians can easily maintain the tempo of the original work in over-dubs. Our CLIK and SYNC command pads are simply this old concept extended into the realm of automation.

Touching the CLIK pad causes SEQUE 1.0 to begin producing a very rapid series of "clicks" that are machine readable and represent a standard clock rate which the SYNC option can read and synchronize to. The click appears at the normal cassette output jack (where programs, etc., that are to be saved to tape come from) and when using this option, this output is tied to one of the channels of the tape recorder on which you're recording your audio tracks.

To use the click track option, the tape that you will be recording and mixing your audio onto must always be prepared first; you can't record a lead part and then come back and lay down the click, it won't work like that. Before doing anything else, connect the 8700's cassette output to the input of one track of your recorder, start the tape rolling in record mode, and after allowing a comfortable quiet leader, punch the CLIK pad. Allow the tape to run much longer than you think you'll ever need for what you're going to be recording, one thing you don't want to do is run out of click in the middle of things.

Synchronizing to the click track is simply a matter of connecting the output of the tape channel that contains the click to the normal cassette input jack of the computer, but note that some juggling of the record and playback levels of this channel may be necessary for the computer to properly write and read the channel. In many cases, unless your recorder is capable of providing very high outputs (similar to the earphone levels from the cassette recorders which the computer was designed to work with), you may need to use a small external amp to provide the extra gain and current drive required. If your SYNC fails to respond, try using the earphone jack signal usually provided on multi-track recorders. If this doesn't provide enough power, try using a small portable practice amp (such as a Pygmy or Pignose) whose earphone output should adequately drive the cassette input jack of the computer.

Assuming that you have some rhythm sequence (ordinarily the first laid down) in the computer memory and that you're getting ready to record it as audio, proceed by first punching into the T-SEQ option (if you plan to use it) then touch the SYNC control pad. Roll the tape with the click track channel set to playback and the audio going to one of the other tracks which is naturally in record mode. Before the quiet leader ends, touch the REPT/PLAY command pad and hold it. When the click track starts, so will the sequence. When enough of the track is laid down, terminate the play mode by touching the NORMAL pad.

It is necessary to select the SYNC OPTION last in the above sequence of events because once this option is asserted, a click track must be coming in on the cassette port for the computer to recognize any further commands. If you find yourself with a "dead" computer caused by CLIK being selected with no click track present, you can either run a tape which has a click track or

reset the computer and run the program again.

In situations where the sequence is not to be played from the first down-beat, the SYNC OPTION should be enabled before rolling the tape and REPT/PLAY punched in when the time comes for the sequence to start.

A little constructive play will go a long way toward familiarizing you with the capabilities of this powerful option. Here are some we haven't mentioned yet:

You have probably already noticed the somewhat cryptic METR designations that appear in both the OPTION and TEMPO control boxes. And probably you've figured out that it means metronome (a handy thing in any studio). But this is kind of a super metronome because not only does it have a "pendulum" (which shows in the computer's twin displays) and an audible click (which you hear from the beeper) but it also provides an electrical output in the form of a short positive going pulse that appears as D7 of the D/A output channel (which in turn shows up on the Flag 2 pin jack of the D/A's front panel). This pulse is enormously useful in synchronizing external devices (a Programmable Drum Set, for example).

Since both the SYNC and METR options may be asserted at the same time, the external device can be synched to a pre-recorded audio track.

The METR pad in the TEMPO control box is obviously the tempo control for the metronome. Like the other tempo controls that we looked at last time, this one works in octaves. Each time the pad is touched the metronome tempo doubles until the maximum rate is reached, then the next touch causes the tempo to "fold back" to the minimum rate.

It may be somewhat out of sequence (?) to mention here that the tempo of the metronome is the tempo at which sequences stored in EVENT mode will play back, though of course, the TEMPO UP and DOWN command pads will also alter the tempo of the sequence once saved, as outlined last time.

Another point - When electrically synchronizing things to the click track, the METR TEMPO can still be varied to accomodate different timings, and since it operates by octaves the integrity of the timing will be preserved.

And a hint - the metronome "beep" can also be recorded on tape to provide a "human readable" click track (though it must be saved on a different track than the CLIK).

The only other command pads that we've added are STOP/STEP (a means of stopping the sequence without "forgetting" where we were as well as single stepping through the sequence) and CONT (continue) which allows us to pick up from the point where we STOPped. This feature can provide easy introductions to songs. STOP/STEP through the piece until you reach the REST just prior to the point where the introduction should start. When the CONTINUE pad is touched, the introduction will play, leading into the repeating sequence.

I wish I had the space and time (and for that matter, knowledge) to go into some expository statements on the art of small studio multi-tracking, but I leave that to an old friend and new-comer to Polyphony's pages, Craig Anderton. I hope that Craig's and my work will complement one another in this area - I think it will.

I also wish I had the space to go into a detailed analysis of how SEQUE 1.0 works. I don't. If you're really interested, the documented assembler listing which follows is tremendously meaty (though sketchy in parts). Careful study of the code used, in conjunction with the comments given, should be valuable in learning more about software generation and execution.

SEQUE 1.0
COMMAND SUMMARY

PROGRAM

SCORE - Saves melody sequence in real time.

EVENT Saves melody sequence as regularly spaced events.

TRANSPOSE - Saves transpose sequence as events.

PLAY

REPEAT - Plays sequence from beginning, cycles until stopped.

SINGLE - Waits for key on AGO then plays sequence from the beginning. Stops at end of melody.

STOP/STEP - Allows stops or pauses during playback.

CONTINUE - Starts melody playback from where you are in memory.

TAPE

SAVE - Dumps current Melody and Transpose sequences to mag. tape.

LOAD - Loads M & T sequences from tape.

OPTIONS

TABLE - Selects transpose sequence table as source of transpositions (otherwise AGO is source).

METRONOME - Initiates visual metronome display and a "beep".

SYNC. - Shuts down internal timing and accepts pre-recorded click-track for timing information.

CANCEL - Turns all selected options off.

TEMPO

UP - Doubles tempo of melody sequence.

DOWN - Halves tempo of melody sequence.

METRONOME - Doubles speed of metronome display and "beep".

MISC

NORMAL - The "normal synthesizer" mode. Does not alter stored sequences.

```
0010 ;*********************************
0020 ;*                               *
0030 ;*          SEQUE 1.0            *
0040 ;*                               *
0050 ;* MONOTONIC SEQUENCER PROGRAMS *
0060 ;*                               *
0070 ;*              BY               *
0080 ;*    JOHN S. SIMONTON, JR.      *
0090 ;*                               *
0100 ;*(C) 1978 PAIA ELECTRONICS, INC*
0110 ;*     ALL RIGHTS RESERVED       *
0120 ;*                               *
0130 ;*********************************
0140 ;
0150 ;DEFINE ADDRESSES OF LABELS
0160 ;
0170 BEEP  .DL 1F22
0180 DECD  .DL 1F00
0190 CASS  .DL 1EAA
0200 DBIT  .DL 1E49
0210 SBIT  .DL 1E25
0220 OUTP  .DL 0840
0230 DSP   .DL 0820
0240 KBD   .DL 0810
0250 ;
0260 MTB3  .DL 0303
0270 MTB2  .DL 0302
0280 MTB1  .DL 0301
0290 MTBL  .DL 0300
0300 TTBL  .DL 02C0
0310 ;
0320 BUFF  .DL 00F0
0330 KBUF  .DL 00EC
0340 PBUF  .DL 00EB
0350 MPNT  .DL 00EA
0360 TPNT  .DL 00E9
0370 MEND  .DL 00E8
0380 TEND  .DL 00E7
0390 TRNS  .DL 00E6
0400 CNTR  .DL 00E5
0410 TTRN  .DL 00E4
0420 LSTL  .DL 00E3
0430 STUS  .DL 00E2
0440 TPO   .DL 00E1
0450 METF  .DL 00E0
0460 MTRC  .DL 00DF
0470 DUMY  .DL 0003
0480 ;
0490 ;
0500 ;
0510       .OR 1000
0520 ;
1000- A9 00     0530 STAR LDA 00        ;START / RESTART
1002- 85 E2     0540      STA *STUS     ;CANCEL OPTIONS
1004- A9 0C     0550      LDA 0C        ;NRML COMMAND LINK
1006- 8D 7B 11  0560      STA ACTN+01   ;PLACE COMMAND LINK
1009- 4C 18 11  0570      JMP COM       ;JUMP TO COMMON
0580 ;
0590 ;NORMAL OPERATING MODE - DOES NOT ALTER
0600 ;T-SEQUENCE OR M-SEQUENCE
0610 ;
100C- B0 05     0620 NRML BCS NRM1      ;FIRST PASS THROUGH
100E- 85 E6     0630      STA *TRNS     ;ZERO TRANSPOSE
1010- 8D 20 08  0640      STA DSP       ;AND DISPLAYS
1013- A5 EC     0650 NRM1 LDA *KBUF     ;CHECK FOR NOTES
1015- D0 04     0660 NRM2 BNE STOR      ;ZERO- NO NEW KEY
1017- A5 EB     0670      LDA *PBUF     ;SO GET OLD KEY
1019- 29 3F     0680      AND 3F        ;CLEAR BOTH FLAGS
101B- 85 EB     0690 STOR STA *PBUF     ;SAVE AGAIN
101D- 60        0700      RTS           ;AND RETURN
0710 ;
0720 ;PROGRAM TRANSPOSE MODE - NOTE PLAYED
0730 ;IS "KILLED" WHEN KEY IS RELEASED
0740 ;
101E- B0 0A     0750 TLOD BCS TL1       ;FIRST PASS, INITIALIZE
1020- 85 E6     0760      STA *TRNS     ;ZERO TRANSPOSE FIGURE
1022- 85 EB     0770      STA *PBUF     ;ZERO OUTPUT NOTE
1024- 85 E7     0780      STA *TEND     ;ZERO TABLE END POINTER
1026- A9 80     0790      LDA 80        ;TURN T-SEQUE OPTION
1028- 85 E2     0800      STA *STUS     ;ON
102A- A6 E7     0810 TL1  LDX *TEND     ;GET TRANSPOSE POINTER
102C- 8E 20 08  0820      STX DSP       ;SHOW IT
102F- A5 EC     0830      LDA *KBUF     ;GET THE NOTE
1031- F0 06     0840      BEQ TL2       ;ZERO- NO KEY, SAVE
1033- C5 EB     0850      CMP *PBUF     ;KEY SAME AS LAST?
1035- F0 05     0860      BEQ TRTN      ;YES - LEAVE
1037- E6 E7     0870      INC *TEND     ;POINT TO NEXT LOCATION
1039- 9D C0 02  0880 TL2  STA TTBL,X    ;SAVE TRANSPOSE
103C- 85 EB     0890 TRTN STA *PBUF     ;AND OUTPUT AS NOTE
103E- 60        0900      RTS           ;THEN RETURN
0910 ;
0920 ;PROGRAM SCORE MODE - USES REAL-TIME CLOCK
0930 ;
103F- 20 84 11  0940 MSAV JSR MSV1      ;CALL SAVE MODULE
1042- E6 E5     0950      INC *CNTR     ;INCREMENT THE TEMPO
1044- 60        0960      RTS           ;COUNTER AND RETURN
0970 ;
0980 ;CONTINUE PLAY MODE - DOES NOT RESET
0990 ;M-SEQUENCE OR T-SEQUENCE POINTERS
1000 ;
1045- 38        1010 CNTU SEC           ;SKIP INITIALIZATION
1020 ;
1030 ;REPEAT PLAY MODE - WHEN FIRST ENTERED
1040 ;M-SEQ AND T-SEQ POINTERS ARE SET TO ZERO
1050 ;BY THE PLAY MODULE (PLA1)
1060 ;
1046- 20 AC 11  1070 RPLA JSR PLA1      ;CALL PLAY MODULE
1049- AD 14 11  1080      LDA STBL+14   ;WAS THE PREVIOUS MODE
104C- C5 E3     1090      CMP *LSTL     ;MSAV (PROG. SCORE)?
104E- D0 02     1100      BNE RPL1      ;NO-SKIP INCREMENT
1050- E6 E9     1110      INC *TPNT     ;INC. T-SEQ POINTER
1052- 24 E2     1120 RPL1 BIT *STUS     ;T-SEQ ASSERTED ?
1054- 30 0A     1130      BMI ROUT      ;OPTION ON - LEAVE
1056- A5 EC     1140      LDA *KBUF     ;OPTION OFF- GET NOTE
1058- F0 02     1150      BEQ OLDK      ;AND IF NO NOTE, BRANCH
105A- 85 E4     1160      STA *TTRN     ;SAVE NOTE FOR NEXT TIME
105C- A5 E4     1170 OLDK LDA *TTRN     ;GET LAST ACTIVE NOTE
105E- 85 E6     1180      STA *TRNS     ;USE AS TRANSPOSE
1060- E6 E5     1190 ROUT INC *CNTR     ;INCREMENT TEMPO COUNTER
1062- 60        1200      RTS           ;AND RETURN
1210 ;
1220 ;SINGLE PLAY MODE - WAITS FOR AGO KEY
1230 ;THEN PLAYS SEQUENCE ONCE THROUGH
1240 ;TRANSPOSED TO INDICATED KEY
1250 ;
1063- 90 04     1260 SING BCC SNG1      ;FIRST PASS, BRANCH
1065- A5 EC     1270      LDA *KBUF     ;AGO KEY DOWN ?
1067- D0 DD     1280      BNE RPLA      ;YES - PLAY SEQUENCE
1069- 20 46 10  1290 SNG1 JSR RPLA      ;NO - "PLAY" THEN RETURN
106C- A5 EA     1300      LDA *MPNT     ;M-SEQ POINTER > 0 ?
106E- D0 08     1310      BNE SRTN      ;YES - RETURN
1070- A9 00     1320      LDA 00        ;NO - PREPARE
1072- 85 E5     1330      STA *CNTR     ;ZERO TEMPO COUNTER
1074- A6 E8     1340      LDX *MEND     ;POINT TO LAST NOTE
1076- BD 01 03  1350      LDA MTB1,X    ;OF M-SEQ AND GET IT
1079- 85 EB     1360      STA *PBUF     ;PLACE IN PLAY BUFFER
107B- 60        1370 SRTN RTS           ;THEN RETURN
1380 ;
1390 ;UP TEMPO AND DOWN TEMPO - COMMON PORTION
1400 ;OF BOTH PROGRAMS ON PAGE 2
1410 ;
107C- A9 7E     1420 UTMP LDA 7E        ;THE OP-CODE FOR ROR
107E- D0 02     1430      BNE U/D       ;BRANCH ALWAYS
1080- A9 3E     1440 DTMP LDA 3E        ;THE OP-CODE FOR ROL
1082- 4C 00 12  1450 U/D  JMP TCOM      ;JUMP FOR THE REST
1460 ;
1470 ;REST MODE - EXTENDS NOTES OR UN-NOTES
1480 ;WHEN IN PROGRAM EVENT MODE
1490 ;
1085- 18        1500 REST CLC           ;PREPARE FOR ADDITTION
1086- A5 E5     1510      LDA *CNTR     ;GET TEMPO COUNTER
1088- 65 E1     1520      ADC *TPO      ;ADD TEMPO VALUE
108A- 85 E5     1530      STA *CNTR     ;PUT COUNTER BACK
108C- A5 E3     1540      LDA *LSTL     ;AND RETURN TO
108E- 8D 7B 11  1550      STA ACTN+01   ;PREVIOUS OPERATING
1091- 60        1560      RTS           ;MODE
1570 ;
1580 ;STOP/STEP MODE - STOPS PLAY WITHOUT
1590 ;CHANGING POINTERS.  SINGLE STEPS THROUGH
1600 ;SEQUENCE
1610 ;
1092- B0 0E     1620 STEP BCS STP1      ;NOT FIRST PASS-BRANCH
1094- A9 FF     1630      LDA 0FF       ;SET TEMPO COUNTER AT
1096- 85 E5     1640      STA *CNTR     ;"TIMED OUT" VALUE
```

```
1098-  20 B6 11  1650       JSR CONT     :CALL PART OF PLAY MODULE
1098-  8E 20 00  1660       STX DSP      :DISPLAY M-SEQ POINTER
109E-  A9 00     1670       LDA 00       :MAKE TRANSPOSE VALUE
10A0-  85 E6     1680       STA *TRNS    :EQUAL TO ZERO
10A2-  60        1690  STP1 RTS          :AND RETURN
                 1700  :
                 1710  :PROGRAM EVENT MODE - SAVES M-SEQUENCE
                 1720  :BUT SUBSTITUTES EVENT CLOCK FOR REAL-TIME
                 1730  :CLOCK
                 1740  :
10A3-  B0 02     1750  ESAV BCS ES1      :FIRST PASS, INITIALIZE
10A5-  85 E5     1760       STA *CNTR    :TEMPO COUNTER AS ZERO
10A7-  20 84 11  1770  ES1  JSR MSV1     :CALL SAVE MODULE
10AA-  A5 E5     1780       LDA *CNTR    :GET TEMPO COUNTER
10AC-  D0 05     1790       BNE EOUT     :NO ENTRY-RETURN
10AE-  18        1800       CLC          :PREPARE
10AF-  65 E1     1810       ADC *TPO     :ADD TEMPO VALUE
10B1-  85 E5     1820       STA *CNTR    :SAVE AS TEMPO COUNTER
10B3-  60        1830  EOUT RTS          :THEN RETURN
                 1840  :
                 1850  :OPTION MENU - RETURNS TO PREVIOUS
                 1860  :OPERATING MODE AFTER TURNING ON OR
                 1870  :CANCELLING OPTIONS
                 1880  :
10B4-  85 E9     1890  TBLM STA *TPNT    :T-SEQ POINTER TO BEG,
10B6-  A5 E2     1900       LDA *STUS    :ASSERT T-SEQ OPTION
10B8-  09 80     1910       ORA 80
10BA-  D0 0E     1920       BNE MCOM     :BRANCH ASLWAYS
10BC-  A5 E2     1930  MET  LDA *STUS    :TURN METRONOME ON
10BE-  09 40     1940       ORA 40
10C0-  D0 08     1950       BNE MCOM     :BRANCH ALWAYS
10C2-  A5 E2     1960  SYNC LDA *STUS    :TURN ON SYNC TO
10C4-  09 01     1970       ORA 01       :CLICK TRACK OPTION
10C6-  D0 02     1980       BNE MCOM     :BRANCH ALWAYS
10C8-  A9 00     1990  CNCL LDA 00       :PREPARE AND
10CA-  85 E2     2000  MCOM STA *STUS    :CANCEL ALL OPTIONS
10CC-  4C 0F 12  2010       JMP TCM1     :JUMP FOR THE REST
                 2020  :
                 2030  :CLICK MODE - SENDS CLICK TRACK TO TAPE
                 2040  :AGO KEYBOARD SCAN RATE IS TIMER
                 2050  :
10CF-  18        2060  CLIK CLC          :PREPARE TO SEND "0"
10D0-  20 25 1E  2070       JSR SBIT     :SEND IT
10D3-  60        2080       RTS          :RETURN FOR KEYBOARD DELAY
                 2090  :
                 2100  :METRONOME TEMPO CHANGE - PROGRAM ON PAGE 2
                 2110  :
10D4-  4C 54 12  2120  TCHG JMP TCH      :JUMP TO PROGRAM
                 2130  :
                 2140  :DUMP M&T-SEQ TO TAPE - PROGRAM ON PAGE 2
                 2150  :
10D7-  4C 20 12  2160  OTAP JMP TOUT     :JUMP TO PROGRAM
                 2170  :
                 2180  :LOAD M&T-SEQ FROM TAPE - PROGRAM ON PAGE 2
                 2190  :
10DA-  4C 33 12  2200  ITAP JMP TIN      :JUMP TO PROGRAM
                 2210  :
                 2200  :
                 2290  :COMMAND LINKS - LOW BYTE OF ADDRESS OF SUBS
                 2300  :
1100- 85 85 85 85 C2 BC B4 C8
1108- CF D4 00 7C DA D7 0C 0C
1110- 45 92 63 46 3F A3 1E 46
                 2790  :
                 2800       .OR 1118
                 2810  :
                 2820  :COMMON PROGRAM - DOES METRONOME WHEN ON
                 2830  :ADDS PLAY AND TRANSPOSE BUFFERS TO GET
                 2840  :OUTPUT NOTE, PLAYS NOTE, READS COMMAND
                 2850  :KEYBOARD AND JUMPS TO SELECTED MODE
                 2860  :SUBSTITUTES CLICK SYNCH FOR KEYBOARD
                 2870  :TIMING LOOP WHEN SYNC OPTION IS ASSERTED
                 2880  :
1118-  A5 E2     2890  COM  LDA *STUS    :CHECK OPTIONS
111A-  48        2900       PHA          :SAVE A COPY
111B-  0A        2910       ASL          :MERONOME ON ?
111C-  10 22     2920       BPL COM0     :NO - BRANCH
111E-  C6 DF     2930       DEC *MTRC    :DECREMENT METRONOME COUNTER
1120-  10 1E     2940       BPL COM0     :NOT <0 YET, BRANCH
1122-  A6 E1     2950       LDX *TPO     :TIME UP, GET TEMPO VALUE
1124-  CA        2960       DEX          :DECREMENT ONCE
1125-  86 DF     2970       STX *MTRC    :THEN SAVE AS COUNTER
```

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1127-  A9 00     2980       LDA 00       :TO DETERMINE ALTERNATE DISPLAY
1129-  AA        2990       TAX          :CYCLE AND "PENDULUM" LEFT
112A-  18        3000       CLC          :PREPARE FOR ADDITTION
112B-  65 E0     3010       ADC *METF    :ADD FLIP-FLOP VALUE
112D-  85 E0     3020       STA *METF    :SAVE NEW VALUE
112F-  10 0C     3030       BPL MET1     :ALTERNATE? - DISPLAY
1131-  A5 EB     3040       LDA *PBUF    :OTHERWISE, GET OUTPUT
1133-  09 80     3050       ORA 80       :SET D7
1135-  85 EB     3060       STA *PBUF    :SAVE IN PLAY BUFFER
1137-  18        3070       CLC          :PREPARE AND
1138-  20 25 1E  3080       JSR SBIT     :CALL BEEP
113B-  A2 08     3090       LDX 08       :"PENDULUM" RIGHT
113D-  8E 20 08  3100  MET1 STX DSP      :SHOW PENDULUM
1140-  A5 E6     3110  COM0 LDA *TRNS    :IS THERE A TRANSPOSE ?
1142-  F0 03     3120       BEQ COM1     :NO - BRANCH
1144-  18        3130  TRAN CLC          :YES - PREPARE
1145-  69 A4     3140       ADC 0A4      :CALCULATE TRANSPOSE VALUE
1147-  18        3150  COM1 CLC          :MORE PREPARATION
1148-  65 EB     3160       ADC *PBUF    :CALCULATE NOTE
114A-  8D 40 08  3170  COUT STA OUTP     :PLAY NOTE
114D-  68        3180       PLA          :GET STUS (OPTION CODES)
114E-  6A        3190       ROR          :SYNC OPTION ON ?
114F-  90 06     3200       BCC KRED     :NO - SKIP
1151-  20 49 1E  3210       JSR DBIT     :WAIT FOR CLIK
1154-  4C 6D 11  3220       JMP CTRL     :SKIP READING AGO
1157-  2C 10 08  3230  KRED BIT KBD      :WAIT FOR DUMMY SCAN
115A-  10 FB     3240       BPL KRED     :LOOP UNTIL STARTED
115C-  AD 10 08  3250  KR2  LDA KBD      :WAIT FOR SCAN TO START
115F-  30 FB     3260       BMI KR2      :LOOP UNTIL STARTED
1161-  2C 10 08  3270  KR3  BIT KBD      :CHECK FOR KEYS DOWN
1164-  30 05     3280       BMI KRTN     :WHEN SCAN DONE, RETURN
1166-  50 F9     3290       BVC KR3      :CURRENT KEY NOT DOWN, LOOP
1168-  AD 10 08  3300       LDA KBD      :KEY DOWN, GET IT
116B-  85 EC     3310  KRTN STA *KBUF    :SAVE RESULT
116D-  20 00 1F  3320  CTRL JSR DECD     :GET COMMAND
1170-  B0 06     3330       BCS DO       :OLD COMMAND - DO IT
1172-  B9 00 11  3340       LDA STBL,Y   :NEW COMMAND - GET LINK
1175-  8D 7B 11  3350       STA ACTN+01  :PLACE LINK
1178-  A9 00     3360  DO   LDA 00       :THIS WILL BE HANDY
117A-  20 03 00  3370  ACTN JSR DUMY     :CALL OPERATING MODE
117D-  AD 7B 11  3380       LDA ACTN+01  :SAVE CURRENT COMMAND
1180-  85 E3     3390       STA *LSTL    :LINK FOR LATER
1182-  D0 94     3400       BNE COM      :AND LOOP ALWAYS
                 3410  :
                 3420  :SAVE MODULE - TAKES CARE OF ALTERNATELY
                 3430  :STACKING DURATIONS AND NOTES IN M-SEQUENCE
                 3440  :USES WHAT WILL BE "END OF SEQUENCE"
                 3450  :INDICATOR IN PLAY MODES AS POINTER
                 3460  :
1184-  B0 09     3470  MSV1 BCS MS1      :FIRST PASS?
1186-  8D 01 03  3480       STA MTBL+01  :YES-ZERO PROGRAM NOTE
1189-  85 E8     3490       STA *MEND    :ZERO M-SEQ POINTER
118B-  85 E6     3500       STA *TRNS    :ZERO TRANSPOSE
118D-  85 EB     3510       STA *PBUF    :ZERO OUTPUT NOTE
118F-  A5 E5     3520  MS1  LDA *CNTR    :GET TIME SINCE LAST NOTE
1191-  A6 E8     3530       LDX *MEND    :AND M-SEQ END POINTER
1193-  9D 00 03  3540       STA MTBL,X   :SAVE THE TIME
1196-  20 13 10  3550       JSR NRM1     :IN CASE NO KEYS DOWN
1199-  29 7F     3560       AND 7F       :CLEAR D7 IN OUTPUT NOTE
119B-  DD 01 03  3570       CMP MTB1,X   :SAME AS LAST NOTE?
119E-  F0 0B     3580       BEQ OUT      :YES, LEAVE
11A0-  E8        3590       INX          :NO, SAVE BY INCREMENTING
11A1-  E8        3600       INX          :M-SEQ POINTER TWICE
11A2-  86 E8     3610       STX *MEND    :AND SAVING AS END
11A4-  9D 01 03  3620       STA MTB1,X   :THEN SAVE NOTE
11A7-  A9 00     3630       LDA 00       :AND ZERO TIME SINCE
11A9-  85 E5     3640       STA *CNTR    :LAST NOTE
11AB-  60        3650  OUT  RTS          :AND RETURN
                 3660  :
                 3670  :PLAY MODULE - MANAGES M-SEQ AND T-SEQ
                 3680  :POINTERS AS WELL AS TEMPO CLOCK.
                 3690  :DETERMINES WHEN NOTES ARE TO BE PLAYED
                 3700  :
11AC-  B0 08     3710  PLA1 BCS CONT     :FIRST PASS ?
11AE-  85 E4     3720       STA *TTRN    :YES-ZERO TEMP. TRANSPOSE
11B0-  85 E9     3730  LP1  STA *TPNT    :ZERO T-SEQ POINTER
11B2-  85 EA     3740  LP2  STA *MPNT    :AND M-SEQ POINTER
11B4-  85 E5     3750       STA *CNTR    :AND CLOCK (TEMPO CONTER)
11B6-  A5 E5     3760  CONT LDA *CNTR    :GET CLOCK
11B8-  A4 E9     3770       LDY *TPNT    :GET T-SEQ POINTER
11BA-  A6 EA     3780       LDX *MPNT    :GET M-SEQ POINTER
11BC-  DD 02 03  3790       CMP MTB2,X   :TIME UP?
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11BF-  90 15      3800       BCC PL1      :NO, BRANCH
11C1-  A9 00      3810       LDA 00       :YES, PREP. COUNTER, ETC.
11C3-  85 E5      3820       STA *CNTR    :FOR NEXT ACCUMULATION
11C5-  E8         3830       INX          :INCREMENT M-SEQ POINTER
11C6-  E8         3840       INX          :TWICE
11C7-  86 EA      3850       STX *MPNT    :AND SAVE NEW POINTER
11C9-  E4 E8      3860       CPX *MEND    :END OF M-SEQ?
11CB-  D0 09      3870       BNE PL1      :NO - BRANCH
11CD-  C8         3880       INY          :YES, INC T-SEQ POINTER
11CE-  C4 E7      3890       CPY *TEND    :END OF T-SEQ ?
11D0-  B0 DE      3900       BCS LP1      :YES-START T&M-SEQ AGAIN
11D2-  84 E9      3910       STY *TPNT    :NO-SAVE T-SEQ POINTER
11D4-  D0 DC      3920       BNE LP2      :BRANCH-START M-SEQ AGAIN
11D6-  BD 03 03   3930  PL1  LDA MTB3,X   :GET THE NOTE
11D9-  85 EB      3940       STA *PBUF    :SAVE IN PLAY BUFFER
11DB-  B9 C0 02   3950       LDA TTBL,Y   :GET TRANSPOSE
11DE-  85 E6      3960       STA *TRNS    :TO TRANSPOSE BUFFER
11E0-  60         3970       RTS          :RETURN
                  3980  :
                  3990  :TAPE TRANSFER PARAMETER TABLE
                  4000  :
                  4010  TAPE .HS FF00FF03C002C002
                  4020  :
                  4030       .OR 1200
                  4040  :
                  4050  :COMMON PORTION OF TEMPO UP & DOWN -
                  4060  :ROTATES RIGHT OR LEFT THE DURATIONS
                  4070  :SAVED WITH M-SEQUENCE
                  4080  :
1200-  8D 06 12   4090  TCOM STA PLAC     :PLACE ROR OR ROL OP CODE
1203-  A2 00      4100       LDX#00       :ZERO A COUNTER/POINTER
1205-  18         4110  TLP  CLC          :PREPARE
1206-  7E 02 03   4120  PLAC ROR MTB2,X   :ROTATE SAVED TEMPO
1209-  E8         4130       INX          :INCREMENT POINTER TWICE
120A-  E8         4140       INX          :TO POINT TO NEXT
120B-  E4 E8      4150       CPX *MEND    :END OF M-SEQ ?
120D-  D0 F6      4160       BNE TLP      :NO - LOOP FOR MORE
120F-  A5 E3      4170  TCM1 LDA *LSTL    :DONE, GET LINK AND
1211-  8D 7B 11   4180       STA ACTN+01  :SET UP FOR PREVIOUS MODE
1214-  60         4190       RTS          :THEN RETURN
                  4200  :
                  4210  :SET UP PROCEDURE FOR TAPE TRANSFER
                  4220  :
1215-  A2 07      4230  STTP LDX 07       :TRANSFER 7 BYTES
1217-  BD E1 11   4240  STP  LDA TAPE,X   :GET PARAMETER FROM TABLE
121A-  95 F0      4250       STA *BUFF,X  :PLACE IN POT-SHOT BUFFER
121C-  CA         4260       DEX          :POINT TO NEXT, MORE ?
121D-  D0 F8      4270       BNE STP      :YES - LOOP
121F-  60         4280       RTS          :NO - RETURN
                  4290  :
                  4300  :DUMP M-SEQ AND T-SEQ TO TAPE
                  4310  :
1220-  20 15 12   4320  TOUT JSR STTP     :SET UP FOR TRANSFER
1223-  A5 E8      4330       LDA *MEND    :SAVE M-SEQ END WITH
1225-  8D 00 03   4340       STA MTBL     :M&T-SEQUENCE
1228-  A5 E7      4350       LDA *TEND    :ALSO T-SEQUENCE END
122A-  8D 01 03   4360       STA MTB1
122D-  A9 DD      4370       LDA 0DD      :SET UP FOR DUMP
122F-  20 46 12   4380       JSR DOTP     :AND DO IT
1232-  60         4390       RTS          :THEN RETURN
                  4400  :
                  4410  :LOAD M-SEQ AND T-SEQ FROM TAPE
                  4420  :
1233-  20 15 12   4430  TIN  JSR STTP     :SET UP FOR TRANSFER
1236-  A9 11      4440       LDA 11       :SET UP FOR LOAD
1238-  20 46 12   4450       JSR DOTP     :AND DO IT
123B-  AD 00 03   4460       LDA MTBL     :PLACE M-SEQUENCE END
123E-  85 E8      4470       STA *MEND
1240-  AD 01 03   4480       LDA MTB1     :AND T-SEQUENCE END
1243-  85 E7      4490       STA *TEND
1245-  60         4500       RTS          :THEN RETURN
                  4510  :
                  4520  :PERFORM TAPE TRANSFER
                  4530  :
1246-  20 AA 1E   4540  DOTP JSR CASS     :CALL POT-SHOT
1249-  AD 0F 11   4550       LDA STBL+0F  :SET UP TO RETURN
124C-  8D 7B 11   4560       STA ACTN+01  :IN NORMAL MODE
124F-  18         4570       CLC          :PREPARE
1250-  20 22 1F   4580       JSR BEEP     :SIGNAL DONE
1253-  60         4590       RTS          :AND RETURN
                  4600  :
                  4610  :CHANGE METRONOME TEMPO
                  4620  :
1254-  85 DF      4630  TCH  STA *MTRC    :ZERO METRONOME CLOCK
1256-  66 E1      4640       ROR *TPO     :HALVE TEMPO VALUE
1258-  90 02      4650       BCC TCHR     :IF NOT ZERO, LEAVE
125A-  66 E1      4660       ROR *TPO     :ZERO, MAKE NOT ZERO
125C-  D0 B1      4670  TCHR BNE TCM1     :GO SET UP PREVIOUS MODE
                  4680  :
                  4690  END  .EN
                  4700
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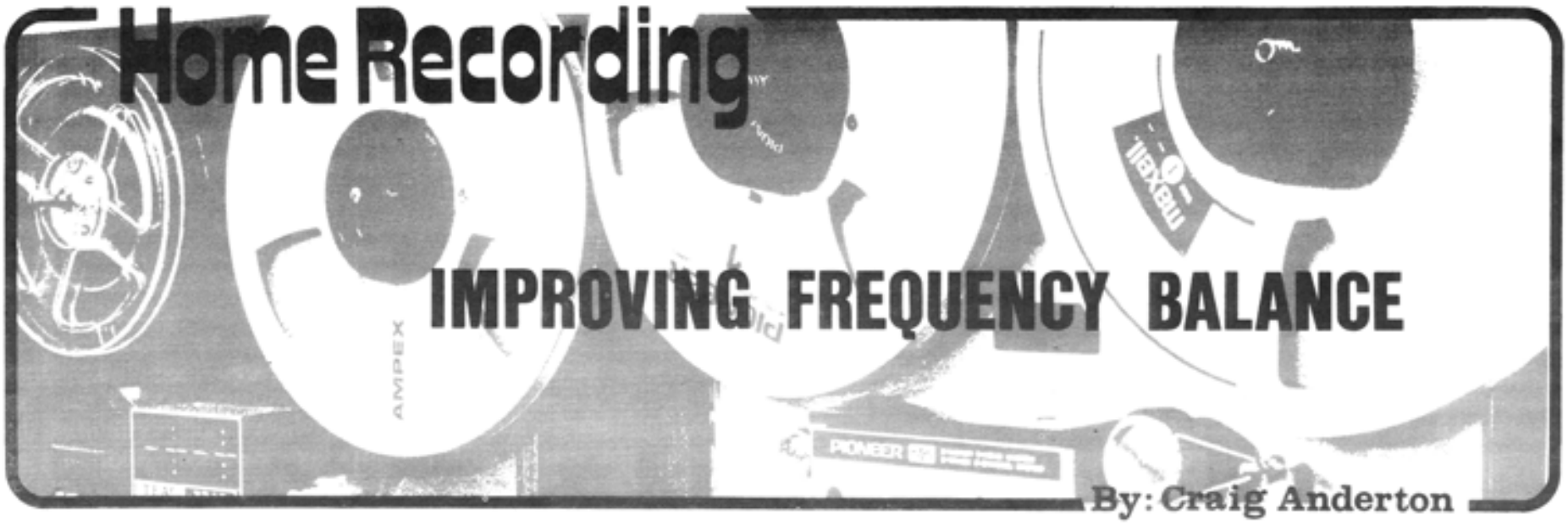
NOTE: The following is available from PAIA Electronics, PO Box 14359, Oklahoma City, OK 73114:

Seque 1.0 cassette data tape with complete documentation and plastic computer keyboard overlay.....$6.95 postpaid

Home Recording



IMPROVING FREQUENCY BALANCE

By: Craig Anderton

One of the consistent problems faced by the home recordist is how to get big-bucks sound out of low-bucks equipment. Although there are many pieces of equipment that can help make for better quality recordings, most of it is useless unless you have a clear-cut idea of what you're looking for, and then utilize the equipment to build that specific sound. Sometimes, just patching things around looking for something interesting can yield good results -- and I'm certainly not discounting sudden chance inspirations -- but you can certainly handle things much faster in the studio if you know what effect you're trying to achieve BEFORE you start plugging in the patch cords.

Some might argue that saving time is not really a consideration in a home studio, since you are not having to worry about the clock and you're not paying a costly studio bill. This is true; but the more efficiently you can work in the studio, the smoother the flow, and the lower the frustration level. The less time you take committing inspiration to tape, the better your odds of the inspiration not floating away as you twiddle knobs.

So, how do you evolve a clear-cut plan of what you want to do? Chances are you already have some kind of composition, or some kind of compositional idea, that you want to put into taped form. It probably also has variations between soft and loud parts, and between the instrumentations used to implement specific passages. All of this variety helps to keep the listener aware of the music, and interested in the general flow -- but there is one often overlooked aspect of composition that can really make a difference in the overall sound. Since this concept doesn't have a name, we'll call it Frequency Balancing.

AMPLITUDE BALANCING

The basic idea of a mix is to balance the amplitudes of the various instruments used in a composition. Percussion, rhythmic instruments, and melodic instruments need to occupy their proper positions in a mix or the ear may tend to be drawn in a direction not intended by the composer. Subtly boosting an instrument can draw the ear to it; everybody reading this is probably familiar with boosting an instrumental passage, or vocal, just a little bit to increase the emphasis in a certain part of a piece. However, what's often missed is frequency balancing. Most boards have some kind of equalization facility, which can vary from simple to complex ... it all depends on the board. Engineers will use this EQ to get a "correct sound", but I've never seen too much analysis of what tonal qualities make for a good "sound". So, let's see what we can do about quantifying things a bit better.

OTHER MECHANISMS FOR FREQUENCY BALANCING

In the old days, EQ was the only way to change tonal quality. With the advent of synthesized sound, however, all the rules have changed. Whereas EQ can only add or take away what is already present in an instrument, a synthesized sound can change the sound of the instrument itself, which can then be further modified by EQ if necessary.

What does this mean? Let's say you wanted to use a trumpet for a particular lead line, but that the sound was too bright. So, you take some top end off with some EQ and add a little lower midrange to smooth things out a bit, but the characteristic bite of the trumpet is still there ... the EQ can modify the bite, but not remove it.

Now let's say you play synthesizer and you want a trumpet part ... so you patch up your synthesizer to make a trumpet sound. Say you decide this sound is too bright. You can always change the filter response, of course, but this is still a change in EQ. A more convenient solution is to simply use a different waveform, with less harmonics, and perhaps even add some attack time to soften things a bit. Thanks to the synthesizer, you can now make radical changes in tonal quality before you even start to think about equalization.

The implications of this are perhaps obvious, and perhaps not ... but they are certainly far-reaching. Not enough bottom on a sound? Don't boost the bass, add a tracking oscillator an octave below. More bite? Use a more complex waveform.

APPLYING FREQUENCY BALANCING TO A COMPOSITION

In my own pieces, I try to aim for a pretty wide-range sound; I like to have something occupying the bass slot, the various midrange slots, and the high frequency slots. However, having all these frequencies present at all times would be just as monotonous as playing at top volume all the time; varying the frequency content throughout a piece adds variety and interest to the flow.

For example, if I'm reaching

for a peak in a solo, I'll start off with a more muted tone, and then as the solo builds to a climax, add some highs -- or possibly kick in a distortion device to increase the harmonic content. In the meantime, suppose this solo is happening over a drum pattern that features a prominent bass drum. Since the bass drum tends to keep a listener "grounded" to the low frequencies, removing it for just a few bars towards the climax of the solo not only focuses maximum attention on the solo, but also temporarily disorients the listener by letting the rhythm float -- thus making the listener more susceptible to the solo's climax. Starting off with a midrangy sound, then increasing the highs, then removing the bottom, and putting it back again later to signal the end of the solo peak can be though of as a frequency response progression as opposed to a chord progression, or a progression of dynamics in a piece.

By the way, this technique is not really limited to any one form of music. Even the very avant-garde types of music contain elements of rhythm, "soloes", and backgrounds; these are just as likely candidates for frequency shaping as, say, a band of acoustic instruments.

Another example: Let's say you have a piece that uses a string synthesizer more or less throughout, but that during the solo you want a very bright lead instrument over the string part. In terms of conventional amplitude mixing, you would therefore drop the string part back to avoid crowding the solo instrument. But wait -- what's being crowded? Well, between the brightness of the average string synthesizer and the deliberately bright voice chosen for the solo sound, I'd say it's the high frequencies where the collision is occurring. So instead, try cutting off the highs on the string synthesizer during the solo, but leave the level up. The frequency response will be better balanced, and the solo instrument will stand out more. In fact, it will probably stand out enough so the listener won't notice the slightly duller string sound. What's more, when the solo ends and the strings return to their normal sound, there is a welcome change of pace that adds variety to a composition.

OPINIONS AND RECOMMENDATIONS

It seems to me that conflict appeals to the human mind, whether it's the physical conflict that athletes enjoy or the mental puzzles that engineers enjoy. In music, there are several conflicting forces which, if perfectly balanced, form "good" music. Some of the conflicts involve the steady repetition of patterns and rhythm vs. the ever-changing melody lines of solo instruments (a case of regularity versus independence), freedom versus structure (improvising around a fixed chord or rhythmic pattern), and dynamics -- loud versus soft. Having these conflicts appear to be NOT in conflict, by working them against/with each other, is in some ways the essence of music. Harmony, for example, takes several different notes, yet makes them work together to form a more pleasing whole.

So, we need to avoid excessive conflict in terms of frequency response, and yet some conflict seems almost mandatory to keep the level of excitement up. Here are some specific situations I've run across to illustrate some points about frequency balancing. Naturally, these are not "rules"; any situation demands a unique treatment.

RHYTHMIC SOUNDS

Drums are an excellent example of a frequency balanced instrument. You have a bass drum for low frequencies, tom toms and the like for midrange, and cymbals for midrange to high frequency sounds. A drummer punches out not just a pattern, but an ever-changing frequency response progression. Here we already see the makings of a trend: lower frequencies are used for the rhythmic, steady underpinnings of a piece of music; midrange sounds (snare, toms) are used for continuity in the piece, and cymbals add an intense emphasis to selected parts. A cymbal crash, with its rich harmonic structure, is going to get a listener much more excited than a single hit on the tom.

GUITAR AND BASS

Guitar follows a similar pattern. The bass (rhythm) pickup is pretty pure in terms of waveform. If the guitarist wants to put the rhythm a little more up front (such as R&B type material), there will be a change to the treble (more harmonics) pickup. When it's time for a solo, what happens? The fingers gravitate towards the high frequency end of the neck, and sometimes a fuzz tone will be added to up the high frequency content. Again, the sine waves provide the rhythm, midrange gives continuity, and the higher frequencies are used to excite and arouse. (It's interesting to note that some background music sound companies roll off the high end to keep listeners functioning on a nice, steady, droning level.)

Bass becomes more noticeable if you increase the treble content; in fact, it seems anything with increased treble content becomes more noticeable.

From the above, we can draw a couple of conclusions. With a song, for example, if you want to mostly emphasize a vocal, use fairly simple waveforms for the various rhythm instruments and cut the vocal with a little brightness. If the vocal disappears to make room for a solo, make sure the solo is also a little bright so that the listener doesn't feel something's missing when the solo hits. Or, make the solo instrument a little less bright than the vocal at the beginning, and increase it towards the end for that good old tension/release effect. Remember, when I say brightness this doesn't necessarily mean EQ; it can also mean initial waveform.

High frequencies should be used sparingly. In some respects they're your ace card for drawing people's attention; it takes much less volume for a 2000 Hz tone to attract your ear than a 50 Hz tone. Also, remember that people hear best in the midrange region, so changes in bass and treble content will have to be less subtle towards response extremes than towards the midrange.

The ear tends to require fairly frequent changes in sound to keep it interested. If you use a fuzz all the way through a piece, it will lose its effect; the same is true with high frequencies. Don's start off too bright, or you'll have no place to go from there, any more than you would start a piece at a consistent maximum volume and stay there.

SUMMING UP

Above all, don't let the frequency response of a piece stay constant throughout the piece, or you'll have something less interesting than it could be. An ideal instrument for measuring frequency response information is a spectrum analyzer, but as you know they are EXPENSIVE and if you can afford one, you probably have a 16 track and are not even bothering to read this article ... much less have any interest in home built gear!

However, as luck would have it I've devised a cheap little gizmo to help you out while mixing that monitors the frequency content of a piece of music. It's simple, but it's so inexpensive that it's really worth your consideration as something to add to your studio. Besides, it's fun to look at (the blinky light syndrome once again raises its LED head...). We're running out of space this month, so watch next issue for how to string together some filters and LEDs to help you monitor the frequency balance of a piece of music. ●

LETTERS!

....continued from page 29

can sample classical tape techniques, for example, or vice-versa.

SOLVING THE BIG PROBLEM

As I see it, the big problem with independent distribution is how to sell the things. If you see an ad in a magazine promoting someone you've never heard of who is selling some of his or her music, how tempted are you to rush right out and buy it? Certainly, the odds would improve if you could hear a sample of the music being advertised. So, the solution to the big problem is: a sampler record.

THE MECHANICS OF THE THING

Let's set up an actual example. We'll use an arbitrary company name of Polyphony Records (abbreviated PR), and it will be halfway between a tape exchange and a full-fledged record company.

PR must first have some music to sell, and four artists releasing four albums seems like a good place to start. First, that's a smaller number of albums to have to store, send out, and the like; starting the label with too many artists would be over-ambitious and probably not very practical. These four artists would contribute pieces of their music to an EP (extended play) record -- or any other medium would probably be OK for starters. PR would charge a price for the EP--maybe $3--that would cover the cost of mailing the thing, with some left over to compensate the people doing the work, overhead, all those funny expenses that crop up whether you want them to or not, and maybe even some advertising.

Along with the EP would be a form for ordering any or all of the music you liked on the EP, with the understanding that delivery would take from 8 to 10 weeks. That way, PR would have a good idea of what kind of quantities to order (ordering too many records and having to eat them would kill off the company very fast, so this helps to prevent this problem). Eventually, more artists would accumulate, and it would be time to release another sampler EP. Or, if enough good music has flowed into the place, perhaps an LP.

AN AMBITIOUS VARIATION ON THE ABOVE

A splashier way to start would be to gather about 30 artists, give each of them 3 minutes to show their stuff, and put out a double album which would sell for about $9. In many ways it would be a very commercial item--lots of different kinds of music for $10, how can you go wrong? Those albums in which you were particularly interested could again be ordered. A double record like this might even be commercial enough to retail through stores.

SOLVING A SMALL PROBLEM

OK...What if no one orders a particular album from the sampler, or only a very small group of people? If only, say, 30 people are interested in an album, it would be impossible to run off that few albums without incurring a financial loss. Perhaps the people running PR could arrange to have limited-run tape dubs made, or simply give the names of the interested listeners to the artist who would then figure out what to do. That way, although PR would not be directly involved with production of the music, people would still get to hear the music they wanted to hear (which is the point of the whole thing in the first place!).

AFFILIATION WITH A DISTRIBUTOR

It is likely that at some point in PR's future a major label will express interest in distributing some of PR's products. Their best bet would be to take the best-selling releases and attempt to distribute these among stores. This would bring more income to the artists and would simultaneously bring in more income to PR. With the extra income PR could carry more and more types of minority music, and let the bigger distributor handle the general interest sales...in the long run everyone would benefit.

WHAT'S IN IT FOR THE ARTISTS

We've already pointed out what advantages there are to the people who run this enterprise: a possible independent way to make a living. This would require hard work, but then again, what doesn't? For the artists, a simple contract would spell out what's in it for them.

continued on page 42....

INDUSTRY NOTES

Tell them you saw it in POLYPHONY

GUITARISTS NEWSLETTER

Device, the Newsletter for the Electronic Guitarist/Musician is a monthly publication for musicians involved in today's technology. Co-edited by Craig Anderton and Roger Clay, subjects covered on a regular basis include reviews of musical equipment, construction articles, interviews, features on circuit design, and reader opinion polls.

Device's intent is to offer accurate and timely information in an open, readable, and entertaining format. It contains no advertising, and is supported entirely by subscriptions. Rates are $15/year (USA), $16 (Canada/Mexico), and $18 (International). A free sample issue is available from Device, PO Box C, Carmichael, CA 95608.

NEW KITS

Two new kits for electronic musicians have been announced by Blacet Music Research (18405 Old Monte Rio Road, Guerneville, CA 95446). The PHASEFILTER uses a combination of exponentially voltage controlled low pass and phase shift sections arranged in four different sounding networks by digital front panel controls. Control voltages can be supplied by external sources, or by the internal DIGITAL PATTERN GENERATOR. A ten segment LED bar graph displays internal control settings for easy programmability. The kit price is $99 ppd US; AC power supply is $20 ppd US.

The ANALOG DELAY uses a 2000 sample delay line in conjunction with a peak limiter and noise gate to provide a quiet (70 dB) 4 ms to 115 ms worth of delay. Digital sine wave generation ensures smooth clock sweeps. Price for the delay kit is $198 ppd US. An AC power supply is available for $20 ppd US; instruction manuals are $3 ppd.

For more information, or a flyer featuring all the Blacet kits, write directly to the manufacturer as listed above.

TOUCH RESPONSIVE PIANO

The new Roland MP-600 64 note electronic piano features a newly developed mechanical keyboard action which more closely duplicates the response of acoustic pianos. The harder you play, the greater your dynamics. In addition, a wide variety of voicings can be obtained from various combinations of "Piano I", "Piano II", and "Harpsichord". An integral six band equalizer allows further alteration from mellow "acoustic" settings to sharp honky-tonk or clavicord voices. The MP-600 also has a variable decay time slider which varies articulation from the short popping of plucked strings to the long decays characteristic of undamped acoustic pianos.

The MP-600 carries a suggested retail price of $1195. Additional information can be obtained from RolandCorp US, 2401 Saybrook Ave., Los Angeles, CA 90040.

SYNTHESIZERS FOR HUMANS

So goes the name of the newest course from the folks at the Boston School of Electronic Music. This course is designed to accomodate amateur musicians, educators, curious individuals and, in general, any human who shows an interest in learning about the synthesizer and its operation, but who cannot fit one or more semesters of intensive study into their schedule.

The class meets two evenings per week for four weeks. Each class consists of a one hour lecture and a one hour lab session where the students may enlighten themselves on the practical aspects of points covered in the previous lecture.

No previous knowledge of electronics or music is required (although it's always helpful). There is a minimum enrollment requirement of 5 students, and a maximum of 15. Tuition for the course is $75. For more information, and a copy of their NEW CATALOG, write: Boston School of Electronic Music, 28 Highgate Street, Allston, MA 02134.

MUSIC SYMPOSIUM

Polyphony columnist David Ernst will be a guest speaker at a symposium on electronic music which will be held during the first week of April 1979, at Barrington College in Rhode Island. For more information, contact the music department at Barrington College.

MUSIC WORKSHOP

Robert Ceely and BEEP Studios (33 Elm St., Brookline, Mass. 02146, 617-731-3785) will be sponsoring an electronic music workshop from February 19 through March 2. The workshop is designed to present a non-technical, applications oriented overview of a wide variety of equipment. Moog, Polyfusion, EML, Synare, Revox, Teac, and Otari equipment is featured in the "hands-on" lab session which allows each student to work on a project of his choice. Cost of the workshop is $90.00. Additional information or reservations may be obtained from BEEP Studios.

Composer Profiles

The Electronic Music of Barton and Priscilla McLean

By: David Ernst

Barton McLean (b. 1938) and his wife Priscilla (b. 1942) presently reside in Austin, Texas, where Barton is director of the electronic music studio at the University of Texas. They compose in both the electronic and instrumental media, and they have formed the McLean Mix - an electronic duo specializing in live electronic performances.

Barton studied with Henry Cowell and Iannis Xenakis at Indiana University where he received his doctorate in 1972. Like many composers, Barton has written essays on his compositional and aesthetic techniques, and we shall use his writings as a point of departure to investigate his electronic works. The subtitle to a forthcoming article ("Coping with Shattered Illusions") reveals an area of electronic music that has intrigued composers since the early 1950's - 'Problems and solutions concerning live-plus-tape composition'.

"Deserts" (1949-54) by Edgard Varese, "Capriccio for Violin and Two Sound Tracks" (1952) by Henk Badings, and the "Rhapsodic Variations" (1953-54) by Otto Luening and Vladimir Ussachevsky are the earliest works of this nature, and each piece displays a different 'solution' to the problem of live-plus-tape composition. In "Deserts", for instance, Varese alternates orchestra with a musique concrete tape whereas the "Rhapsodic Variations" simultaneously combines orchestra and concrete tape. On the other hand, Badings electronically synthesizes an orchestral accompaniment on tape to play in conjunction with a solo violin. The compositional problem is twofold: timbral (electronic or concrete materials on tape) and textural (combination or separation of instrument(s) and tape). Barton McLean's aforementioned essay, along with his composition "Dimensions II" (1974), provide valuable insights with respect to these problems.

Timbral and textural unification suggest harmonic, melodic, and rhythmic structures in "Dimensions II", for piano and tape. In his essay Barton considers these elements as constituents of 'illusion', that property which creates the framework for a work of art. McLean feels that combination of electronically generated tape and acoustic instruments is poor because electronic and instrumental sonorities project conflicting illusions. Judged according to this criteria Badings' "Capriccio" exemplifies timbral conflict between the solo violin and purely electronic tape. (This is not necessarily to be interpreted as a negative statement for there are many ways to compensate for conflicting illusions, aside from the fact that a composer may purposely establish such conflicts as one structural level).

Absence of conflicting illusions leads to homogenious relations, and Barton attempts to "blur" the distinction between electronic and acoustic sonorities to "fool the listener into perceiving an image that is greater than the constituent parts...It is this blurring of the distinction between the two that creates the illusion of one unified concept." Incidentally, this is what Badings does in his "Capriccio"; the electronic tape simulates the role of a conventional orchestra to such an extent that the listener may be

fooled and mistake the tape for an orchestra.

The tape for "Dimensions II" is derived totally from piano sonorities modified by tape transposition, tape echo, modulation and filtering; both traditional and piano interior sounds are employed. Consequently, the pre-recorded tape assumes various timbral characteristics, especially those of voices, organ, percussion, and string orchestra. For instance, the choral effect at the beginning of this piece was produced by tape transposition, echo and modulation of low piano strings. With respect to timbre this tape then serves a dual function. Exclusive use of pre-recorded piano helps to establish generally homogenous timbres between the tape and performer, whereas extensive electro - mechanical transformations assist in the attainment of "new" tape sonorities. All sounds in "Dimensions II" stem from piano to form timbral cohesion, thereby eliminating one of the prime causes of conflicting illusions.

Performer and tape are further integrated by sharing rhythmic and melodic motives, often making it difficult to differentiate between the two. Successions of rapid repeated notes alternating between piano and tape illustrate this technique, and massive textures evolve when repeated melodic motives are superposed. Simple tape transposition for example, is sufficient to retain motivic unity while timbral contrast is introduced, and as more elaborate sonorous modifications are applied timbral contrast increases.

By working in this manner Barton McLean was able to consider the pre-recorded tape as an extension of the piano, a concept formulated by the early musique concrete composers. The tape of "Dimensions II" resembles the solo tape compositions of Pierre Schaeffer ("Etude Violette" and "Etude on Piano II"), Ussachevsky ("Sonic Contours") and Ilhan Mimaroglu ("Prelude No. 1"). All of these works employ tape manipulation of piano sonorities to produce "new", yet related, timbres; McLean simply extends the medium to include piano. "Dimensions II" creates a pianistic atmosphere wherein natural and transformed sounds interact to give the illusion of a super-piano.

The other commercially available electronic compositions by Barton McLean include "Genesis" (1973), "Spirals" (1973) and "The Sorcerer Revisited" (1974-75). They are purely electronic tape pieces that illustrate a high degree of motivic unification in conjunction with timbral illusion. "Genesis" is a mixture of synthesized orchestral sonorities with sounds of a more electronic nature. In addition to motivic repetitions - often via sequencers - Barton uses orchestral timbres as a basis for obtaining additional timbres, frequently by filtering and/or modulation with a low-frequency oscillator. Like "Genesis", "Spirals" also employs much motivic repetition but the timbral palate is greater. Orchestral sonorities are less prevalent in "Spirals", and electronic and vocal-like sounds appear more frequently. "The Sorcerer Revisited" is based on the well known "Sorcerer's Apprentice" by Paul Dukas, and the tape is composed of orchestral elements due to the nature of the Dukas piece. Thematic entries appear in various 'instruments' while motivic repetitions are usually played by sequencers.

The electronic music of Barton McLean exhibits strong thematic unification along with highly organized timbral structures. Both of these elements are treated in an organic fashion whereby subsidiary motives and sonorities evolve. Most important, McLean realizes acoustical differences among conventional instruments and electronically generated sounds, reflected in his treatment of timbral relations.

Priscilla McLean also received an advanced composition degree at Indiana University (1969). She is presently on the Executive Committee of the American Society of University Composers, as well as director of the ASUC Radio Series entitled Radiofast: New American Music. Like Barton, she works in both the instrumental and electronic media, and Priscilla has also written essays on electronic music. One of these, "Fire and Ice: A Query," discusses the choice of sonorous elements in an electronic composition.

The key to understand Priscilla's electronic vocabulary is her concept of the 'imago-abstract' sound - that which is suggestive of a multitude of images, ideas, etc. Although these sounds may be programmatic, they are not treated as such in a composition. It is not their programmatic quality, but rather their acoustical properties with which Priscilla works and develops. In this way the concrete image is transcended and gives way to the abstract. This was the attitude of early musique concrete composers, and Priscilla cites the environmetal music of Jon Appleton and the nonsense speech in Luciano Berio's "Visage" as examples of the imago-abstract sound. Such a concept truly liberates electronic composers, for sounds must be judged according to their usefulness in a piece. For instance, if a composer wishes to filter some sounds they must possess a rather rich harmonic spectrum. Should the chosen sounds suggest definite images, such as barking dogs, jet engines, etc., it is the composer's responsibility to create a sonorous context wherein their suggestive powers are weakened or eliminated. One method would be to filter extensively the original sound. Another solution would be to follow Berio's example as in "Visage". The sonorous flexibility afforded by the imago-abstract sound is evident in Priscilla's "Dance of Dawn' (1974).

Slowly evolving sections constructed upon motivic and timbral relations characterize "Dance of Dawn". Rhythmic unification is accomplished by articulating short periodic rhythmic patterns of varying lengths while the pitch remains constant, producing variable speed tremolos. The tremolos result from amplitude modulation of oscillator signals by sub-audio pulses. Gradually the low frequency of the modulating signal is increased so that the rhythmic (tremolo) effect of the modulation is supplanted by a distinct timbral change - the harmonic spectrum is more complex. Timbre becomes a function of rhythm. Furthermore, the tremolo motives are

contrasted against sustained chords; as the tremolo effect is transformed into timbral complexity, sustained pitches predominate. The aforementioned timbre-rhythm relation is now extended to include vertical pitch combinations.

Now we must relate the preceding to the imago-abstract sound. "Dance of Dawn" is a purely electronic tape consisting of vocal, instrumental and electronic timbres. It is not programmatic, but many of its sonorities are highly suggestive if taken out of the context of the entire composition. The tremolo sound discussed above, for example, seems to depict sounds of nature (crickets, birds, etc.). Because of the way in which Priscilla blends these elements, both acoustically and structurally, the images that they might normally suggest give rise to more abstract concepts.

Finally, Priscilla's treatment of dynamics should be mentioned. She employs the entire amplitude spectrum - from practically inaudible to very loud thereby adding another dimension to the sound environment.

Barton and Priscilla McLean have managed to develop an individual approach to electronic composition, and this is critical for all composers. Their music and essays (see Discography and Bibliography) should be examined by those interested in this medium, and a brief list of supplemental readings and recordings is included for further study.

DISCOGRAPHY

Barton McLean: "Spirals", CRI SD-335.
"Dimensions II", "The Sorcerer Revisited", and "Gensis", Orion ORS-75192.
"Song of the Nahuatl", Folkways (forthcoming).

Priscilla McLean: "Dance of Dawn", CRI-355.
"Invisible Chariots", Folkways (forthcoming).

BIBLIOGRAPHY

Barton McLean: "Coping with Shattered Illusions". Synapse (forthcoming).

Priscilla McLean: "Fire and Ice: A Query". Perspectives of New Music, Vol. VI, No. 1 (Fall/Winter), 1978.

Barton and Priscilla McLean: "Philosophies and Soliloquies". ASTERISK: A Journal of New Music, Vol. II, No. 2 (May), 1976.

SUPPLEMENTAL READINGS AND RECORDINGS

Berio, Luciano. "Visage". Turnabout TV-34046 S.

Ernst, David. The Evolution of Electronic Music. New York: Schirmer Books, Macmillan Co., 1977.

Fletcher, Harvey, Blackham, E. Donnell, and Stratton, Richard. "Quality of Piano Tones." Journal of the Acoustical Society of America. 34(1962): 749-761.

Mimaroglu, Ilhan. "Prelude No. 1" and "Piano Music for Performer and Composer". Turnabout TV-34177.

Schaeffer, Pierre. "Etude Violette". Philips 6521 021.

Ussachevsky, Vladimir. "Sonic Contours". Desto 6466.

LETTERS!

....continued from page 38

PROBLEMS

One problem is physically warehousing these records, shipping containers, stamps, address labels, mailing lists, and the like; this is also a factor that must be included in the cost of running PR. So, PR is going to have to have a certain amount of space--it couldn't be operated out of someone's closet, although a garage might make do...

Another problem is raising the capital to get the thing off the ground, although it's really not all that hefty. For a ballpark figure of $2,000 it would be possible to press 1,000 good quality EPs, ship them, and minimally promote them. This figure could maybe even be trimmed, but by how much I don't really know offhand. Nonetheless, this isn't really prohibitive. Assuming a profit on the sampler record, selling these would provide enough funds to keep the company afloat as more orders come in for records represented on the sampler. Then the records would be pressed and sent. The key point is that the prices of anything offered by PR would have to be capable of making a profit, or the company will not be able to grow--and it will have to grow if it is to provide more music to more people.

CHOOSING ARTISTS

The people running PR would pretty much have to have the final say over what will be chosen for inclusion on the sampler record. This fails to solve one of the problems with traditional record companies --- what if the person listening to the music just isn't into your particular groove? Hopefully, however, the people at PR would genuinely listen to things, get a few different opinions, and evaluate with an open mind rather than just playing the first 30 seconds to see if it has a chorus you can hum.

FINAL TOUCHES

Artists could also be selected by people already on the label; they would receive tapes for evaluation, and vote on what new artists they'd like to see on the label. This kind of thing appeals to me--that way, if you like someone's music, you can be pretty sure they'll like people that you'll like.

FINAL COMMENTS

There are probably at least one or two dedicated music aficionados who have the interest, the stamina, the dedication, and the objectivity to make this thing work. There is hopefully a minimum audience of 1,000 people or so who are interested in new music and would love to see something like this happen.

There are doubtless refinements that could be added, details to think of, and problems to solve. But by creating something in-between a "tape club" and a full-fledged record company, maybe it's just possible to please most of the people most of the time. Comments and genius ideas are greatly needed...let's have'em.

Craig Anderton ●

Equipment Exchange

A place for our readers to offer for sale or trade equipment related to music and electronics. Keep listings as brief as possible and enclose $1.00 for each listing. Persons responding to ads should write directly to the other party. DO NOT write to POLYPHONY. Polyphony is not responsible for any claims made in ads or results of transactions. We reserve the right to refuse or edit any ads submitted.

FOR SALE: 2720R with glide, $150. Functional, needs calibration. Cords included. Gretsch Pro Bass amp, $100. Will take offers. Richard Rosser, 2500 Bobwhite Trail, Edmond, OK 73034.

FOR SALE: 4700S Fully assembled and calibrated. $600 or best offer. Franklin Huffman, 13205 NW Porter Rd., Kansas City, MO 64152, (816) 891-3488.

FOR SALE: Paia 4700S built, tuned, great condition. All patch cords. 15711 Arbela Dr., Whittier, CA 90603, (213) 947-4104.

FOR SALE: Partially complete 4700 with 4730, (3) 4770s, (2) 4740s, LFO, Balanced Modulator, 2 oscillators (need work), road case and keyboard, 4711 Mixer and 2700 series VCA. Also Paia Gnome partially assembled. 4700 synthesizer has been custom normalized. Both 4700 and Gnome for $150. All literature included. David Graper, 104 St. Regis Drive, Chapel Hill, Newark, DE 19711, (302) 738-7585.

FOR SALE: Complete System - Contains 2720-1, 2720-2A, 2720-3B, 2720-3L, 2720-4, 2720-5, 2720-7, 2720-11 and 2720-12 in a 4761 Wing Cabinet. Has been used for processing electronic piano and guitar. Great condition. $225.00 postpaid. Donald Poole, 17 Eagle Lane, Tampa, FL 33549.

Local Happenings

The following people wish to contact other synthesists and electronic music enthusiasts in their area to organize ensembles and exchange information.

Thomas W. Medchill
4833 Bancroft
San Diego, CA 92116
(714) 281-1103

Gary H. Graves
Rt. 5, Box 5007
Killeen, TX 76541

Val Wyszynski
N.M. State University
Electronic Music Lab
Box 3F, Jacobs Hall
University Park, NM 88001
(505) 646-4517
Would like to talk to other college EM students as well as independents.

John Snyder
214K Mountain St. E, #170
Worcester, MA 01606
(617) 852-8548

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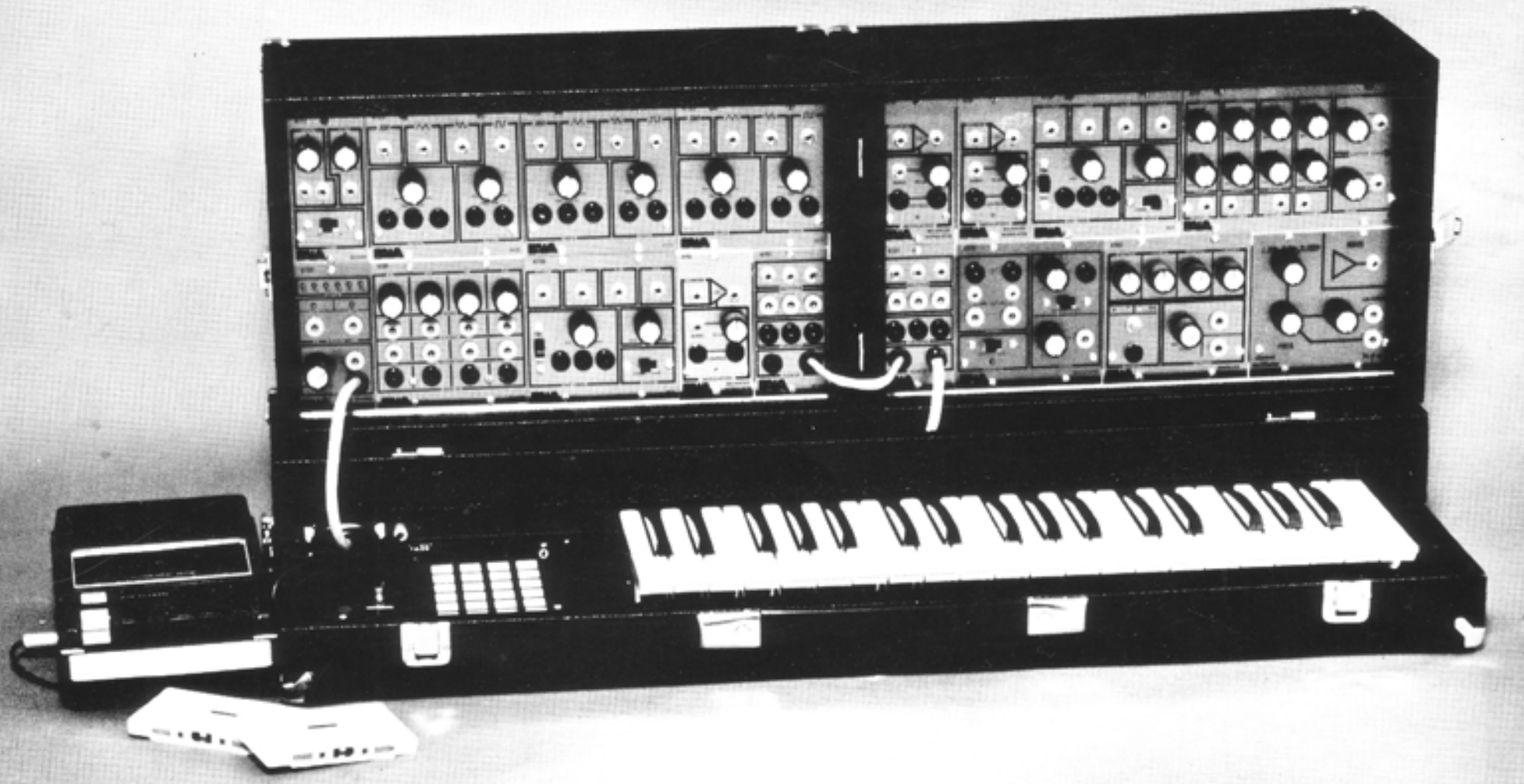

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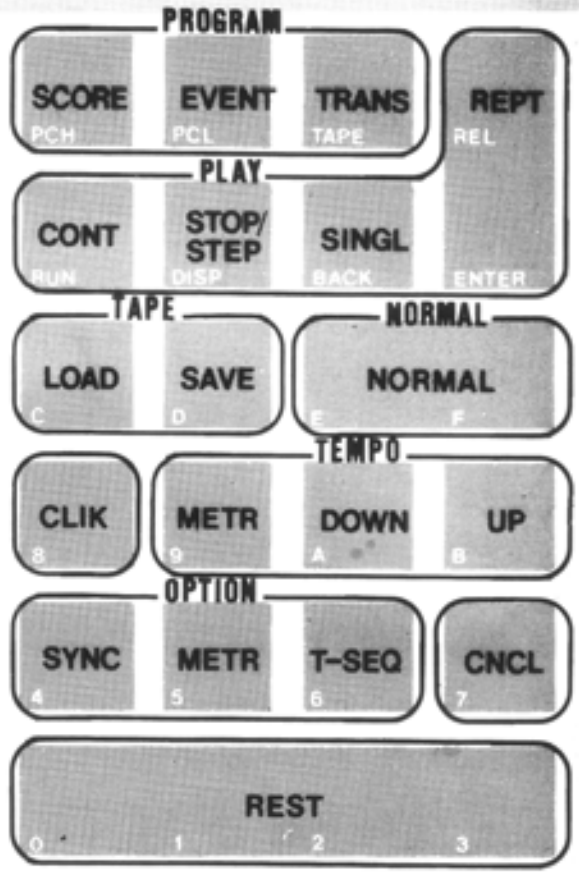

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