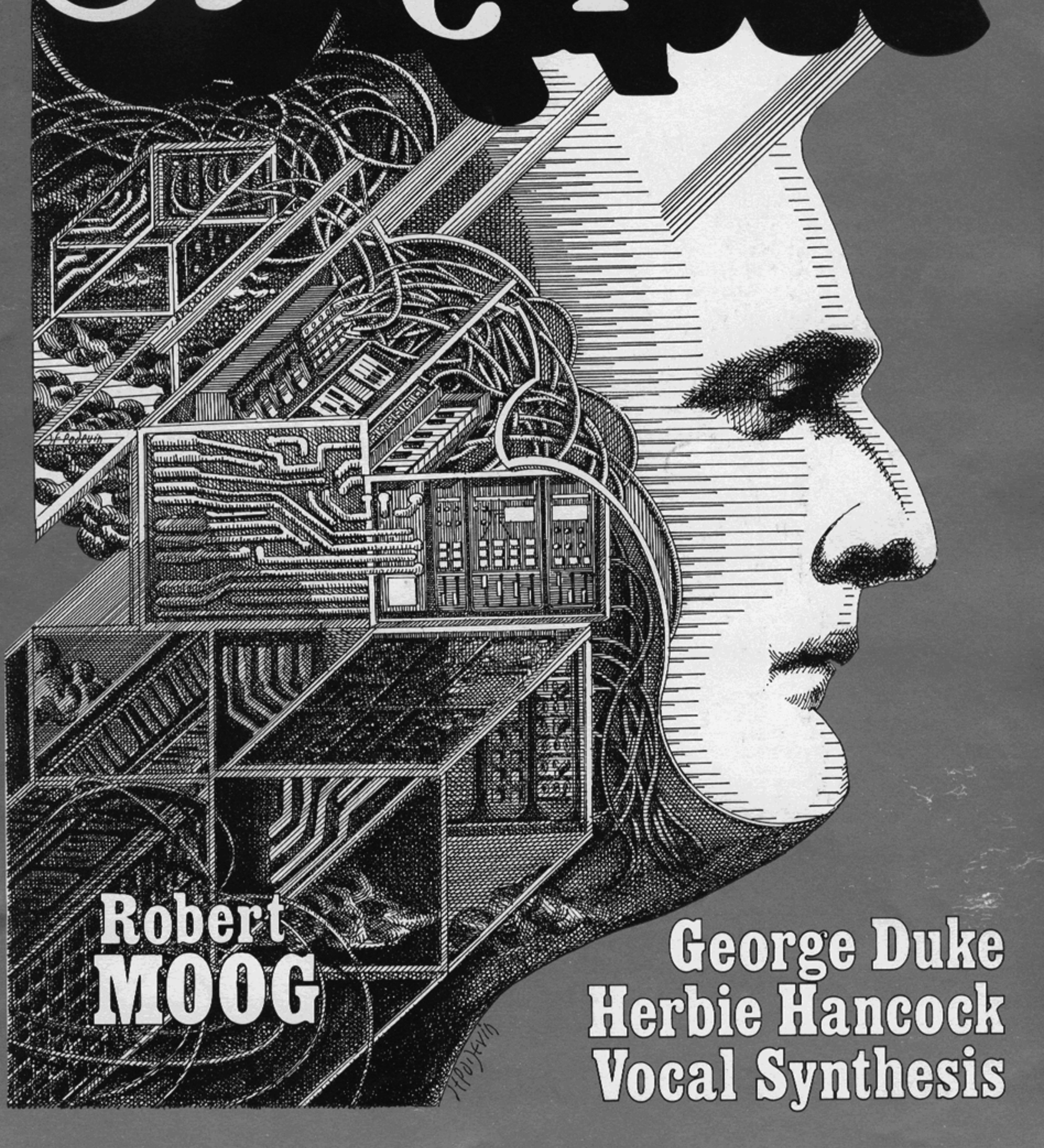
VOLUME 2 NUMBER 1

MAY/JUNE 1977 $1.25

the electronic music magazine

Synapse



Robert MOOG

George Duke
Herbie Hancock
Vocal Synthesis

"This is unquestionably the best polyphonic keyboard system available today."

PERFORMANCE

EQUIPMENT FIELD TEST

NEW YORK-**Oberheim synthesizers** are based on what might be called a "semi-modular" design that is unique within the industry. The basic building block of the design is a single module which integrates two VCO's, a state-variable two-pole VCF, VCA, LFO and two ADS envelope generators into a single control panel. This module is marketed separately as the Oberheim "Synthesizer Expander Module," and constitutes the individual voices of the Oberheim polyphonic synthesizers. The other modules available (in various configurations) include an 8 x 2 sequencer with self-contained clock, sample-and-hold, and noise generator (the mini-sequencer"), output mixers, and two kinds of keyboard electronics: 2 and 4-or-more. In addition, the company has just released a digital-memory "Programmer" module which can be used either as an accessory or as an integral module.

Although, like any modular synthesizer system, polyphonic Oberheims can be ordered in a wide range of custom configurations, the stock versions available are two, four and eight-voice models. This report is concerned with the **four-voice** Oberheim.

OBERHEIM Four-Voice Synthesizer

Polyphonic Synthesizers. There are two schemes in use today for producing "polyphonic" synthesizers: the first is essentially a hybrid organ-synthesizer design, the second is "pure" synthesis. In the first scheme, a master oscillator is divided down to the proper audio frequencies to produce a tempered scale, and these are individually processed through a "synthesizer-on-a-chip" for each key. The PolyMoog is the best example of such a design. The advantages of doing it this way are: 1) There will be a note for each key even you lay an arm on the keyboard, just as with a piano or organ. 2) The audio event produced when a key is depressed can be more intrinsically interesting, because of dynamic filtering and enveloping, than those produced by an organ or piano.

The disadvantages — in comparison with the "pure synthesis" designs, are that: 1) There is really only **one** oscillator. Therefore all pitches must bend or modulate in parallel; and there can be no use of complex modulation-produced timbres. 2) Since it is impractical, if not impossible, to provide **separate** adjustment for each characteristic of each key-chip, the manufacturer must design for parallel control of most or all of them by a limited number of panel sliders or knobs. Thus the possibilities for producing a wide variety of dissimilar events at the same time is **severely** restricted. In the case of the PolyMoog, for example, there are limited provisions for using a "split keyboard", but in several crucial respects such as attack time, both sections of the keyboard must remain uniform.

In the second system design, used by Oberheim, the number of simultaneously sounding keys is limited by the number of voice modules in the synthesizer; but since each voice is really a completely separate synthesizer from the others — they share only their power supply — there is no design limitation whatsoever on the sound produced by any of them. So, for advantages of the Oberheim system, let's list the following: 1) Freedom to set up four simultaneous voices completely unlike each other. 2) Capacity to produce inherently pitch-inflected events, since there are two VCO's that can enter into the production of each single event from the keyboard. There is no "master oscillator" with a divider network; a four-voice Oberheim actually has eight VCO's. 3) Inherent capacity to produce usable modulation timbres. (This is not a capability of stock models but requires some modification. I mention it because the other system is **inherently** incapable of separately modulating individual pitches.

Against these, we must stack the following disadvantages: 1) Limited number of simultaneously sounding keys. On the stock four-voice the limit is of course four keys at the same time. This can be expanded to eight — at a considerable investment. 2) Learning time and setup time. The number of panel controls can be somewhat daunting, and in live performance only long practice will make it possible to move quickly and smoothly from one sound to another (this is remedied by the programmer accessory.)

General Evaluation. I, and the staff and students of the Boston School of Electronic Music, have been working with a Four-Voice Oberheim Synthesizer for over a year. We have played it in performance, taught with it, used it in studio work. Among the very few genuinely polyphonic synthesizers on the market, it is outstanding in design, in workmanship and in serviceability. The hardwired patching on the stock model is carefully chosen for greatest flexibility in a small panel space; with some practice even a stock model **without** the programmer can be used fluently in live performance. With

Cont. on pg. 33

PERFORMANCE

PAGE 32

Programmer Module

JANUARY 21, 1977

Notes fr. 3

me got a taste of what was to come when my wife, Connie, PERFORMANCE editor Nick Nichols and I ambled past a sun-room minute the main party area, wherein a quartet of dresser-type card players reacted to the cowboy hats in syncopated startled stares. With a lot of good food, drink, and conversation later, CBS VP's **Ron Alexenberg** and **Rick Blackburn** introduced Big Charlie, standing in front of an elaborate mantle graced by huge portraits of President Andrew Jackson and his beloved wife Rachel. A few minutes after the brief but enthusiastic ceremony, Marshall Chapman walked up to a group of us and said, "Hey, did y'all see Andrew and Rachel raise an eyebrow when Charlie was standing up there?" Indeed, but it was really a grin. I'm sure — after all, not since Andrew has Washington, D.C. seen an inauguration such as the one Charlie and a lot of others are going to help this one to be. As Charlie aptly put it, "I been sayin' the South's gonna do it again — well, by damn, it's done done it!"

BILL LITTLETON

Neighbors fr. 3

the few remaining practioners of the art of the elegant letter writing.

All of which set the format of Bill Littleton and Neighbors — loose, wide open, ebullient and structured to show off talent. Bill likes. Musicians appearing on various nights included **Aubrey Kelly**, mouth harp; **Charlie Gore**, dobro; Bill's longtime friend **John Bailey** on bass; PERFORMANCE **Scott Perry** on drums; and a brand-new fiddle player in town, **Davis Grubb**. Contributing a tune or two along the way were singer/songwriter **Joe Sun** and **Doug Dillard**, president of the only black-owned record label in Nashville.

A good-natured, informed and [illegible] figure on stage, with a strong stage [illegible] Will Rogersesque anecdote, the lean, lanky Littleton looks like a cross removed of Jed Clampett in [illegible] Hillbillies. A natural 6'5", he top[illegible] top worn another 6-8" of straw [illegible] which is rimmed with crochet[illegible] from friends. The whole pict[illegible] rests on a well-worn pair of [illegible]

To anyone whose ears are [illegible] acclimatized to AM radio, [illegible] is probably impossible to [illegible] voice is rough and raw, and [illegible] affirms from the stage, be

Chequepoints fr. 4

Despite the material, his band doesn't rock, but plays with a more country feel. He himself comes on strong in a dazzling white outfit ablaze with sequins, while his band, the **Dream Lovers**, are dressed in red pajamas. His act is polished and smooth and put together for maximum audience response, which it gets.

He also has media consciousness. His first set featured a lot of visual humor. For the radio show, he added some impressions of country musicians that could also be enjoyed unseen.

Basically, though, Craddock is a performer in the Elvis Presley mold. He looks a bit like Elvis, except for a Robert Redford smile, and inevitably, he does an Elvis impersonation, although it's to his credit that he does it as a parody.

As Elvis, he's entertaining. If he can get a little more into the essence of Billy Craddock, he might just achieve an image breakthrough that will add a whole new following to his country fans.

AL RUDIS

Equip. Field Test fr. 32

the programmer, the instantaneously available range of sounds that can be obtained from the Four-Voice Oberheim far exceeds that of its nearest competition. This is unquestionably the best polyphonic keyboard system available today. It is unlikely to be surpassed, or even equalled, for some time to come.

NOTE: The manufacturer maintains that [illegible] while the case that the unit comes with is [illegible] sturdy for heavy road work, they recommend supplementing this, especially for heavy air transport, with cases built for shipping by commercial case companies.

JAMES MICHMERHUIZEN

James Michmerhuizen founded the Boston School of Electronic Music in 1972, two years after writing the Arp 2600 Owner's Manual.

JANUARY 21, 1977

"There are two schemes in use today for producing 'polyphonic' synthesizers: the first is essentially a hybrid organ-synthesizer design, the second is 'pure' synthesis. In the first scheme, a master oscillator is divided down to the proper audio frequencies to produce a tempered scale, and these are individually processed through a 'synthesizer-on-a-chip' for each key."

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These excerpts are taken from a Field Test on the Oberheim Four-Voice Synthesizer performed by James Michmerhuizen, founder of the Boston School of Electronic Music, for the January 21, 1977 edition of "Performance."

Write us for reprints of the Equipment Field Test as it appeared in "Performance" and/or a catalogue of the complete Oberheim line.*

Oberheim

Some Things Are Better Than Others

Oberheim Electronics, Inc., Dept. MS
1549 9th St., Santa Monica, Ca 90401

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the electronic music magazine

Synapse

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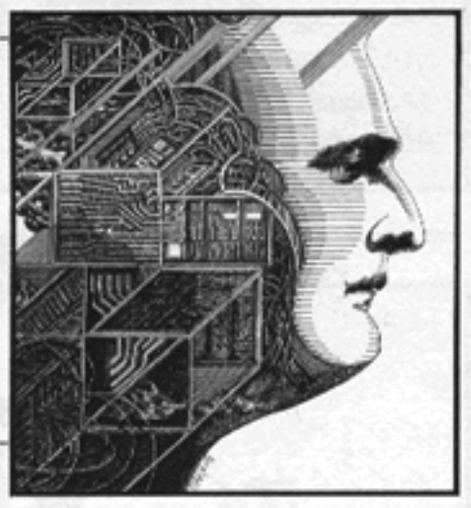
George Duke
Not just another piano player
Doug Lynner 17

Star Instruments
An adventure in percussion synthesis
Phil Terr 21

Herbie Hancock
"New instruments, new music."
Bryce Robbley and Doug Lynner 23



Robert Moog
An interview with the most influential man in contemporary electronic music
Carter Thomas 27

Learning Voltage Control
Politics, problems and substance
Alex Cima 31

A Closer Look at Digital Dronezilla
Build a digital performance instrument
Phil Loarie 32

Analog Programming
Alternatives to the One Note Organ
Eric Valinsky 34

Vocal Synthesis
Keyboards, guitars, horns, woodwinds, percussion . . . why not voice?
Peter Hillen 37

Number One	2	Giveaway	16
Letters	2	Synthesis	41
What's Happening	6	Equipment	42
Discola	8	Computers	44
Books	11	Listings	46
Performance	14	Classifieds	46

Vol. 2 No. 1

It isn't every day that a magazine begins its second volume. In light of this auspicious occasion, Synapse decided to publish a special issue. Nor is the "occasion" the only reason. There is a lot of activity in the electronic music world and to let the reader know about it is the purpose of this magazine.

For instance, did you know that Robert Moog's design influence is felt not only in synthesizer manufacturing but in guitar and amplifier manufacturing as well, and that Herbie Hancock was influenced by synthesizers more in the past than the present, and that George Duke expects more integration between acoustic and electronic, or that a new manufacturer is putting its energys behind percussion synthesis? If not, read the four interviews in this issue and if so, read them anyway. They all have more to say.

LETTERS

Good paper, too
I'm amazed that someone is publishing a magazine that treats VC Instruments intelligently, and on good paper too! I play guitar and have a guitar synthesizer interface (360 Systems). I use this with a four panel Serge system. I would like to see more equipment reviews and circuits. Keep up the good work.

Christopher B. Muir
Brookdale, California

Recording
I thought your magazine was superb. I do home multi-track recording and have a fantastic studio synthesizer—Electro-Comp 101. It was interesting to see the article on recording with two cassette decks. I don't have the best deck, but my 7140 Dokorder allows quite a bit of room for creative recording, Outrageous magazine, really.

Alonzo Powers
Richland, Washington

Self Defense
I have recently learned of your magazine (Jan/Feb 77) and subscribed the day I saw my first issue. In this issue, you ran a magnificent article on Patrick Gleeson and his rendition of Holst's "The Planets". In this article he is constantly putting down Tomita's version of the same piece. I feel that Tomita's rendition is both technically as well as musically superior to that of Gleeson's. Why don't you do an article on Tomita and give him a chance to defend his piece?

Thanks so much for the help, and keep up the good work!!

Sincerely,

Steven C. Bilow
Encino, California

Keep your eyes on our fall issues. Satisfaction will be found there.—**Ed.**

Odyssey Modification
I just got my first issue and I am very impressed. I want more! Could you put me in contact with Arp Odyssey owners who have expanded with kits, modules, and synthesizers of other makes such as, CFR Associates, E-mu, Aries, Oberheim, Roland 102 etc. I would like to expand my

The SLAVEDRIVER is here and it's time for keyboard players to move over!

Hook a slavedriver between your own guitar and your favorite synthesizer! You'll get all the sounds that you'd get with the keyboard, and more that can only happen for guitar players. That's because only the SLAVEDRIVER gives you *total* control over the synthesizer's functions. For example, it'll follow you at any parallel interval over a nine-octave range, copy your dynamics, trigger filter sweeps every time you pick a note, and it even lets you process your guitar sound through the synthesizer. Step on the foot control and you'll hold a note "forever," or transpose it to any parallel harmony. With a SLAVEDRIVER, you'll back up your best guitar sounds with a couple of extra parts from your synthesizer. It's like having a couple of extra guys behind you! And you can use *your own* guitar, plus it lets you slide, bend notes, and it copies right-hand punctuation too. So when you try out guitar synthesizers, make sure you're playing the one everybody else is into. Write us for the whole story, and have your dealer get you the SLAVEDRIVER to try out.

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360 SYSTEMS

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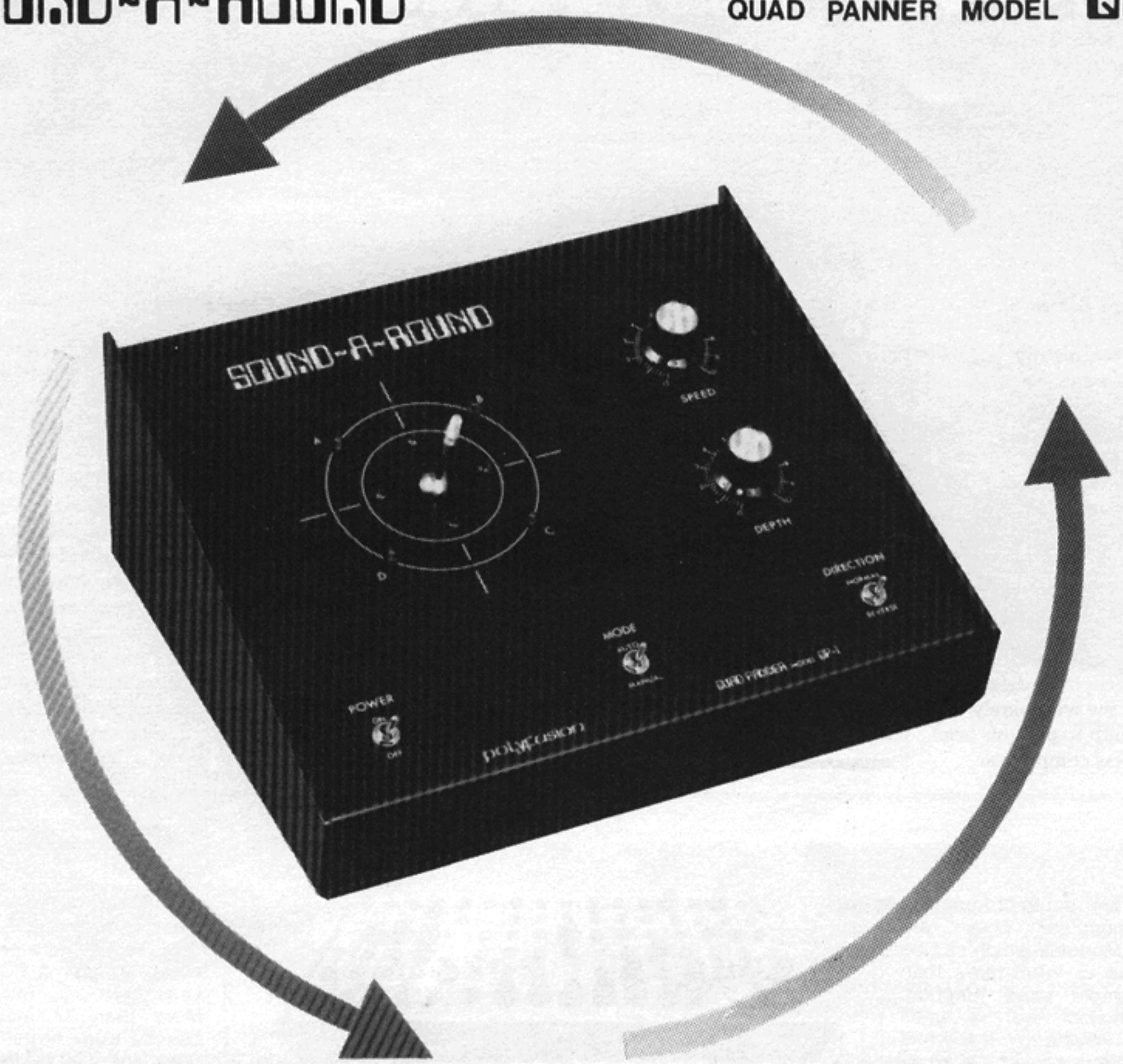
SOUND-A-ROUND

QUAD PANNER MODEL QP-1



The SOUND-A-ROUND can turn your quad system into a dynamic, moving sound environment.

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LETTERS

Odyssey, but I don't want to make costly mistakes. Long live Electronic Music.

Forrest E. Jehn
110 Lazy Acre Road
Wausau, Wisc. 54401

We have included your address so that Odyssey owners can reach you.—**Ed.**

Siluurian Slime Beings Invade Earth
Alas, as you too plainly perceive, this is not the promised Poly-Box review. An invasion of the dreaded Siluurian Slime Beings prompted the Guardians of the Galaxy to beg my assistance in keeping a hapless Earth from being totally overrun. Naturally, the effort was successful and the Siluurians were sent packing back to Andromeda, but not before my nightlong exertions in defense of mankind left me with barely enough strength to pen this brief note, much less complete a review that is promising to be one of the most incisive ever to grace the pages of SYNAPSE. So, for me it is off to a photon re-energizing cubicle for the strength to make it to the weekend, and, for you, I swear by the Seven Sons of Moldar that the review shall be in your hands no later than Friday morn-

Tom Davey

Hmmm.—**Ed.**

SYNAPSE back issues are available!

Quantities limited. Volume 1 Number 4 **Malcolm Cecil & TONTO** $2.00. Volume 1 Number 5 **Pat Gleeson, Gary Wright** $1.75. Volume 1 Number 6 **Synthesizers on the Eco-Front, Roger Powell and Todd Rundgren** $1.50. Enclose 50 cents per copy for first class postage and handling. Send orders to Synapse—Back Issues, 2829 Hyans St., L.A., Calif. 90026, or use the enclosed postage paid subscription envelope.

Keith Emerson
I just subscribed to your magazine through the Electronic Music Dept. of the college where I am currently a graduate student, and your magazine is fantastic. I'm a keyboard player with a band specializing in original material along the lines of classical-rock. A particular hero of mine is Keith Emerson, and I was wondering if, in any of your previous issues, you had covered his equipment or him? Any information that you could provide on Mr. Emerson and the band would be greatly appreciated.

Sincerely,

E. Moran
Petersburg, Virginia

There is a little of the information you seek in this issue's Robert Moog interview. We have more planned in the future but no details, yet.—**Ed.**

The Word
Yes Angela, there is a word (at the end of Laserium II).

Sincerely,

Ivan Dryer
Laser Images

P.S. Thanks for the kind words.

Lesser known systems
After receiving my first issue of Synapse, I was surprised to see such an abundance of lesser-known systems. Is this an indication of differences in quality or something else? I have considered buying E-mu and EML synthesizers, but instead purchased a 2600 and an Oberheim 4-voice. Is there something I don't know about this situation? Also where to get info on Serge Systems?

Charles Haglan
New Orleans, Louisiana

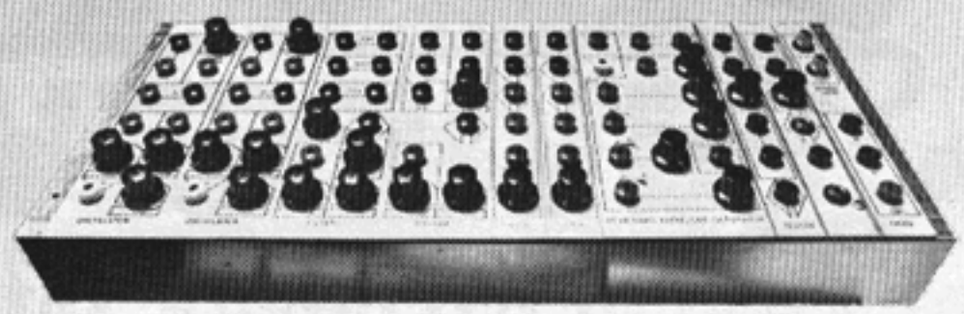
The lesser known systems (they all were at one time) have always been there and there are more all the time. There has just never been a magazine to let people know about them. Check the Listings for manufacturers' addresses.—**Ed.**

What are patch-programmable modules? These are Serge Modules which can be patched to fulfill more than one single fixed function. This makes even a small Serge System many-fold times more powerful than an equivalent sized traditional synthesizer, because the Serge can be patch-programmed to function in a far wider range of ways, according to need.

Check out the following Serge System:

1 New Timbral Oscillator, 1 Standard VC Oscillator, 1 VC Filter (BP, HP & LP), 1 Dual Positive Slew, 1 Dual Negative Slew, 1 Dual Audio Mixer, 1 Triple Waveshaper, 1 Smooth & Stepped VC Generator, 1 VCA, 1 Ring Modulator, 1 4 Stage Programmer (presets), 1 Mic. Preamp, 1 Reverb.

Inexpensive? With a power supply, patchcords, Panels



and two metal cases, the cost of this system is $1111.50 in kit form, $1500.00 fully assembled, f.o.b. LA, Calif.

By patch-programming this system, a whole set of additional functions becomes possible, including:

8 VC Oscillators, five of which can have VC waveshaping. 3 VC Portamento (lag) modules, not including the one built into the NTO. 1 VC rate controlled Sample and Hold. 1 VC Staircase Generator. 1 VC pseudo random timing and envelope generator. 2 Envelope Generators with independent VC rise and fall times. 2 Trapezoidal low frequency VC generators. 1 Triangle wave low frequency VC generator. 2 Envelope detectors (followers) with VC decay rates. 2 VC Pulse delays and pulse monostables. 2 VC sub-harmonic sawtooth generators (audio range). 2 VC sub-harmonic timing pulse low frequency generators. 3 Non-linear audio "filters" (can be used as VCAs). 1 Control Voltage Multipliers. 3 Non-linear distortion generators with frequency doubling, quadrupling, etc. 1 Pitched percussive or resonant sound generators. Etc. . . .

Features of the Serge:

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Catalogs available at $1.00. The Serge System Instruction Manual available at $2.00 each. California residents add sales tax. Refundable with the first order. Delivery time is from 4-7 weeks.

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Hollywood, California
90029

serge modular music systems

64 SYNTHESIZERS FOR $1195

Traditionally, the use of synthesizers has been plagued by one fundamental limitation — the inability to quickly and accurately set up a desired sound. Preset synthesizers reduce this problem, but they also sharply decrease your control over the sound.

The Model 700 Programmer successfully eliminates these problems by enabling you to set up sounds with your synthesizer and record them into memory. Then, at the simple touch of a button, you can recall any of 64 different sounds that you have recorded. No longer are tedious and time consuming manipulations of controls necessary.

Significantly, the characteristic sound of your synthesizer is not lost in the process (a Mini-Moog still sounds like a Mini-Moog), nor is the ability to selectively pitch bend, modulate, or glide while playing. The sound can also be changed remotely by the footswitch included, or by a number of other controllers, including sequencers.

Suggested list price $1195

Sequencers are just now starting to be recognized as valuable accessories to synthesizers. Most sequencers, however, restrict the user to sequences of limited length, and only one or two different sequences are available. Timing is also very difficult and time consuming to program accurately.

The field-proven Model 800 Digital Sequencer provides you with the capability of programming sequences of notes directly from your synthesizer keyboard rather than from a row of pots. It reproduces both the pitch and the timing exactly as played. This makes it extremely easy to set up a sequence, even in live performance.

Different sequences of both long and short length can be recorded and played back either individually or together with other sequences. Over 250 notes total can be remembered. The footswitch included enables remote control of recording and playback.

Extra memory is available in the Model 810 Dual Voltage Memory.

Suggested list prices Model 800 $875
Model 810 $495

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see us at the NAMM show in Atlanta

What's Happening

. . . **Allen Strange, Donald Buchla, David Morse, Stephen Ruppenthal** *and* **Patricia Strange (The Electronic Weasel Ensemble)** *will be offering a week long electronic music course beginning June 19. The course will take place at Jumpoff Joe Ranch, 3886 Winona Rd., Grants Pass, Oregon, 97526. Topics to be covered in the $275 course (includes a cedar log cabin and food) are electronic instruments, idiomatic composition, live performance, sound poetry and techniques of teaching electronic music. Academic credit is available for the course from the University of Oregon. Write Jumpoff Joe Ranch for more information.* . . . . . .

. . . *For those struggling to overcome the shortcomings of a home recording studio* **Westlake Audio**, *6311 Wilshire Blvd., L.A., Cal., 90048, is offering the Headphone Mult Box Model 1200, at $189. The box allows four outputs from a single input and is available with phone and XLR connectors.* . . . . . .

Model 1200 Headphone Mult Box

. . . . . .

. . . **Rick Wakeman's** *return to* **Yes** *need not alarm fan's of his solo efforts. A&M Records reports that Wakeman will stay in Switzerland after completing sessions with Yes to record his next solo album.* . . . . . .

. . . . . .

. . . **ARP Instruments** *has announced the unveiling of two guitar synthesizers at the Atlanta NAMM convention in June. On display will be the production prototypes. There is no date yet for their commercial release, but Synapse will let you know more about them as soon as we can.* . . . . . .

. . . . . .

. . . **Electrax** *is currently marketing plans for a guitar/synthesizer interface. The plans include octave division and multiplication as well as normal treatment devices. The plans, parts list and construction ideas are available for $6.* . . . . . .

. . . . . .

. . . **Sequential Circuits Co.** *will premier their* **Model 700 Programmer** *at the* **Los Angeles AES** *convention. The programmer is designed to pre-program small performance synthesizers, resulting in increased variety during a live performance.* . . . .

. . . . . .

. . . **Herbie Hancock's** *new album, entitled V.S.O.P., is scheduled for a late spring release.* . . . . . .

. . . . . .

. . . *Utah's claim to electronic fame,* **Steiner-Parker**, *has released two new synthesizers. The* **Minicon** *(designed to compete with the ARP Axxe and the*

turn to page 48

FULLY MODULAR STUDIO SYNTHESIZERS

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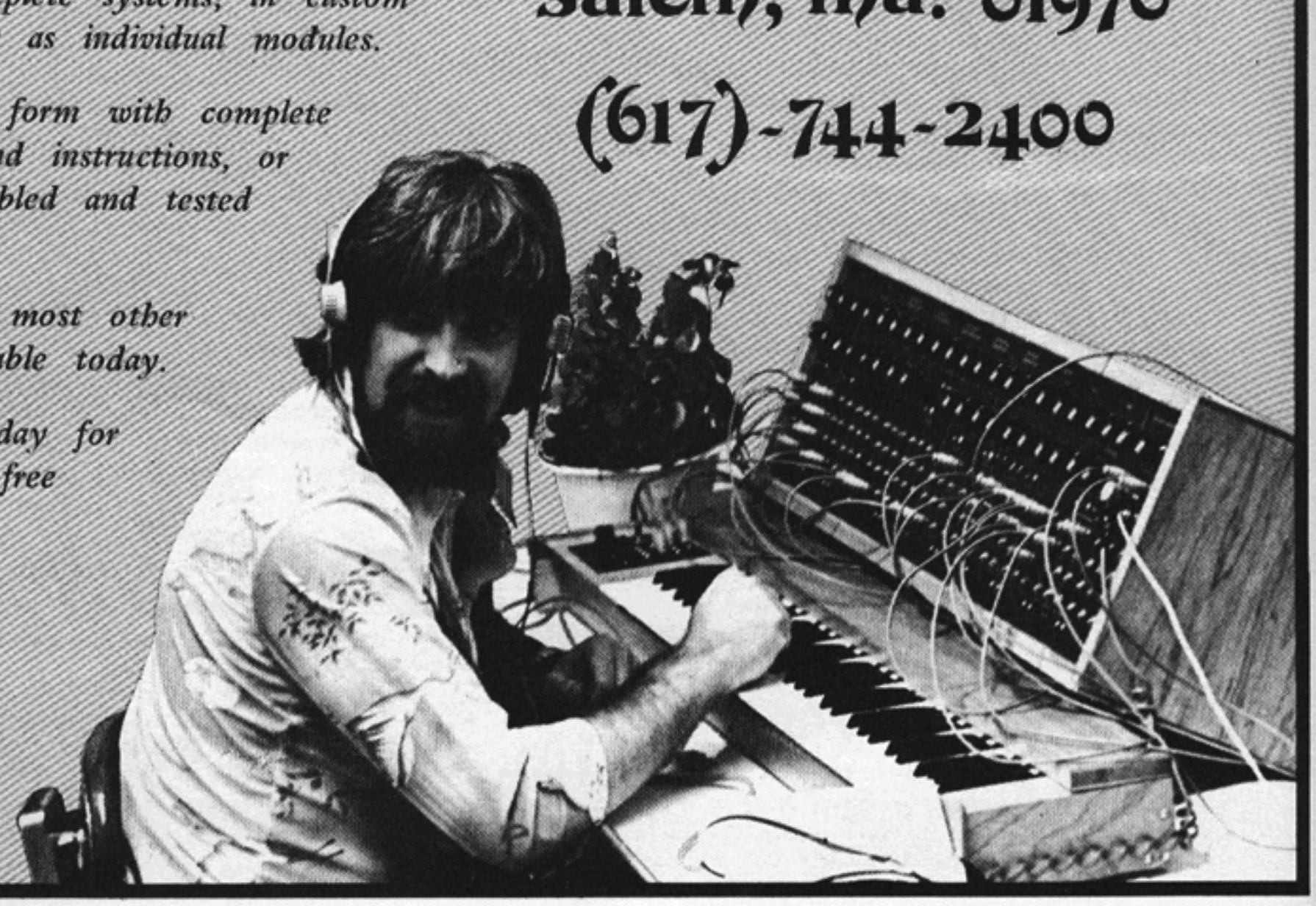

Confidence

MXR Professional Products Group

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Ra
Utopia
Bearsville BR 6965

Todd Rundgren must have been naughty in one of his previous album lives, for his current reincarnation is a lowly one. Since 1974 Rundgren has released four discs, two solo and two with Utopia, his house band. Although unequal to his earlier triumvirate of masterpieces "Something/Anything?" "A Wizard, A True Star," and "Todd," the later solo albums ("Initiation" and "Faithful") were the better half of Rundgren's output; "Ra" does not reverse the trend.

Despised by the critics, the two earlier Utopia discs featured dense, complex epics on mystic themes ("The Ikon," "The Seven Rays") that were fascinating for their progressive bravura if not precisely enjoyable. What passes for a mystic epic on "Ra" is "Singring and the Glass Guitar," an "electrified fairy tale" that is even sillier than it sounds. Other juvenile regressions are "Magic Dragon Theatre" and the astonishing "Hiroshima," a song that kicks a horse dead for thirty years with a tastelessness that masquerades as courageous social comment:

God, God is on our side, he
placed the power in our
hands,
To teach the yellow peril, this
is Christian mercy . . .
We'll show those Axis powers
how to make an oven.
Fry them!

© 1976 Earmark Music

The album is redeemed by two good tunes and the outstanding performances throughout. "Jealousy" (although partly plagiarized from "Black and White" on "Faithful") harks back in an engaging way to the punk days of "Something/Anything?". The cut that flashes the most solar power is one that Rundgren composed himself, "Communion With The Sun." It is both energetic and majestic, with elaborate vocals occasionally Queen-like.

Perhaps because not a single member of the original Utopia is now in the group, "Ra" is the least Rundgren dominated of all the Utopia albums. Rundgren has taken pains lately to emphasize that he considers himself just a member of the band. Indeed, a creative weight almost equal to Rundgren is synthesist Roger Powell, former artist-in-residence at Moog and free lance synthesizer soloist. I would place Powell among the top three performing synthesists, along with Jan Hammer and Mike Cotten of The Tubes. On "Ra" Powell excels with the rousing "Overture/Communion With The Sun" and his solos on "Hiroshima" and "Singring."

One reason "Ra" seems relatively eclipsed is that the songs are performed better than they are composed. Utopia seems unsure whether they want to be a progressive band, or do pop-rock, although Rundgren's own early career shows one can excel at both. If this is the target Utopia is aiming for, "Ra" is a miss.

—Tom Davey

Kraftwerk
Trans-Europe Express
Capitol SW-11603

Kraftwerk's mechanical minimalism reaches new heights in their new album. Kraftwerk's mechanical minimalism reaches new heights in "Trans Europe Express." "Trans Europe Express" relies on only a few thematic elements. Only a few thematic elements reaches new heights in Kraftwerk's impressionism of Europe Endless travel on "Trans Europe Express."

Riding on TEE (that is, Trans Europe Express) from ". . . Station to Station, at Dusseldorf City, meet Iggy Pop and David Bowie . . .*" Mechanical minimal Trans Europe Express, Trans Europe Express, clikity, clack, a mechanical disco soul train. Drum synthesis reaches new heights on T.E.E. Mechanical Mellotron doppler effect as Trans Europe Express passes by. Europe Endless mechanical EMS Vocoder instant cliché (hear Pink Floyd's dogs?) Rhineland Endless Folk tune melody mechanical minimal elements thematically.

Mechanically, "Trans Europe Express" synthesis reaches new heights by Kraftwerk. Painting vibrant mechanical pictures minimalistically. (If this is boring, so is riding on a train). Marvelous flanged mechanical "hi-hat cymbal" impressions. Marvelous minimalistic mechanical drum solo on T.E.E. Trans Europe Express. Trans Europe Express throughout Europe Endlessly riding, riding, riding on the Trans Europe Express. Mechanical Mellotron makes much expression on Europe Endless. Europe Endless makes much use of a 16 stage analog sequencer dum, ta da dum, ta da dum, ta da dum, ta da dum, endlessly across Europe.

Mostly "Trans Europe Express" is mechanically minimalistically marvelous.

*©Famous Music Corporation

—Danny Sofer

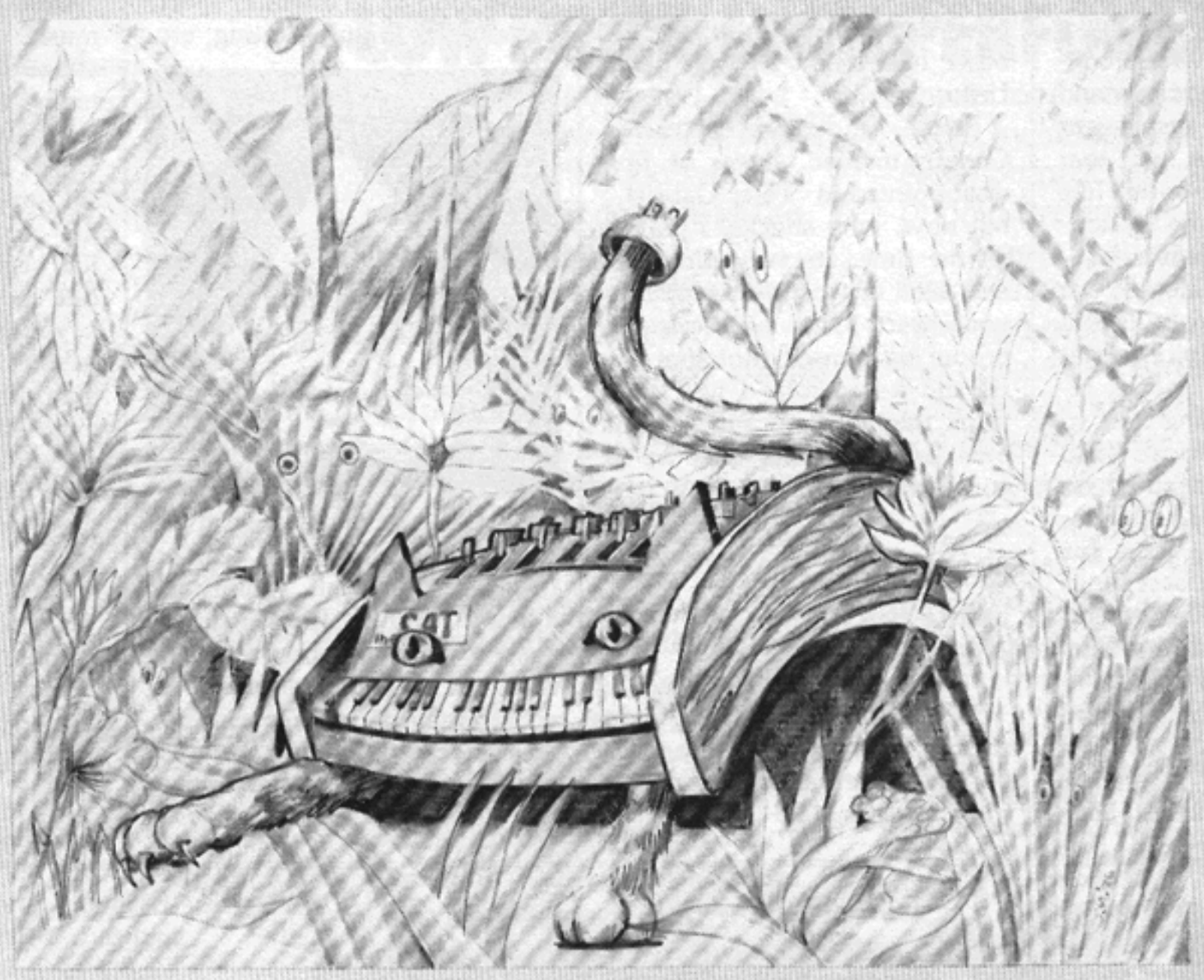
Peter Gabriel
Atco SD 36-147

After seven albums with Genesis and the gaining of a reputation as the Laurence Olivier of rock, Peter Gabriel has done an about face on this, his first album since The Split. Foresworn are allegorical tapestries of street punks fallen through the looking glass. Banished are the visions of planetary migration and the anguish over the decline of Britain. Instead he returns humbly, the costumes locked in the trunk; as he himself says on "Here Comes The Flood"; "The Actor's gone/ there's only you and I." "Peter Gabriel" is a mere collection of pop tunes made unique by Gabriel's literate approach and bizarre takeoff.

This is not to imply that "Peter Gabriel" is better than any Genesis album. It is not, not better even than the most recent "Wind and Wuthering," which is the least good Genesis album. But "Peter Gabriel" is still pretty off the wall. All sorts of crazy people are on this disc. Bob Ezrin produced. He's the one to finger for Kiss's "Destroyer" if you feel like writing a letter to the D.A. For "Peter Gabriel" Ezrin brought along his metal behemoth's Steve Hunter and Dick Wagner. More like Gabriel's old musical milieu is Robert Fripp, late of King Crimson, playing the banjo, while Larry Fast of Synergy is along

turn to page 10

WHAT'S NEW IN THE SYNTHESIZER JUNGLE.



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to help patch things up. Even the London Symphony Orchestra puts in an appearance; they were on their way to record "Tosca," showed up at the wrong studio, did "Down The Dolce Vita" and never knew the difference.

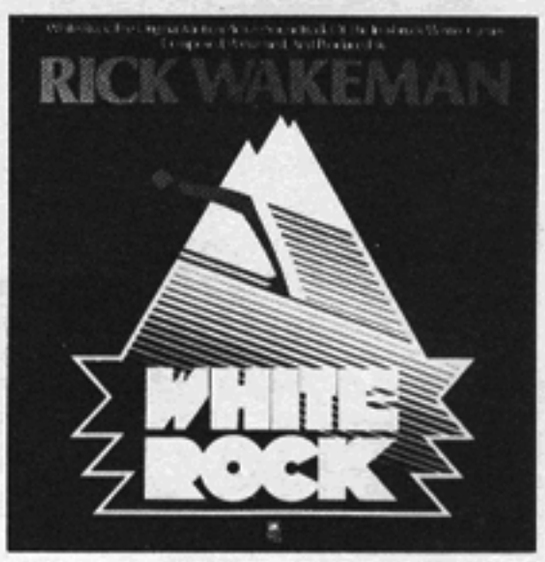
This diverse mix of, er, talent makes for an entertaining disc. Ezrin's storm troopers make way for Larry Fast, whose contributions are evocative and tasteful, avoiding synthesizer cliches. Gabriel's own fear, that the album would sound like "Sammy Singer and the Sessionmen" occassionally seems justified. No matter. Gabriel can sing up a storm, and he is still fond of altering his voice to suit the character or the mood, although there is nothing here to equal the virtuoso vocals (and virtuoso vocal processing) on the incredible "The Lamb Lies Down on Broadway." As for the tunesmithing, the best songs are the first three: the quietly menacing "Moribund the Burgermeister," "Solsbury Hill," a lyrical and affecting ballad, and the cynical rocker, "Modern Love." My favorite is among those three, but I cannot bear to choose. Two songs fall flat: "Excuse Me," and "Waiting for the Big One," which has a witty parody of Randy Newman's vocal style but bores at seven minutes. The most grievous oversight on this disc is the lack of a lyric sheet. The lyrics that are audible are more than quotable, but due to the curiously distant vocal ambience the other half might as well be in Urdu.

Being an unreconstructed Genesis maniac, I was at first disappointed in "Peter Gabriel," but now, why shucks, I play it all the time. Its very differentness kind of worms its way into your heart. Once Gabriel starts producing himself (not that Ezrin did a bad job—I just don't think they clicked) and gets his own band together he'll be in good shape.

—Tom Davey

Rick Wakeman
White Rock
A&M SP-4614

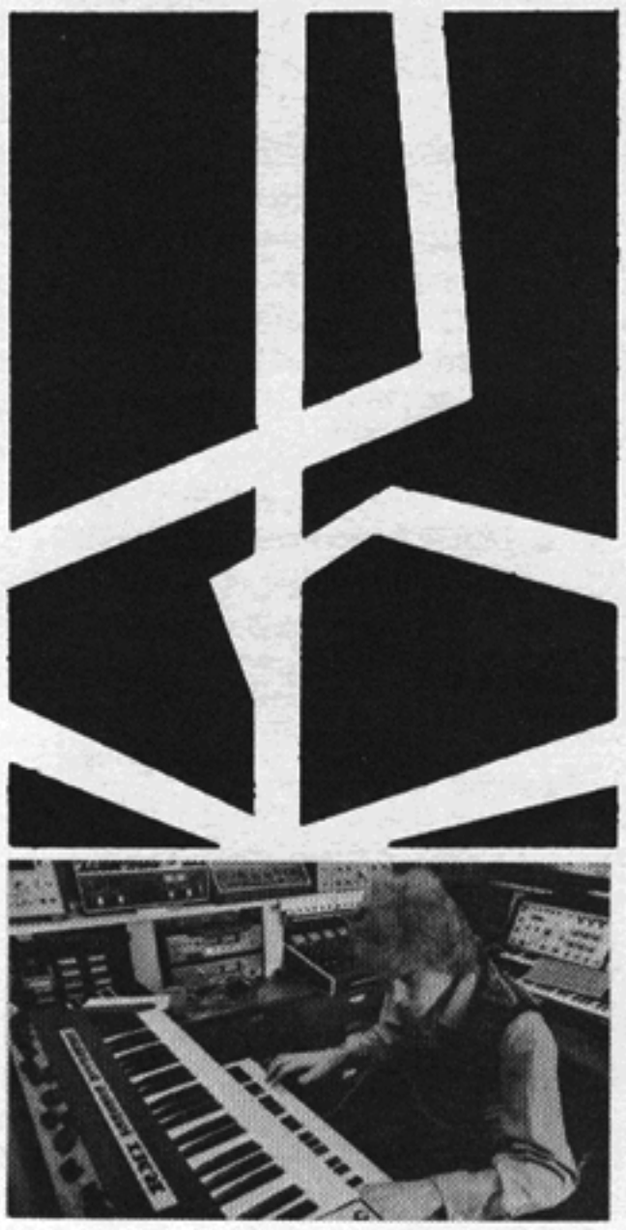
Rick Wakeman's latest solo effort, "White Rock," is an all out instrumental album mercifully affording no opportunity for the kind of vocal stiltedness that turned last years "No Earthly Connection" into an ortorio. "White Rock" is also a soundtrack, or eight excerpts from one. The movie of the same name is about the '76 Winter Olympics. The scheme of things has each album cut corresponding to a winter sport; bobsledding, figure skating, etc.



Alas, this is as much of a formal plan as one is likely to hear on this disc. Like all soundtrack albums, "White Rock" suffers acutely from the absence of the screen. Good movie music reacts to the film footage as much as it does to its own internal processes; without the footage the score is bound to be mystifying. With these realizations out of the way the listener can proceed to enjoy "White Rock", after a fashion.

Wakeman dishes out his usual potpourri of style and idea. Some of the album is frankly borrowed, like the quotation from Liszt's "Liebestraume" in "After the Ball" or the Gypsy music in "Montezuma's Revenge". Some of it is effect: tacky effect like the shooting synthesizer glissando in "Lax'x", which doubtless accompanies a ski jump; or striking effect, like the slowly phased cymbals at the beginning of the same cut. But mostly the music is sheer keyboard display. Whatever his recent lapses of taste, Wakeman's fingers remain among the nimblest still on the end of arms. This, coupled with the fact that these days he uses synthesizers almost exclusively as his lead line instrument, makes for some flashy solos, like the one on the title cut. Synthesizers are ubiquitous on "White Rock"; they are the cornerstone of the album's instrumental variety.

turn to page 47



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books

Electronmusic: A Comprehensive Handbook by Robert A. DeVoe Published by Electronic Music Laboratories, Inc.

Electronmusic is a manual for composing electronic music (which is electronmusic in DeVoe's terms) in a synthesizer/tape studio environment. The "tools" in such a situation are tape recorders, mixers, noise reduction, a bulk eraser, a volt-ohm meter, an oscilloscope, editing materials, maintenance materials, and a synthesizer.

From there, the acoustic and electronic production of sounds are outlined and projects such as building an anechoic chamber or projecting the images of sound waves as transduced through water are offered.

The book is made to be used in educational situations and has "class problems" at the end of each chapter. Many are imaginative and will make for active class time on the middle and high school levels.

Unfortunately, DeVoe makes some associations that are misleading and limiting for the student.

When defining Electronmusic, the author says "It *usually* can not be performed live, although many pieces are produced using *live* musicians *in combination* with tape."

Even with the underlining, at a time when live electronic performances are becoming practical and the instruments more capable, it seems counter-productive to limit the scope of instruction to only the tape medium.

In a section labeled, "Polyphonic V.S. Monophonic Keyboards", DeVoe dismisses polyphonic instruments with statements about beating, cancellation, and intermodulation distortion that occurs when multiple electronic tones are sounded simultaneously. The author says, "In other words many notes would be too distorted for human ears. "He further states that multiple VCO's would make the cost prohibitive.

Robert DeVoe's advice? "If you've gotta have polyphony—go buy an organ."

There are enough good projects and ample basic skill information in the book to make it valuable in a beginning course but I hope that instructors will point out the inconsistencies to their students.

—Phil Terr

The Evolution of Electronic Music by David Ernst Schirmer Books, N.Y., N.Y. 1977

The Evolution of Electonic Music is the most contemporary overview of electronic music to date. The author patiently exposes the various elements that led to the develop-

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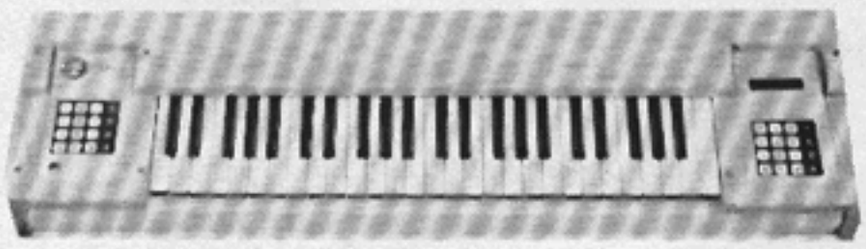

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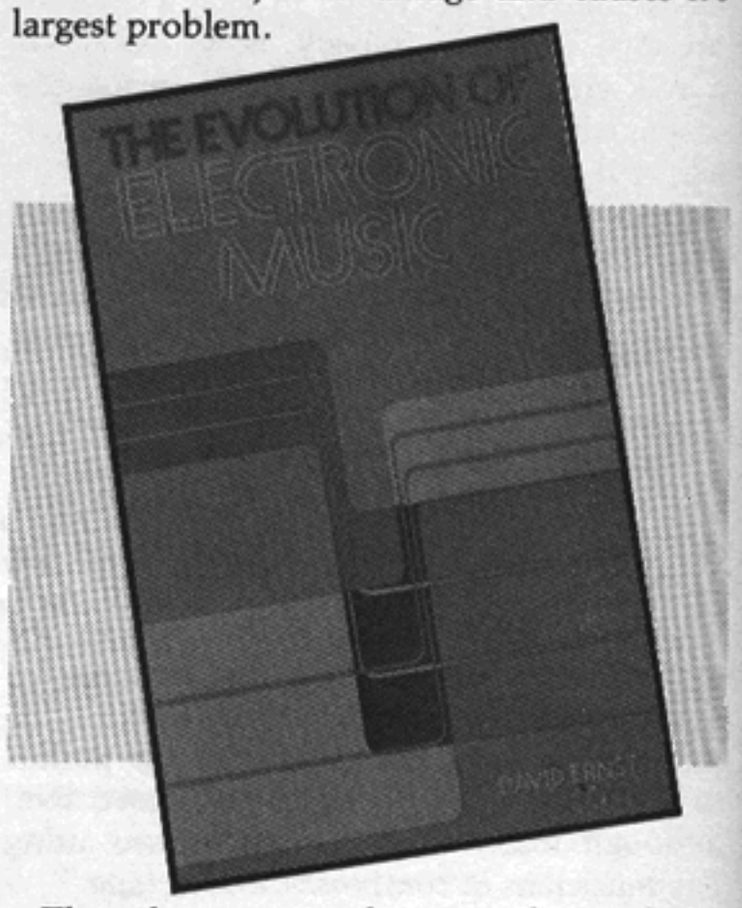
books

ment of electronic music and the techniques employed.

The book is divided into five parts according to the sources (sonic) utilized in the compositions discussed. Each section is amply illustrated and valuable discographies are provided.

The Evolution of Electronic Music documents through the middle of 1976. This constitutes it's major advantage and causes it's largest problem.



The advantage is obvious. The reader is left with a smaller gap between history and the present.

The problem is one of structure. Although the early compositional work in this field can be easily grouped and discussed, this does not hold true for recent music. This problem is apparent in Ernst's sections on popular electronic music.

Since the author cannot objectively document an "era in progress", he turns to a quasi-critical approach. Unfortunately, the scope is too limited to have critical validity and judging from some inaccurate statements (Robert Fripp identified as an ex-Yes member), I wonder if Ernst is the best critic.

But don't let all this dampen your enthusiasm. At the least, you'll be educated and your opinions about Jan Hammer, Paul Bley, et al, will be challenged. And besides, it's the most thorough book of its kind. All in all, you won't find a better electronic music history reference book.

—Phil Terr

Switched On Synthesizer
by Philip Springer
ALMO Publications 1977

This book could also be titled "Progressive Publisher comes to the aid of all Minimoogers and Odyssey owners". ALMO Publishers compiled a folio of popular hits from their

extensive catalogue consisting of contemporary playlist songs such as Peter Frampton (Show Me The Way), Toni Tennille (The Way I Want To Touch You), Paul Williams and Roger Nichols (Out In The Country), and Grace Slick (White Rabbit), altogether 11 pieces with anywhere from one to four arrangements each. Springer accomodates most synthesizer performers in that the faceplate of the Arp Odyssey and the Minimoog are reproduced to write the different patches.

For the most part the patches should be accessible to the majority of synthesizer players who no doubt are the ARP and Moog owners. However a universal patch is also written along with the others, this consists of a general graphic description of oscillator(s) routing and VCO/2 filter modulation. . . . perhaps to match the Minimoog's limitations, the ARP ring modulator goes unused or barely suggested, but this book is not a manual on electronic music although it could very well be part of the reading, it was designed with the player in mind, in simplifying what may be seen as technotalk and not musically descriptive. This book is very visual as ever patch is demonstrated either as an Odyssey, Minimoog, or Universal diagram. Because of the dominant appeal to a working musician not generally interested in esoterica the book avoids dissonant patches which in any case are not easy on the instruments primarily displayed.

Along comes a soundsheet with examples of the patches. Each arrangement shows the patches for synthesizers and the general chord structure, arrangements can be adapted for the particular number of musicians and for multiple keyboard players who may play a Fender Rhodes and synthesizer at the same time.

Springer includes an introduction to voltage ideas which really simplify the concept, he explains and draws the various waveshapes, and generally stays clear of a technical approach, that is saved for the glossary where allusions are made to radians, degrees, and integral multiples. Demanding more than the rest of the book, the glossary will be tackled by the more serious and technically minded of readers, particularly nice were the definitions on periodic waveform, phase, Q, and sample/Hold circuit.

To my taste, the most successful patches were Bass String provided for "I Won't Last A Day Without You", "Out In The Country", and "The Way I Want To Touch You", The Talkin' Wah-Wah was a great imitation of the talk box effect, the Morning Horn in "Morning Has Broken", the Snared Bass in "White Rabbit", the Ethereal Melodicum in "Out In The Country". The Celeste Chimes (two VCO's a minor 6th apart) was most pleasant. The Liquid Vibes patch in "We've Only Just Begun" was particularly nice. One patch provided tweetering birds, another a sustained filter drone which harmonized through the piece.

—Alex Cima

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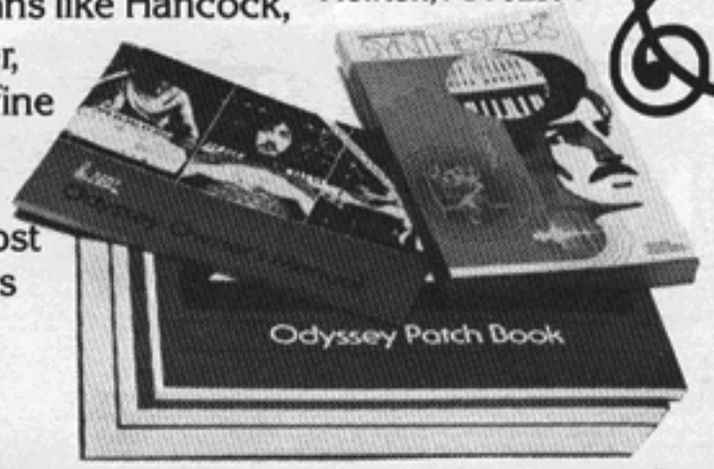

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PERFORMANCE

City Flow—a Work in Sound Liz Phillips The City University Graduate Center Mall March 29—April 30, 1977

The Mall of the Graduate Center, City University of New York is the first floor of the building, and is completely open to the street on two sides. The central portion is known as the Gallery, and here, rather than exhibitions of paintings, concerts of music and dance and installations and performances by visual artists occur. It is in this space that Liz Phillips presented City Flow, not outdoors, as previously reported in *Synapse*.

I witnessed part of the month-long event on April 6 and 11. A microwave field responded to the motion of the people walking through the Mall, by increasing the activity of the sounds. The activity was reduced by two capacitance fields which responded to proximity. Traffic noise from the street was miked, amplified, and modified, and in turn modified the synthesized sounds. In addition to her own synthesizer equipment, Ms. Phillips also employed some venerable old Serge equipment. For a fuller discussion of the techniques employed, see "Sound Articulates Space" in *Synapse*, Vol. 5.

The main attraction of the piece was to be the interfacing of the synthesizer equipment with traffic flow data generated by the city's computerized traffic light system. However, the city was late in coughing up the required interface device, which is typical of New York. That the event actually happened is also typical of New York.

What did it sound like? First off, it was ugly. The Mall is not accoustically isolated from the street. The traffic noise, quite loud to start, was amplified within the space. The electronic sounds were similar to the traffic sounds. But after about five minutes, one perceived that the grey noise of the traffic-like sounds was actually composed of subtle and beautiful hues. The city itself is like that—at first glance ugly, but then the beautiful architecture, parks, people are perceived. In that sense, City Flow was truly a piece for New York.

—Eric Valinsky

"A Celebration of the Curious" by the Real* Electric Symphony, Cat's Paw Palace of the Performing Arts, Berkeley, California March 25, 26, 27, 8:00 PM, 1977.

Bay Area performances have been known for looseness, and A Celebration of the Curious, presented by the Real*Electric Symphony, a loose confederation of Bay Area artists headed by Ron Pellegrino, was no exception. For those nostalgically attracted to the sixties, the series of three concerts was a genuine multimedia event, yet reflected the advances of technology and techniques in the last ten years.

The performances were to start at eight, which is when the audience began to stroll in, eating trail mix, looking at holograms by holographix. By 8:30, the performances began with caligraphy demonstrations by Tai Chi master Ngoh-Yun Hsu.

Friday night's performance was initiated by Quasar, the musical propaganda arm of the One World Family, a flying saucer cult. Their combination of religious folk-rock, cosmic Freddie go-go dancing, pornographic slides, and generally bizarre stage presence generated a strange energy which partially marred the evening. But it was a phenomenon worth experience once.

Events of technological note in the series were: live electronic music by James Gillerman on the ARP 2600, Paul Kalbach on custom modified surplus Buchla equipment, and Ron Pellegrino on ARP 2600, two EMS Synthis, and a Buchla 200 system; tape music of beautiful sonorities by Maggi Payne, who mitigated the stark performance by the tape-recorder with abstrace projections; excellent video synthesized tapes by Jody Gillerman, Bill Roarty, Michael Sheathen, and Richard Lowenberg, the last having interfaced galvanic responses of people, animals, and plants with his video synthesizer; impressive abstract films by Chuck Hood; gorgeous analog synthesizer generated laser imagery by Ron Pellegrino. Unfortunately, the video people were not well represented because the structure of the series prevented them from performing live.

Honorable mention to the non-technologists: Peter Plonsky, the master of human resonators produced uncomparable vocal weaslings; the Future Primitive Art Ensemble of San Francisco hacked away at unique invented instruments and musical found objects; the Xperimental Chorus of Mills College presented vocal theater pieces; and the electronic wizard of Oakland, Tony Gnazzo, went accoustic, performing a verbal dialogue of outrageous obscurities. After each performance, the audience danced to the wonton dissonances of the Rigor Mortis Rescue Squad.

Why did all this occur? According to Pellegrino, to present a catalog of artists in the Bay Area, and to facilitate contact between those artists. It was loose, the sound system wasn't great, the video monitors inadequate, but A Celebration of the Curious *happened*, and was successful, which is a lesson for us all.

—Eric Valinsky

Tangerine Dream April 5, 1977 Avery Fisher Hall New York

I had never heard of Tangerine Dream when I spotted *Rubycon* in the record store a few years ago. Since it had a pretty cover and the credits listed syn-

turn to page 47

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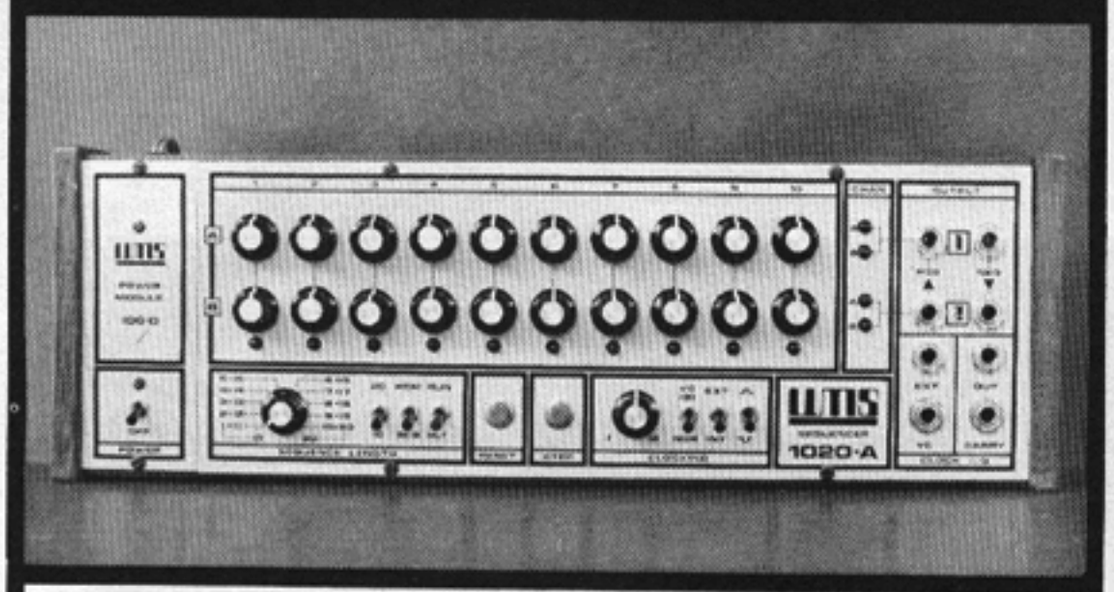

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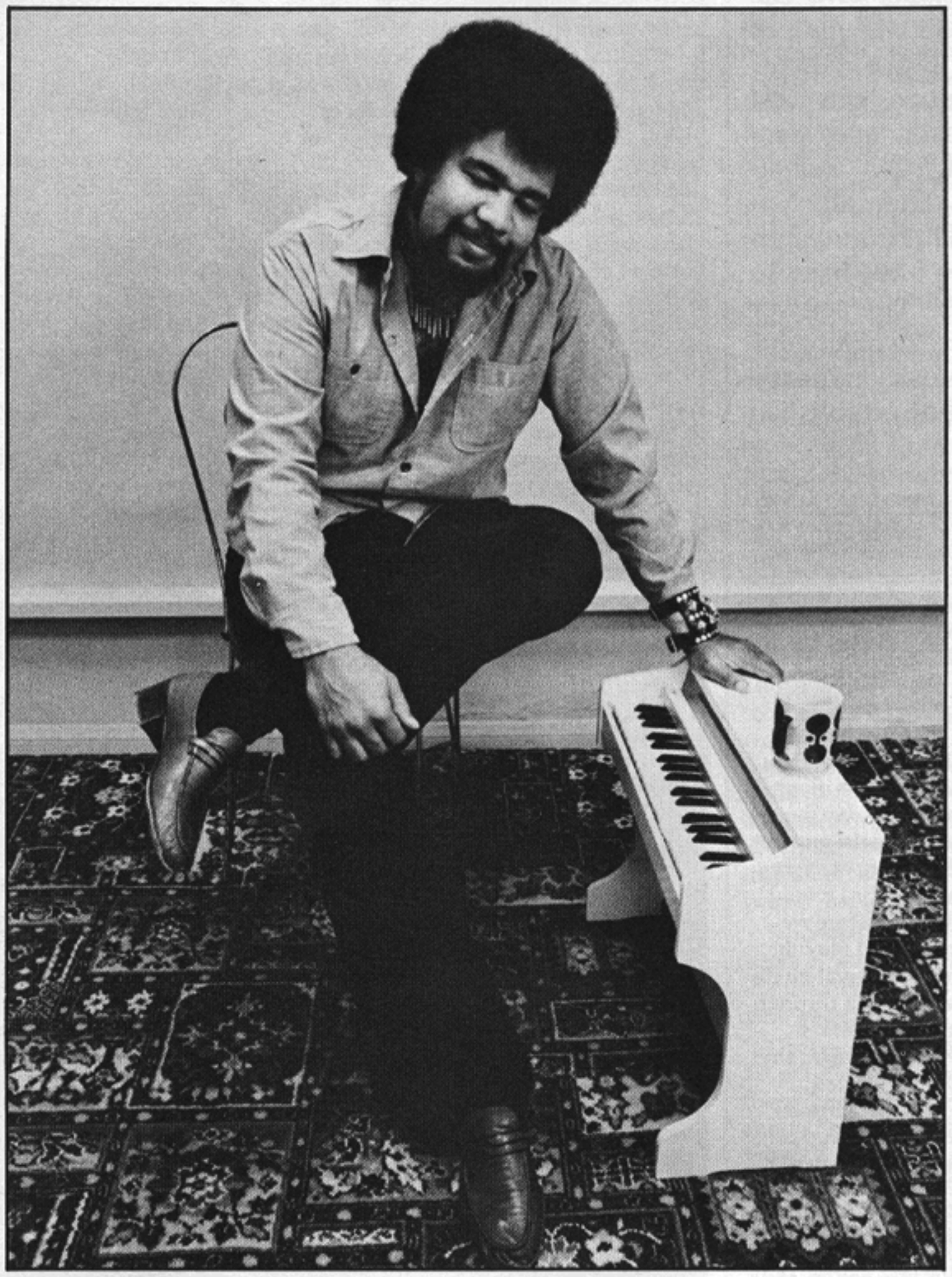
George



Duke

Duke

As one of the leading exponents of synthesizers in the contemporary jazz idiom, Synapse asked George Duke to comment on the course of jazz, and the role that synthesizers will play in its development. If Duke is right, the musicians' unions can rest easy because acoustic and electronic may not be such incompatible bedfellows after all. Synapse also asked Duke how important synthesizers have been to his musical success. The answer reveals a man quite aware of his position in the music industry and the elements that established it.

by Doug Lynner

Doug Lynner: *How did you originally get involved with synthesizers?*

George Duke: I got involved with synthesizers because one day Frank Zappa no longer had Don Preston or Ian Underwood working with him but he still wanted that timbre in the band and he asked me about it and I said, "Well, I'm not so sure." Eventually he bought one, set it on top of my Fender Rhodes and let it sit there. He plugged it in so it would be playable every day during rehearsal. Even on gigs he'd have the guy put it there in front of me and I'd bump it every now and then and make a squak or I would just start playing around with it before we rehearsed. Eventually I just started playing it. I more or less learned how to play it on the job. Once I took it home and tried it through my little home system with a book and I couldn't seem to get anything that made any sense to me, so eventually I just started tweeking knobs trying to see what different combinations of faders being pushed up or down would do and that's how I got involved with it.

Synapse: *It seems that with all the escalation in the use of synthesizers, the greater portion of it is in the jazz world. Why do you think that jazz players were quicker to pick up on it than musicians in other styles of playing?*

George: I don't know. You think that's true?

Synapse: *It seems to be. There is a tremendous amount of new jazz albuns using synthesizers.*

George: Well, you know what that probably is. I really don't know whether "jazz" players picked up on the thing beforehand, but I think more fuss was made of it. You know what I mean? I think there were probably a lot of rock players that were playing the instrument before or right along the same time but see it was accepted as part of the normal run of things. Rock 'n roll bands would normally go to something that a lot of people would consider esoteric. But jazz players, see, they expect you to stay pure and so when all these guys that have been idols for so long with the jazz world start turning around playing electronic instruments along with changing, making fusion music or playing rock 'n roll; then a lot of critics and a lot of people left because they saw their idols dwindling in the sunset and I guess it was a letdown to a lot of people, but you know, that's the way of change and everything must change. So I don't know if that's necessarily true but I know I've heard a lot of electronic instruments in rock but it's just considered normal I guess; nobody makes really a fuss of it.

Synapse: *What do you think of the word fusion? Does it describe your music?*

George: Well, I don't think it's a bad word, actually. I think it's better than some of the other words I've heard for this. I've heard "contemporary jazz," which doesn't mean anything to me. Then they say "progressive" . . . well, when I was coming up, progressive meant something else, you know, so there's really no other name that I found that seems to fit as well as fusion music. That's sort of indirect too. It seems like when you get something like this nobody knows what to call it. Rather than getting a more specific word they come up with a less specific word that encompasses a lot of things. Fusion, yeah, I guess it's cool. That's about what it is, a fusion of a lot of different elements. It also has an electric connotation, but it's an electric age so it was bound to happen.

> "...it was possible to be human with the instrument."

Synapse: *Where do you think the popular music is going now with the advent of all the electronics? How do you think the electronics will effect it?*

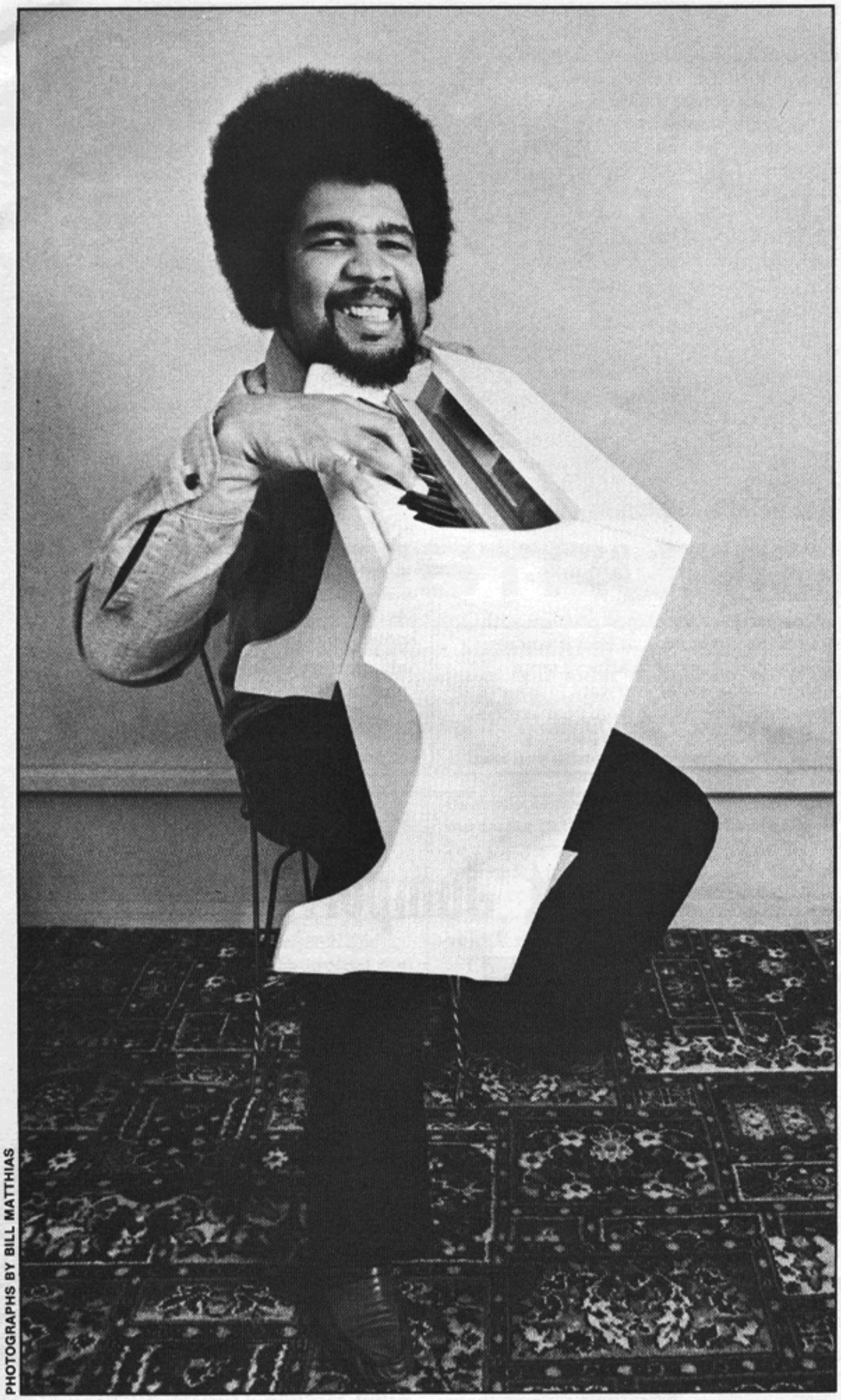
George: Well, obviously, it's greatly effected the entire industry because any teeny-bop, pop record has a synthesizer player on it or something like that. There's also a lot of use now of synthesizer bass. I've noticed on quite a bit of records you hear a lot of synthesizer bass. You know, I don't think anything's going to change for a while because the thing is still in a very elementary stage and most of the people that are playing it in the real, real pop medium are still using it very elementary. I would say probably some of the more progressive rock groups use the thing more tastefully and experimentally than even a lot of the jazz players I've heard because they take the time. And of course they've got the money and the time to spend in the studio to really get it together but they seem to have more of a knowledge of the instrument. Why that is, I don't know. Maybe they're more interested in structure. But jazz players, for example, seem to be more interested in sticking with one thing and that's what it is for the entire piece. You don't hear too many synthesists in the jazz/rock syndrome changing timbre in the middle of a solo and it's something that I noticed and said, "Man, what's wrong with these guys?" I mean I do it a lot too. I'll stick with one thing, but I've begun within the last year and a half to change the timbre in the middle of a solo two or three times or alter the attack or interject some element to make the solo go somewhere else. That's the thing that's nice about being able to construct your own sound. You can change it in mid-flight, and that's the one advantage you've got with a synthesizer you don't have with acoustical instruments that are unaltered and that's one of the great advantages of the instrument that hasn't been taken advantage of as of late, at least with "jazz players." Certain rock groups such as Yes tend to use the synthesizer a little more experimentally or maybe they're more involved in timbres.

Synapse: *What do you think of the acoustic end of it all. Where do you think that is going?*

George: Well, at this point in time I see the acoustic end of the business coming back, but it more than likely will come back in a slightly altered fashion. In other words, there will be a thing where people will play an acoustic piano with one effect or they may try to run it through a synthesizer. It's not that this hasn't already been done but I think you'll see more of it. And also of course now there is the new Yamaha piano with a pick-up on each string so you've got the electric with the acoustic. I think you're going to see more of that kind of thing happening.

Synapse: *Do you feel that there is any one person that has been the most influential in getting the use of the electronic instruments popularized?*

George: Well, the guy that I first heard that made some sense to me playing synthesizer was Don Preston. Now this was long before I hard Jan Hammer or any of those people, but the guy that really first impressed me was Don Preston. I didn't know what that stuff was when I heard it on Frank Zappa records. I said, "Man!" I heard the use of synthesizer in contemporary classical music, you know, a la Mort Subotnick and people like that, but this thing was a little different. And then when I heard Jan Hammer, that was a totally different thing and he seemed to have such control of the instrument that it was really, really nice. But the one thing that I mentioned before that Don Preston would do that I didn't hear anybody else doing at that time was that he



PHOTOGRAPHS BY BILL MATTHIAS

would change timbre in the middle of a solo. You see, it's the one thing that you didn't find these other guys doing. Well, besides that, the guy that made it popular was Jan I think. I mean Jan Hammer just took the instrument and overnight it became a success because of what he was doing with it.

Synapse: *The other day you mentioned that Jan was the person who played synthesizer in a very human way and . . .*

George: Yeah . . . well, Don Preston did too but Jan was working with a band that had achieved a certain amount of notoriety, so that's what made it popular, but he brought out the humanness of the instrument to the popular audience and that meant a lot to me, but I had already figured out that something could be done along that line and this was right after I had heard the Mahivishnu Orchestra and I decided that since Jan played a Moog I would play a Arp because I didn't want to be . . . even though I loved the stuff that he was playing, I didn't want to be compared to his type of thing. And seeing that I was constructing my own sound I didn't see any reason why I should have to sound exactly like him, so I picked an Arp and I started playing it and figured that, "Hey, you can play the blues on the instrument." It's been amazing, but I've been hearing a lot of people playing the blues on synthesizers. Not that I had anything to do with it but I think they became aware of the same situation; that it was possible to be human with the instrument. The only thing they're not doing is actually constructing the sound. They have two or three people in town, like in L.A., that program these synthesizers and other people play 'em.

Synapse: *What do you think of that situation where the musician is only involved with the synthesizer in so far as he plays the keyboard and doesn't really understand the workings?*

George: That's a problem. It's not necessarily that they have to know the voltage control oscillator from the voltage control amplifier and all of this other stuff. They just have to understand when they twink a knob what it will do and what certain combinations of sounds will do. That's what it amounts to more than knowing technically what's happening, but that helps too, to know entirely what's happening. But for me, I don't know all that stuff. I just know how to work the filter to get the sound that I want. I know where to place it. So to me, that's the most important thing, and it's actually coming from me, I feel, because I become more or less a part of the instrument as I feel Jan has become a part of his instrument as well as Don Preston and other people that play the instrument.

Synapse: *Do you think that the synthesizers in your music have helped or have hindered the success of your records and your performances.*

George: Well, no doubt about it. It's actually helped my success. I think without the synthesizer I'd probably have been another piano player, and you know it's very possible. I think the same thing is true of Jan to a certain degree and some other players that have become very much a part of creating the whole synthesizer syndrome. Yes, I would say it's very much become a part of me now, and my success is very much a part of what I've been able to create on that instrument, let alone the piano. That's been another thing, you know, but the whole electric business I think has helped me quite a bit.

Synapse: *What do you think about the idea of being stuck behind a whole bunch of keyboards? What other kinds of approaches are you looking for in performance?*

George: Well, that is a problem. There are several ways to get around it and one which I

may try for the next tour is a horseshoe shape which is open to the audience with all my keyboards in a "U" shape behind me. One other thing that I tried for the last tour that I did with Billy Cobham was mirrors. We had mylar that we took with us, and in the larger concert halls, we were able to mount these things. We had not only two mylar screens behind me but two behind Bill, so the people who were sitting in the audience could see us actually playing the instruments and not just feet and a head wobbling. That plus a horseshoe shape with nothing between me and the audience, I think, would be the best way to go.

Synapse: *What's the name of your new album?*

George: It's called "From Me To You."

Synapse: *How has your music changed from your last album?*

George: Well, for one thing, well there's a nice acoustic piece on it. But besides that it's much more vocally oriented, much more. So, I've got some background singers and I did a lot more singing in a more defined manner, you know, I mean I did some stronger singing; some of my best singing to date for sure, no doubt about it as a matter of fact. Except for some of Frank's records where I did some stuff that I can't even believe I did actually. Maybe I was just messed up or something. I don't know how I did some of that stuff but anyway . . . there's more singing on it and for me this record is much more of a production because I use horns on it and I did more orchestrating. Normally on my other records because I was limited budget wise, I always orchestrated with a synthesizer as much as I could until the money ran out and then that was it. With this record I decided, "well I'm going to orchestrate using acoustic instruments" so I used horns, trumpets, I used strings on certain cuts, and I had vocals and the whole bit, you know I mean I made a production out of it. I may never do it again, for a while anyway, but I felt like doing it this time. It's my first record for Epic and I said, "Why not?" So that's the difference. Stanley Clarke plays acoustic bass on a couple of things and electric bass on two things. So it turned out really good. A guy named Mike Cebella played guitar; Stevie Wonder's guitar player, excellent, excellent guitarist that not too many people know about. I tell you, if I could get him from Stevie I'd steal him right now.

Synapse: *Where do you feel that the current synthesizers fall short from a performance point of view?*

George: Well the biggest problem with synthesizers right now, at least if you're somebody that wants to achieve more timbres than a few or you want to achieve some really nice sounds from your synthesizer, the biggest problem is patching, because for the multi-keyboardist you need to be able to do something fast because you're trying to play a show, you're trying to accompany other instruments, you may be trying to sing, you may be trying to orchestrate with all of your instruments at one time. Therefore, most people wind up carrying three or four synthesizers, at least two, so that they can have one patched one way while the other is patched to something else to allow the time to get from one thing to the next and still try to carry on a show. You know, it gets pretty insane sometimes when you've got a lot of instruments. It just spoils the flow. The only instrument that takes care of this, at least in the price range that is in any way reasonable, is the Oberheim because they've got a programmer in it. All you've got to do is push a button and you get the sound that *you* pre-patch into it, which is the thing that's been lacking in synthesizers besides not being polyphonic. What I'm looking for is a true polyphonic synthesizer, where each note can have the timbre you want, which is what the Oberheim is about right now and there are probably some other ones around that do the same thing, but anyway, this one I knew about and I'd known Tom a long time so I bought it. The only problem is a lot of people aren't going to know how to patch the thing. The way certain people play synthesizer nowadays, they'd rather have it patched at the factory but not me. That's one of the problems. ~~~

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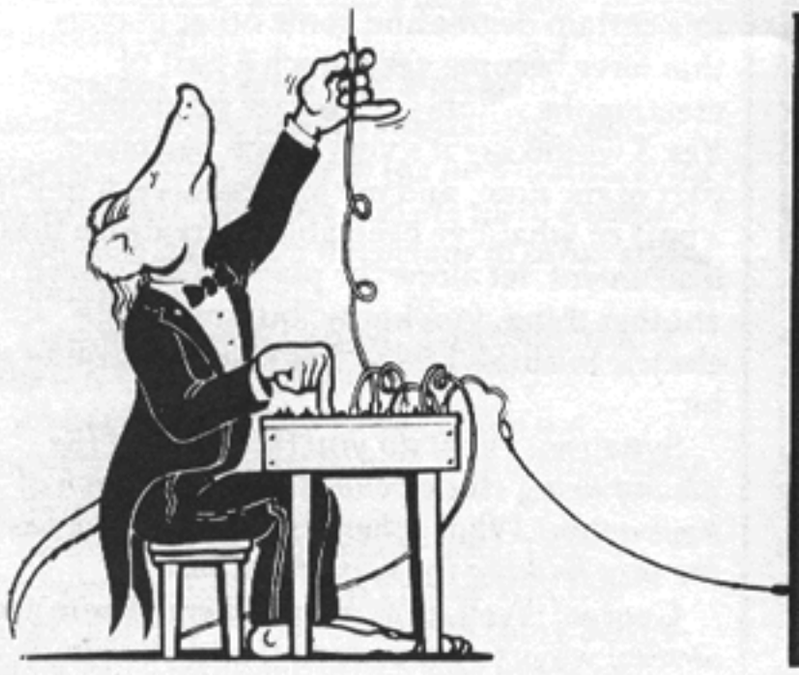

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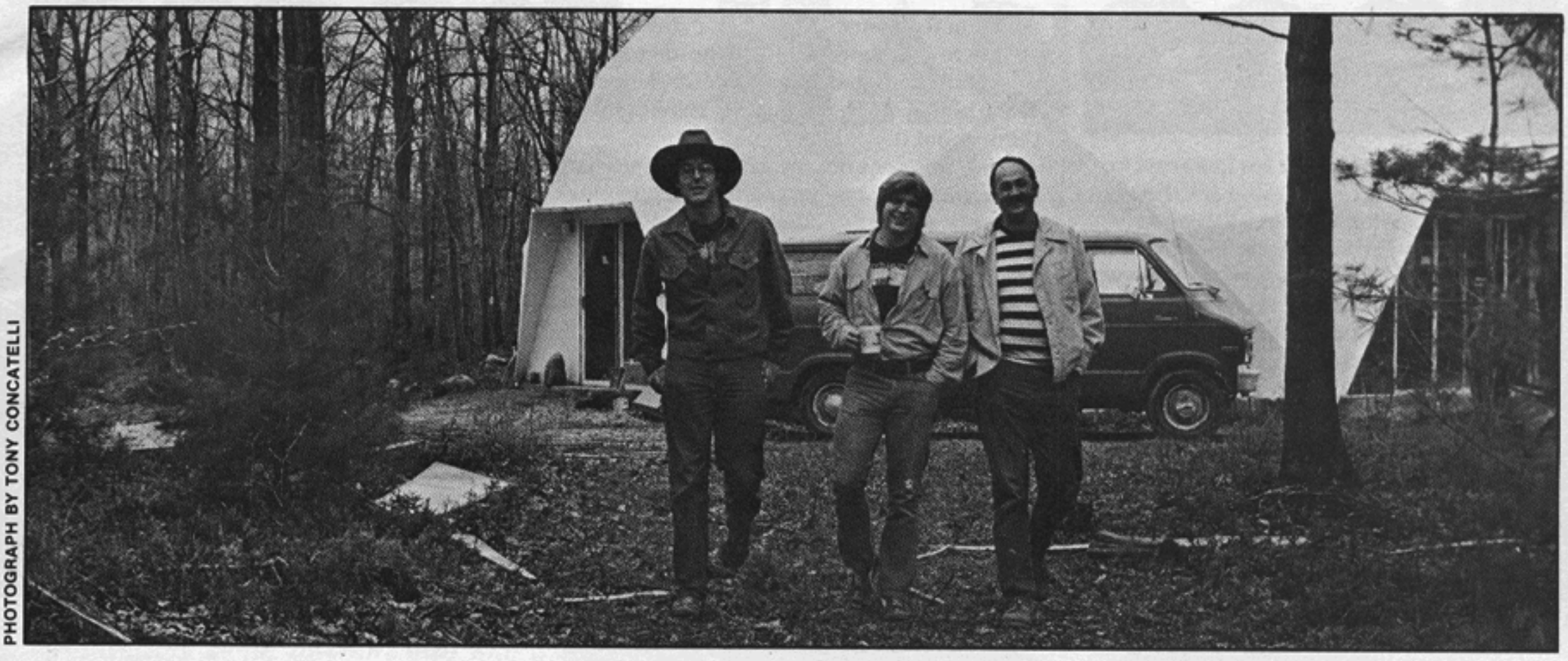

PHOTOGRAPH BY TONY CONCATELLI

STAR INSTRUMENTS, INC.

David Kusek, John Borowicz, and Norm Millard (left to right, above) are the principles of Star Instruments Inc. Star represents a departure from the mainstream of synthesizer manufacturing. Instead of contending in the already crowded keyboard synthesizer market, they have opened themselves to a relatively untapped market for electronic instruments. Percussion. In this respect, they have opened the possibility of a percussion synthesis boom, equal to, if not exceeding, that of the keyboard synthesizer.

by Phil Terr

Phil Terr: *How did STAR get started?*

Norm Milliard: STAR resulted from my personal desire to convert good, innovative ideas for electronic music instruments into marketable products. To accomplish this, I resigned as Vice President of Electronics Music Labs and sold my interest in EML to finance the start of STAR.

About a month after I left, Dave and John resigned their positions at EML and joined me in getting STAR off of the ground. This occured in May of last year.

The three of us spent the first few months on two parallel projects. First, converting one of my geodesic domes into a factory and office; and two, firming up the company philosophy and purpose. This stage was completed by the end of June.

Synapse: *What philosophy was STAR organized around?*

Norm: Possibly the most unique aspect of our philosophy is that it is written down—this is particularly unusual in a small company. Our philosophy statement concentrates on two aspects—people and products.

Basically, a company is a team of people devoted to achieving well defined goals in a suitable, enjoyable environment. The people part is everything—they are the only ones that can generate the goals; achieve them through their devotion; and create that ever so important suitable environment.

As a corollary to this, STAR works to treat people not as they want to be treated, but rather to treat them right. STAR must be a company where the kind, supportive, confidence building comment is the rule, not the exception. This does not preclude criticism but rather states in what tone of voice it should be given.

Our product philosophy is based on STAR's need to be profitable and our own personal desires to provide instruments that contain a part of us. The first part is required to permit us to survive; the second part is the reason people are able to undergo the burdens of starting a company.

During STAR's childhood as a company it *must* offer innovative, simple, low cost products in markets where competing products are few or non-existent. The reasons for this are simple: innovative design and use of "high order" technology is important because STAR will initially lack the marketing clout of an established name. Simply, innovation offers the opportunity to offer a sole source product. Simplicity makes manufacturing easy which is the first step in developing quality products. Quality products are extremely important in developing a reputation and we want to have the best reputation possible. Low cost means a wider market among dealers and consumers which in turn leads to higher volume, more automation in manufacture, higher profits and lower cost to the consumer.

Our approach to founding STAR is definitely not unique nor fully original, but we feel it is sound and has worked so far. Certainly, our first product, SYNARE P.S., is a result of our company philosophy, it meets our design criteria as to innovation, its simple to manufacture, and is low cost.

To the best of our knowledge SYNARE is the only *integrated* percussion synthesizer on the market. It opens an avalanche of possibilities for the drummer to explore and utilize. As you can see, we're very excited by the possibilities it offers to percussionists and ourselves.

Synapse: *What made percussion synthesis your focus instead of a keyboard approach?*

John Borowicz: We looked at many different market areas due to the "new company" reasons Norm just outlined in explaining our philosophy. Electronic percussion seemed to be a perfect, untapped and natural area for us to apply our energy. We definitely have not abandoned the keyboard area. Collectively, we have a *lot* of experience and knowledge we'd like to apply to keyboard synthesizers and we will. However, no matter how good our ideas and approaches may be we still have to establish ourselves and our image as a reliable and innovative manufacturer. I believe SYNARE will make that statement.

Besides, electronic percussion instruments are part of the evolutionary chain of events for electronic instruments. First there was an electronics improvement for guitarists, then the big explosion, in the form of synthesizers, of electronics for keyboards. Now, we're about to witness another

STAR

improvement in capability for guitarists in the form of a guitar-synthesizer for them. Why not percussion? In short, I believe SYNARE is a natural extension of the drum set given the technology of present time. Now the drummer can be a part of the electronics world and create with electronic sound as well as acoustic.

I've had many, many drummers come to me at EML and say, "why don't you guys build a synthesizer for us?" Drummers have been asking for electronic percussion for years, now it's here. STAR has made percussion synthesizers a reality, available, and affordable.

I'd like to make just one overall statement that applies. If we see that out there in the "real world" there's an instrument or market we can apply our talents and expertise to, to *significantly* improve and contribute to—we will.

Norm: Just to echo John, someday we will introduce a keyboard synthesizer. But at this time in our history we don't have the financial resources to do the job as well as we'd like. I'd like to add that keyboard synthesizers are our first love and that Dave is presently working on an innovative approach to a "true" polyphonic synthesizer Come see us next year, I think you'll be amazed.

Synapse: *What does the word innovation mean to STAR Instruments?*

Dave Kusek: When we design an instrument, or are to commence a project, we look upon the man/machine interface as being of primary importance. Understand that this goes far beyond how the front panel is layed out or what color knobs we're going to use.

When we can minimize the internal complexity yet increase the capability of the instrument's core, that is, its oscillators, filters, VCA's, envelopes, etc., we *can* offer the musician a much greater degree of control at a lower cost. This is the key.

We tend to pursue the "fringe of technology", a rather abstract awareness that is difficult to maintain. Certainly and without question, the most promising and personally exciting area that we are exploring is that of computer control. In the past, a computer was set up in one place, forever to remain in that room; for it was a large, bulky, finicky, and very expensive machine. There are many interesting applications of computers to music and composition, but very few attempts at controlling a synthesizer. And why not? I mean, it isn't easy to carry a PDP-9 to a gig. However, this hardware barrier no longer exists.

Today, a full-blown computer can fit in your pocket, although I'm sure your shirt can manage by itself.

No single influence will have as great an affect on the course of electronic music as the micro-computer. You will be amazed by the possibilities that *ultimate* control over *every* aspect of the synthesizer provides. Just think about it.

And, this does not mean that the musician will have to become an engineer or computer expert to play a STAR synthesizer. We use the computer as an extension of the musician's expressiveness; giving the synthesizer the intelligence it needs to interpret the performers creative flow.

Synapse: *STAR's use of technology in innovative approaches to design indeed may provide greater capability, but is technology being utilized in the design to enhance "playability"—human engineering?*

John: Yes, very much so. Dave touched upon it. We firmly believe that our instruments must be designed to be "compatible" with the musician's training and playing style, subsequently we design from that perspective. We do our research, consult many musicians and ask thousands of questions.

How a musician is going to activate and *control* the instrument in real time is definitely of primary concern. This is *the* area we attempt to answer first.

Expanding on this point, I'm sure you're aware that many electronics musicians, critics, the listening public, and even engineers view this "compatibility" between man and electronic music instruments as *the* area of greatest importance. Yet it is this very area that has been avoided and ignored, relatively speaking, the longest.

Norm, Dave and myself are three people that believe that the "compatibility" question is *the* question. I'd like to add that it is in this area of blending machine to man that we at STAR feel we can contribute to the most.

Please understand, we don't intend to slack off in other aspects of synthesizer design, such as sound generation and modification. I don't mean to imply that, however, to say that we will concentrate our energies on the "blending of machine to man" is essentially true. But this also means that we will spend a great deal of energy on the synthesizers sound generation and modification functions, for as you improve the controlling-decision making processes you ultimately improve the stuff you're controlling. Simply, form follows function.

I'd like to use SYNARE P.S. as an example of what I'm talking about when I say, we make our instruments "playable". The SYNARE Percussion Synthesizer is responsive to the musician playing it, definitely more so than a monophonic synthesizer is to the keyboard player. The "playability" of SYNARE is its biggest asset, for there are no magic sound generation circuits in it.

First off, it doesn't require the drummer/percussionist to alter in any way his sticking technique or style. Secondly and of equal importance, the Percussion Pads are "zone sensitive", like a regular Tom-Tom or tympani head. Depending on "where" you strike the Pad (or head) will result in some change in the sound. With the drums, the variations are limited by their physical characteristics and construction. With SYNARE the changes in sound and their extent are decided and set by the drummer. He can alter the pitch, range, timbre, a little bit or a great deal. He can also vary dynamics. Just by "where" he hits the Pads.

And it was the combined technology of digital networks, electronic control panels and calculator keyboards that allowed us to blend the synthesizer to the drummer.

And more blending is in the future. As we come to better understand and recognize problem areas and intelligently combine what we've learned with our technological expertise to solve these compatibility problems.

SYNARE is a quantum jump improvement in this area of "blending" we've been discussing, considering the compatibility and required playing alterations of the electronic music instruments that have preceded SYNARE. My intention is not to cast stones but point out that the name of the game *now*, is playability.

Synapse: *What impact on percussionists do you see SYNARE having?*

John: How much impact it will have is for the passing of time to tell us. But it will have an impact. I see SYNARE making the drummer an even more integral and important member of the music group. It has to because he'll be able to contribute even more to the group's total sound. After all, he'll have with SYNARE more tonal and timbral resources to explore and create with.

Dave: I believe that SYNARE, those available now and future versions, will do for the drummer what synthesizers have done for keyboard players.

Norm: Musicians are experimenters and explorers. And when people explore and test and evaluate they learn and improve. Drummers will experiment and explore with SYNARE and in the process learn and expand their talent and roles.

Synapse: *Are there any general comments or observations you have concerning the future of electronic instrumentation in the music industry?*

Norm: Generally the proliferation of electronics in music will continue at an ever accelerating pace. This results from the growing ability of electronic instruments manufactured to provide more capability per dollar spent.

John: I agree with Norm, but may I add that the next 5 to 10 years are going to be a truly exciting, if not amazing, period for musicians. Right now we're on the edge of several step-function technological advancements and you'd better believe that musical instruments and musicians are going to benefit.

Some of the stuff we see coming down the line both amaze and excite us, and I strongly contend that the next decade will be the most "advancing" decade for the musical arts and medium of all time. ⌐∿∿–

HERBIE HANCOCK

INTERVIEW

Herbie Hancock is a popular recording artist who has already gone through two stylistic approaches to the use of synthesizers in jazz "rooted" music. The first approach utilized Pat Gleeson. In the second, Hancock himself is the performer. The result is a change from synthesizers as an independent voice to synthesizers as an instrumental imitator. It's not without reason though. There's a theory that the public can accept the synthesizer as a flute more readily than as a synthesizer.

by Bryce Robbley
and Doug Lynner

Doug Lynner: *What motivated you to start using synthesizers?*

Herbie Hancock: It came at the suggestion of my manager, David Rubinson. At that time, I was trying to get a footing in the pop market. Maybe I better explain that. I felt the need to get closer to the kind of people that buy most of the records. I really wanted to find out more about people in general, not just musicians and their tastes in music. I was very open to that, more or less like a student. I didn't know anything about pop music or what appeals to people in rock and roll. I had just come to the point where I realized the value of entertainment where before I felt like entertainment was a lot of crap. I felt that all you needed to do was play the music and that should sustain the audience. So there were a lot of things I had re-evaluated and opened up to. Anyway, David told me, synthesizers, that's kind of a new thing and the kind of music I was doing was really far out. It's real funny because on one hand I was into this far out music and on the other hand I was trying to figure out a way of presenting it at places like the Fillmore in San Francisco and the Roxie, where rock acts would work. So the synthesizer was a perfect compliment to the kind of music I was into anyhow. Synthesizers, I realize now, can be a perfect compliment to any kind of music. It doesn't matter. New instruments, new music. So David suggested I use Patrick Gleeson to open up some things on a record that I was doing. So I say, well, Patrick, he may be just a mathematician, who knows? He might ruin

PHOTOGRAPHS BY BILL MATTHIAS

HANCOCK

the record. So we figured we would take the tapes and let him open up some stuff on it and see if we like it. If we don't like it we'll take it off. Pat was agreeable, so we tried it and I just gave him the tapes and I said, you got it. We got the tapes back and it blew my mind, it just blew me away. A song called "Quasar" was the first thing that was on the tape and just what he did with the song, it took my breath away. I was shocked. Just the way it felt was incredible. Soon after that, he went on the road with my band.

Lynner: *Are there any people that influenced your own vision of synthesizer playing? Any recordings or performers?*

Hancock: My two favorites for solo synthesizer work are George Duke and Jan Hammer. I also like Chick Corea. As far as the use of the instrument in orchestration or ensemble or whatever, I'm limited by my own knowledge or lack of knowledge, I should say. I suppose Patrick Gleeson is an influence as far as the mechanics or electronics of the instrument is concerned but musically, it would be Stockhausen, maybe Stravinsky, Revelle and anybody else that, acoustic or electric, has influenced my playing.

Lynner: *It seems that a lot of the contemporary synthesizer music is going on in the jazz area more so than in rock 'n roll or other forms. Why do you think that is? Why would it be so easily interfaced with jazz and not some other forms?*

Hancock: Maybe because the music has a lot more room for complexity and changes in direction, moods and sounds. The character of the music is so broad-based that it's easy to include an instrument that has a new kind of character. A part of what makes jazz what it is today is the fact that so much of the emphasis is on the sound.

Bryce Robbley: *Do you find now that you build pieces conceptually around a synthesizer as opposed to when you first got it touch with it and started working with Pat Gleeson, or do you still work basically from a keyboard standpoint like piano?*

Hancock: I still work basically from keyboard.

Robbley: *Rather than synthesizer?*

Hancock: Yeah, that's what I've done. Not that I'm not open to doing it the other way. There was one piece of music we did when Patrick was in the band on an album, I think it's called Sexton, that's all synthesizers. Well, not all synthesizers, but it started with a device called a random resonator that doesn't exist anymore. It sounded like a sample and hold. We made a tape loop out of something that sounded pretty good and we put the loop on one track and Patrick overdubbed compositions. And then we overdubbed some acoustic instruments but it started off basically from synthesizers.

Robbley: *So most of the things that he put together with synthesizers were ornamental would you say or did you use it as just another sound source?*

Hancock: I've been using it for color; I've been using it in place of acoustic instruments. Making a synthesizer into an acoustic instrument is kind of silly. On the other hand, since it is a new instrument and has a character of its own, it's "on" even when you make it sound like an acoustic instrument. People like it and they are not as disturbed by it as they might be if it had a character not attached to acoustic instruments. People are starting to hear synthesizers a lot now so they know what it is.

Lynner: *So you think that because people are getting used to the acoustic sort of implementation of the synthesizer, that the sounds are able to progress because they got to first base so to speak?*

Hancock: Yeah, maybe, that was just a theory of mine. That's not the only reason I've been using it the way I've been using it. I like what I'm hearing. I think I've heard some recordings that as far as my personal opinion is concerned, sounded somewhat bizarre and I don't want to use the instrument that way either. Maybe that kind of turned me off to experimenting a lot with the capabilities of the instrument. At the same time, I was trying to learn it too. When I could finally make a sound that sounds something like a flute, then that was an accomplishment. That's a jumping off point. It's somewhere to start.

Lynner: *What do you feel that using synthesizers has done for your own musical career now that you've been using them a long time? How do you feel it's influenced your music. Do you write any differently because you use them? Do you have ideas that you might not have had from the piano's influence?*

Hancock: I think basically what I've done besides using the synthesizer as sort of a substitute for acoustic instruments i . . . I've tried to extend the possibilities or have used some extensions of those possibilities; I mean a simple thing like the way a portimento might be used which acoustic instruments can't do. There are some other little ornaments that I've done but the character of my music has not been heavily influenced by synthesizers, not yet. Oh, it's real funny. I have to remember when you ask me questions about my use of the synthesizer that the way I use it today and the way I used it when Patrick was in the band is sort of two different things because it was two different kinds of music. The answer I gave you was for the kind of music I've been doing since Headhunters in 1973, but before that, 1972 to the middle of '73, the music was influenced also by the synthesizer. As a matter of fact, in some cases there was a real dependence on the synthesizer in certain parts of the composition. So we used it in the more complex way, or more complete way in the beginning than we do now. The biggest difference is that I'm playing it now.

Robbley: *When you do live performances, do you preset individual instruments in order to get around from sound to sound, or do you change settings a lot in performance?*

Hancock: Maybe I should tell you what I

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have. I got things all around me. In front of me I have a Rhodes 88 suitcase piano and on top of that there's a clavinet. On my right there's an Oberheim 8 Voice with a programmer. Behind me is an ARP String Ensemble. On my left is a Yamaha Electric Grand and I've been playing a prototype of the Yamaha four voice synthesizer too. And I also have a Micromoog that I use for solo out in front of the stage. See, now that I have the Oberheim 8 Voice, I've got 16 programs in it so I use those presets. As far as changing any of the modules, I haven't done that yet. I haven't had that instrument that long.

Lynner: *Do you program your own sounds on all the instruments?*

Hancock: Yes. Now, the Yamaha 4 Voice is already preset at the factory. There's one switch for doing your own preset but the other ones are done at the factory. So I haven't been moving around too many knobs. Only when I play the Micromoog. But

BILL MATTHIAS

struments, music."

I do have to plan ahead. This is one of the biggest problems I ran into when I first got the Oberheim 8 Voice with the programmer. I would always have to think ahead before I would get to a certain section of the music. There would be more than pushing one button to bring in the new program. Sometimes I would have to change another switch that goes from polyphonic to unison or change the portimento or change the octave switch or change the master filter and also change the gain. I can't do all that in an instant so before I got to that spot, every time I get a free moment I would change a couple of things. I remember in the beginning it was atrocious. I hadn't made those plans and I'd go to the Oberheim and I'd only have to push one button and then I'd realize, oh my God, I've got to switch octaves . . . I mean it got crazy. Even now I forget sometimes; I forget maybe to throw the portimento switch and I get ready to hit this big fat chord and it goes w o o o o o o. It's really a drag when that happens.

Lynner: *It's interesting that keyboards have been the traditional interface with the synthesizer and now today, there are so many other interfaces, like guitar controllers, E.V.I.'s, and percussion synthesizers. Have you been considering introducing those with some of the other players like WaWa Watson, with his guitar?*

Hancock: Yeah. I did record with Miroslav Vitous. What was the name of that record? Something Shepherd, or did he look like a shepherd. He had a sheepskin on. I forget the name of the record, anyhow, Miroslav has a double neck guitar/bass that was interfaced with some Oberheim modules. He had a bunch of switches on the instrument for different sounds. That was the first time I ever worked with anybody . . . now, I worked opposite John McLaughlin who was using Moog equipment interfaced with his guitar. I guess you had to use the 360 interface.

Lynner: *So then those are the things that we might see in your music in the future?*

Hancock: If they can afford it. I'm not going to buy it for them. I've got enough troubles. That Oberheim cost a fortune.

Robbley: *What would you like to see develop in terms of instruments that would be useful to you in your music from the electronic and . . .*

Hancock: Three or four more hands; that would be fantastic. They're doing digital synthesizers now. Haven't seen one so I don't know where the difference lies. True velocity touch. I guess you can get a lot more minute details on that than you could on the present synthesizers. I would also like to see developed, some kind of synthesizer where you can reproduce drum sounds or percussion sounds of various tempos and make rhythm with it. Complex rhythms, any rhythms you want where you can change at will certain aspects while others you can kind of play around with it. Then you can throw all that into a memory unit so it can be remembered and brought back at will.

Lynner: *Then you're looking for a more physical interface between you and the synthesizer.*

Hancock: I played the acoustic piano for, let's see, in April, it will be 30 years. That's a long time. I'm used to that kind of touch response. Also, in my jazz solo work, the single note style I do, this particular element is not unique to me but I'm accustomed to playing a lot of accents. It's part of my way of thinking. I'm used to hearing those accents and I can't do that with synthesizers.

Robbley: *Touch sensitivity and velocity sensitivity would give you that?*

Hancock: Yeah, it would make it easier for me to solo because I hear that in my head and that's not what's coming out. It's always made the synthesizer feel kind of awkward to me. I think that's maybe one of the things that's kind of hanging me up.

Lynner: *It's interesting that in the last couple of years, jazz on the whole has become accessible to a wider audience. What do you think is responsible for that change; do you think it is in any way related to what you said about people wanting to listen more to music as opposed to just dancing?*

Hancock: It's the other way around. I think jazz became more accessible and they began to listen to it, buy the records and after they were dancing to it they realized there was more there too. There was something they could listen to and get off on. When people think of jazz, they usually think there's something interesting to listen to but they don't always feel that they are ready to listen to it. They say, "you've got to be a musician to understand jazz." People kind of put themselves down and feel that they are not able or developed enough to be able to related to it but I think they're finding out that there is a music that is developing there. They're developing and so is the music at the same time. I think the reason we're in this position now is because some musicians, including myself, have taken the time and energy to find a way, to learn something from the music of the people. I would have to say that pop music comes from the people. It's more people music. How can I qualify that? Not that jazz isn't. Jazz is sort of the avant-garde of that expression. But the kind of music that everyone can relate to is pop music. Not necessarily because of economic reasons either although that's something you're aware of.

Lynner: *How do you mean economic?*

Hancock: Remember, jazz wasn't a money maker. Extremely talented people playing jazz weren't making any money. Making very little. I was able to make ends meet. I'm sure Chick was able to make ends meet and Weather Report, or the guys in Weather Report, before they were a band. They could make ends meet. They weren't starving. But it wasn't a monetary thing that swayed us. I think each of us . . . I can only speak for myself but I have a feeling that each of us feels a more humanitarian spirit and more interested in people in general and not a particular taste of people. Not just our jazz audience but people in general. So the character of our music changed and we found out that it worked. People liked it. We could tell because they started dancing; they started buying records. I also have to say that pop music was changing at the same time. That is, having more substance to it too. You can tell by the musical change in Stevie Wonder or Earth, Wind and Fire. Even groups like Grand Central Station, this complexity of the rhythms and rhythmic orchestration and the way the tunes are organized, all these are advancements in their music. Marvin Gay's music, for example. Those are the ones that I know about. We could also talk about Joni Mitchell's music. There are a lot of different groups that have a brand of people they already have to the point where they can hear more.

Lynner: *Where do you think it may all end up.Do you think there's any chance that the musical definition between pop and jazz is breaking down because they're learning to*

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live together. Do you think it will be useless at some point to make those distinctions?

Hancock: In many ways yes, because we're borrowing from each other and developing the result of that. In many ways, the grey area between the two is even greyer. Now, we still have the really far out groups and you can't put them all in one category and say that the whole of jazz is moving toward rock. You can only say that jazz is expanding itself so that the areas are becoming less defined, less definitely jazz or definitely rock. I think in the future, that the music of this area we're talking about that grew primarily out of the jazz tradition is going to use more elements from the jazz tradition. I think that the music that grew out of rock tradition is going to use more elements from jazz tradition.

Lynner: *So you think that they will be both borrowing a lot from the jazz tradition?*

Hancock: Yeah, I think so. That's what's left to do. At the same time, there's other things coming up. Synthesizers came up; there will be other things coming up to change the sound of the music or the rhythm or the character one way or another.

Lynner: *What do you think of the word fusion and the way it's used these days?*

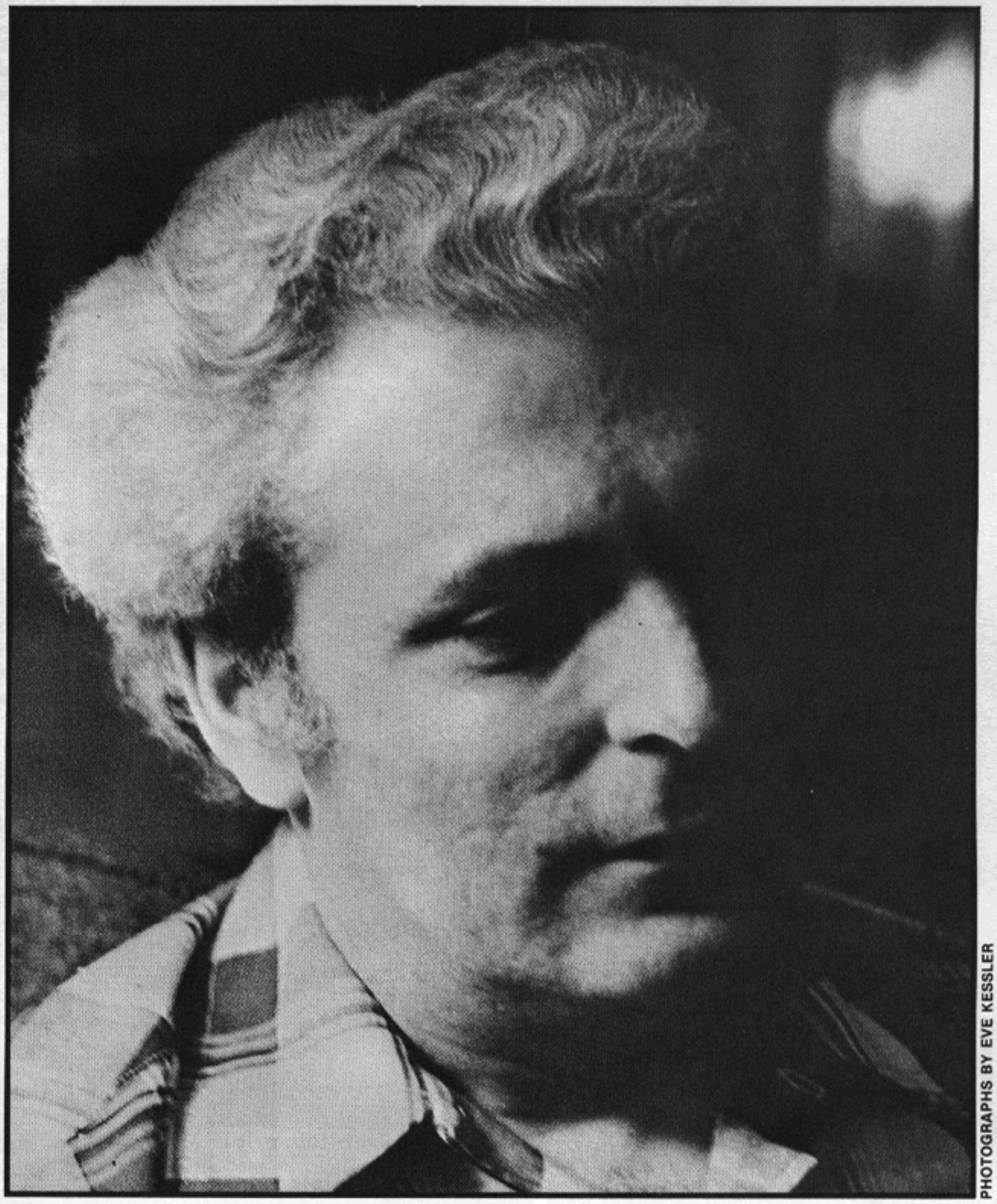
Hancock: I haven't heard anything I like. Except the word music; that doesn't sound so bad. The only problem with the word jazz is that it doesn't tell you too much; doesn't give you any distinctions between the different areas of jazz but it draws a distinction between the total area and rock. It gets a little confusing. I've used the word fusion music; it sounds funny. I have a funny thing about labels sometimes. Although I'm not the kind of person to say "I hate labels, no good, no use." Labels are valuable at times, they really cut a lot of corners. I think they cause a lot of problems too. So I'm content with sometimes using the word jazz in quotes or what sometimes people call fusion music. You know what they call our music? I read it described as sophistifunk. I'm trying to work on something that includes a lot of things. I hate to use the word universal because what the hell does that mean. Anybody wants to do that. But something that has a lot of different areas in it is what I like. Weather Report is doing it their way. Chick Corea his way. And up to this point, I haven't really been doing that. I've been a student of funk for the past few years. I've been really trying to learn about that aspect. Now I can gather in a few other things. There are a lot of things I haven't really explored. Haven't explored the theatrical side of things, visuals. I have lighting now. Sometimes we have a couple things we do on the stage, just surface things, but I haven't really gotten into it. I want to find out about that too.

Lynner: *How important do you think the theatrics are as far as putting energy into a performance?*

Hancock: It's something I want to try out; to find out. —WW—

interview with bob

MOOG



PHOTOGRAPHS BY EVE KESSLER

This interview traces the history and current projects of the man whose name is associated with synthesizers more than any other. It is, of course, Robert Moog. In recent years, Moog had widened his engineering horizons. As the director of Research for the Electronic Products Group of Norlin Music, Moog's responsibilities include synthesizers and much more.

by Carter Thomas

Carter Thomas: *How did you first become interested in the possibilities of electronic music?*

Robert Moog: I'll give you the chronology. I didn't know anything about electronic music. I went to Columbia for a couple of years and studied undergraduate engineering there, and I knew very, very vaguely that there was some guy by the mane of Ussachevsky who was doing something really funky in a cellar somewhere. At that time the Columbia/Princeton concerts were generally open only by invitation and I was just an engineering student. I was making theremins to raise a little bit of money to support my family; Shirley had just given birth to our oldest daughter. A couple of years after I began making theremins in my postgraduate life I was invited by our New York distributor, Walter Sear, to participate in an exhibit at the New York State School of Music Association Convention. Well, anyhow, one Herbert Deutsch came by the exhibit; he started talking about the theremin. He said he used a theremin for sightseeing and bla-bla-bla, and this and that and did I know anything about electronic music because he was into electronic music. I said, "Sure, I know all about that." So he said, "How would you like to come to a concert of mine?" He was

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putting on a concert at Jason Seley's studio. Jason is now director of the art department at Cornell. At that time he was one of Herb's cohorts at Hofstra. Well, it was a very exciting concert. It was a mixed media thing; at least mixed aural media, with instrumentalist, vocalist, electronic tape, and a percussionist playing on Jason's sculptures and the whole thing worked artistically. It was just a gas for me and as a result I became enthusiastic about what Herb was doing and invited him up just to pay a visit. It was nothing premeditated or with commercial designs. Herb came up with his family and stayed at one of the cabins in Taughannock Falls. He brought his tape recorder and I had designed some little circuits. Out of those couple of weeks came some of the very basic ideas for the synthesizer. By the time he left we had a couple of voltage control oscillators, a couple of voltage control amplifiers, keyboard controller with glide, and he'd done a couple pieces of music, which still are fairly attractive pieces. He came up again in the late summer. He and I got in the car and drove around Lake Erie to Toronto and visited Myron Schaeffer, who was then head of the electronic music studio at the University of Toronto. Schaeffer was the first person who was part of the establishment at that time to get all excited. I don't remember exactly what frame of mind Herb and I were in. We never thought in terms of selling this or anything. It was just interesting to do. Then a very nice lady by the name of Jacqueline Harvey who runs the exhibits for the audio engineering society convention called me up one day. I didn't know who she was and she said, "Say, we hear that you people up there are doing some interesting things. CBS had a booth here but they just called me up and told me that they won't be able to exhibit anything so we have a booth. How would you like to have a booth for nothing?" That was the proverbial offer you couldn't refuse, so I came into New York City.

Synapse: *What year was this?*

Robert: 1964. I had this little handmade thing with paper labels on it and two oscillators and amplifiers. The panels were constructed from sheet aluminum that I got out of the student shop at Cornell and sprayed with the paint. And there I stood. On one side of me was Ampex and on the other side of me was Electro Voice and JBL. It was fantastic. I'd never seen anything like it in my life. These incredible professional audio exhibits. I was sort of disoriented. The first big thing that happened is Aliin Nikolais rushes in. He said, "Say, Jim Searoy just told me to come down and see what you have here. What do you have here?" I showed him and he said, "Okay, I'll take it," or something to that effect. That was it. All of a sudden we were in business. The next day or so a gentleman by the name of Eric Siday came by. Do you know that name?

Synapse: *No.*

Robert: Eric Siday, who died recently, was a commercial composer and he's done some of the really big sound logos: CBS 5 Seconds, The American Express, and Maxwell perking coffee pot. He was Mr. Big in commercial sound logos at the time. In fact, he was single-handedly establishing sound logos as an advertising gestalt. Anyhow, he came by and says, "okay, my technician and I will come up and visit you." And sure enough a couple of weeks after I got back, up they came and that was our second order. He ordered what was then an incredibly big system. That's how we got started. I guess Lejaren Hiller also came by and ordered a couple of things that were delivered to the University of Illinois. That was the first bonafide institutional purchase.

Synapse: *So this all happened like between '62 and . . .*

Robert: January 3, 1964 was Herb Deutsch concert and June sometime, 1964 is when he and I worked together.

> "I was an engineering student, period."

Synapse: *Was this the first voltage controlled studio that existed?*

Robert: Well, I think so.

Synapse: *Was Buchla doing something on the West Coast then?*

Robert: I don't know when Buchla started. Buchla has claimed . . . I've seen it claimed in other articles that he began before I did. But I'm not sure that he knows when I began. Herb Deutsch and I began working June 1964. That's when we began and for a couple of months before that I was thinking about it but I'd never actually worked with a musician until Herb came up in June of '64. I didn't know anything about electronic music. Everything that Herb did, his whole aesthetic, was new to me.

Synapse: *Do you have any musical training?*

Robert: Yeah, but I wasn't part of the hip avant-garde scene at that time. I just wasn't. I was an engineering student, period. Engineering students 20 years ago were not like they are now. Engineers had a reputation of not reading anything and not listening to anything. Now there are thousands of engineers who are interested in electronic music and other thousands who are interested in video.

Synapse: *How does this progress into what is now the Moog Synthesizer?*

Robert: At first it was a small group of academic composers who showed an interest. Myron Schaeffer was the first; Ussachevsky placed the first order for envelope generators and envelope followers. It was his specifications that gave rise to what you find on every $500 synthesizer. It was Vladimir Ussachevsky in 1965 with the ADSR business. It's not mine, it's not ARP's, it's not Buchla's,—it's Ussachevsky's. Gustav Diamaga, who succeeded Myron Schaeffer, ordered the first voltage control filter; a young protégé of Ussachevsky's by the name of Walter Carlos ordered the first fixed filter bank and after a while I guess we had maybe six or eight institutions using our stuff plus Eric Siday, plus Aliin Nikolais and just a couple of other private people.

Synapse: *So the early Moog was a very custom system?*

Robert: You could have anything you wanted. It took us a couple of years to get the circuitry onto printed circuit patterns. We actually hand-wired them on victor board; pin by pin and wire by wire. Then the next stage, talking about a year or two down the road now, the same Walter Sear who sold my Theremins, being a consummate professional musician in New York City and a businessman to boot, saw an opportunity for the system among advertising agencies. Sear did a very thorough job of promoting the use of the synthesizer and making sound logos and music for commercials so it very quickly came to be that the music you heard coming out of the radio and TV, the commercial music and the soundtracks of commercials had synthesizers in them. People began to hear them, not realizing what they were. Then we met Paul Beaver who had a very active business renting musical instruments on the coast and in addition to that was a successful studio musician and a dabbler in electronic musical instruments. He began selling our stuff to the studio musicians. This is 1967 now. I could show you the first LP using a Moog Synthesizer. It's one of the funniest things you'll ever want to hear. That was 1967.

Synapse: *Which album was that?*

Robert: It's called, "Zodiac Cosmic Sounds."

Synapse: *Paul Beaver had a large studio then in L.A. with your equipment, didn't he?*

Robert: Yeah, well he built up a studio. The first time he exhibited in L.A. was at a AES Convention in 1967. That was at Paul's invitation. That was the first time anybody exhibited anything like this at an AES Convention and the first time there was an electronic music session at an AES Convention. People don't realize how fast this has come but in 1967, Los Angeles didn't know from synthesizers, period. Now it's sort of a focus. Paul got an incredible number of musicians interested in systems. Once in a while we fell behind. We just couldn't make them fast enough.

Synapse: *Was this before the Minimoog?*

Robert: Yeah, several years away from the Minimoog. Meantime Walter Carlos is in this one room apartment working away with

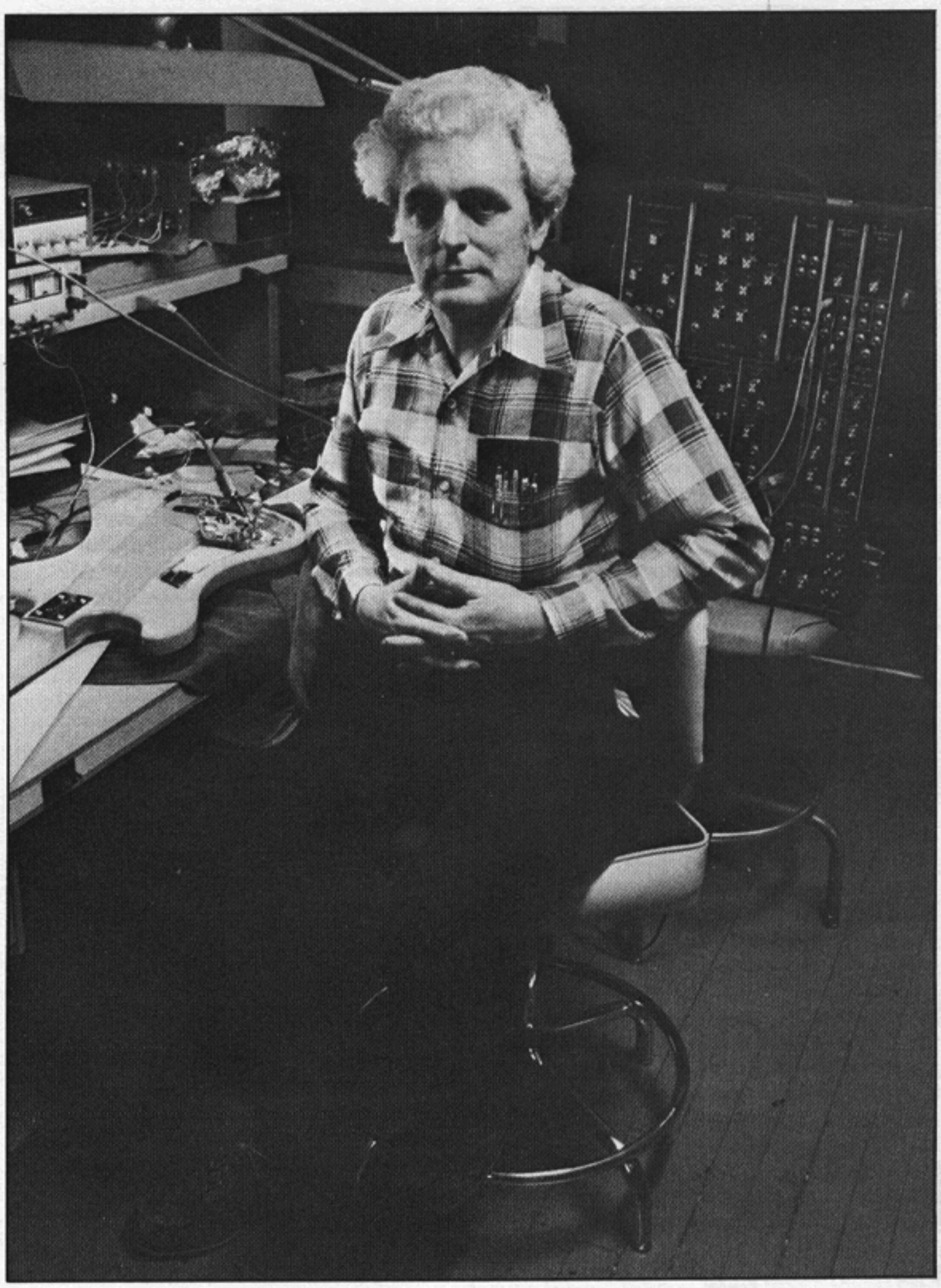
his own 8 track made out of surplus Ampex parts, his own 2 channel 8 input mixer, assembled components that we made for him and out came "Switched On Bach." Nobody knew what the hell was in store for him. They had all they could do to sell the completed master to Columbia for something like $5,000 up front.

Synapse: *Did they sell the album outright?*

Robert: No, but they only got $5,000 or less up front. At that time there was sort of a surge of activity among the avant-garde musicians in the commercial music world. Do you know David Behrman?

Synapse: *Yes.*

Robert: David Behrman was a producer at Columbia at that time and he got David Tudor to do an album and he got Alvin Lucier to do an album and the powers that be at Columbia figured "Switched On Bach" fit right in. It took off to become, as you know, a hit record. The biggest classical seller of all times. You might say that it didn't hurt "Switched On Bach" that they used, the vocabulary that they used for it had already been developed on commercials and on various LP's around. People were used to hearing those sounds, subliminally at least. Then "Switched On Bach" came and bang! Ten thousand dollars a week, $20,000 a week. Columbia didn't know what hit them. Then the guys with the cigars and the shiny shoes in New York City decided that this was the gimmick of 1969. If you could have a synthesizer record . . . The money machine, that's what they used to call it. Then the Moog records of 1969 came out and they were pissed . . . oh! You know, you can't find them now. They went up and they died. It was like an overactive yeast culture. They all choked themselves to death and everybody figured the gimmick had gone sour. Then there was the recession and all the sudden we weren't behind in our orders. In fact, we were behind in our payments and then we were bought out. At the height of all this, in 1969, we were invited to put on a concert in the Museum of Modern Art's "Jazz in the Garden" series. In order to celebrate this auspicious event, we built three or four performance oriented synthesizers and when I say, "built" I mean we finished two hours ahead of the concert. The garden of the Museum of Modern Art was filled up, shoulder to shoulder with 4,000 people—by far the biggest crowd they ever had. Herb Deutsch got together a few musicians and a fellow we'd gotten to know, Chris Swanson, and that was the evening. Afterwards, we tried to sell those synthesizers. They were set up with pre-set boxes to make fast changes possible. One of 'em went overseas to our London distributor who then sold it to Keith Emerson. Keith Emerson at that time had just left the Nice and was performing with Emerson, Lake and Palmer and they were at work on their first album. They incorporated the synthesizer in the last couple of tracks. I credit Keith Emerson, more than any other public performer, with really introducing the



EVE KESSLER

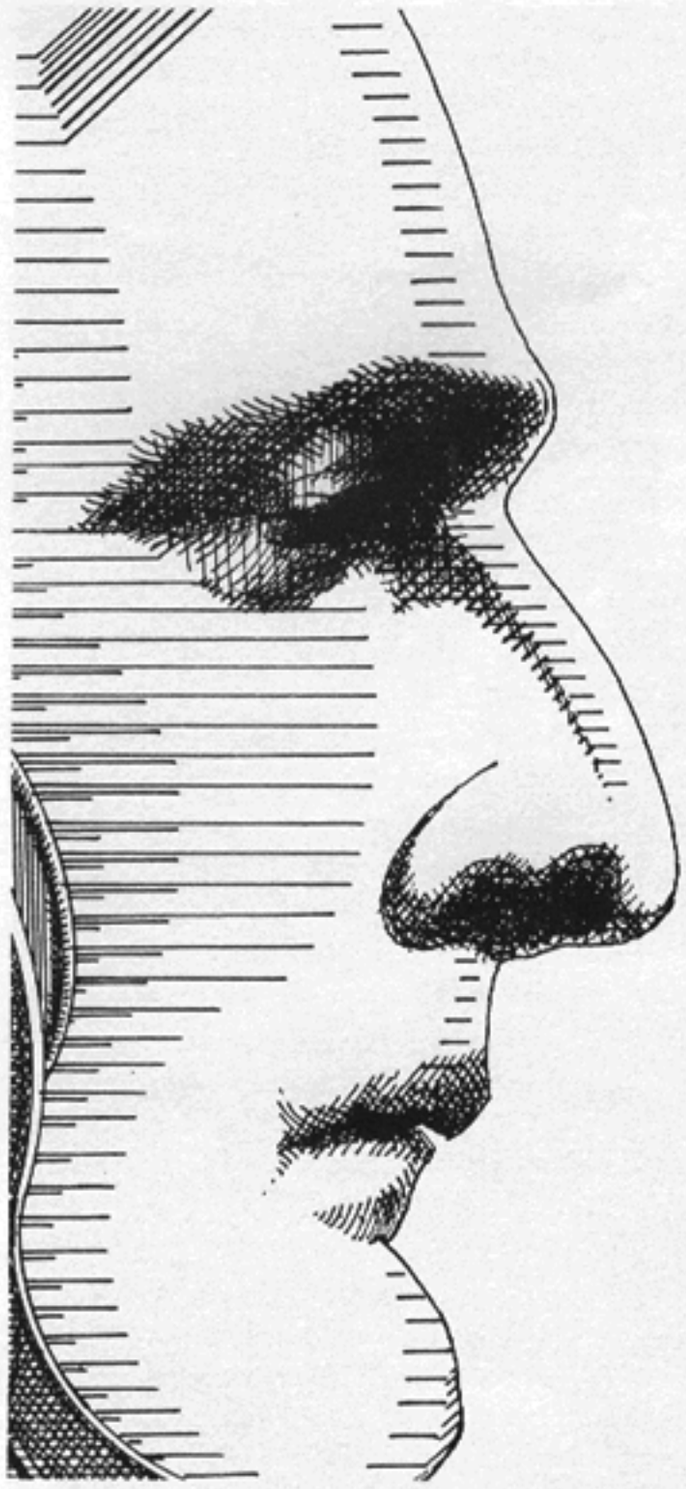
synthesizer as a performance instrument in rock 'n roll. So with the demand that Emerson was beginning to stir up, and other performing musicians expressed, we designed a Minimoog. It was at an AES Convention in 1971, in New York City, that ARP introduced the 2600 and that we introduced the Minimoog. We were both working the night before in our own hotel rooms getting these systems finished.

Synapse: *You just introduced the Polymoog to the market. Can you explain a little bit about the Polymoog and how it works and where you think it's going? Are you doing the total design now?*

Robert: No, there are quite a few of us in engineering. In fact, strictly speaking, I'm not even in the engineering department. I'm Director of Research for the electronic products group of Norlin Music. That includes not only synthesizers but a whole radius of devices, in fact, we just completed a very interesting project of putting some electronics in a new Gibson guitar, which is also part of our company.

Synapse: *I'd like to hear about both of these things. Let's start with the Polymoog and then go on.*

Robert: Let me point out a difference between monophonic synthesizers and polyphonic or chord playing synthesizers. A monophonic synthesizer offers a great deal of versatility off of one of two voices. You have all you can do with your hands to shape that one voice. It's like a solo instrument. The polyphonic synthesizer on the other hand enables your fingers to control which notes you play, how hard and when you play them. Therefore your hands are less engaged in actually shaping the sounds. The instrument itself shapes the sounds. They are really two different



approaches to playing. Okay, why is a Polymoog a synthesizer and why is it polyphonic. It's polyphonic because you can play any or all of the keys at once. You can play all of the keys on a Minimoog at once too but only the lowest one will sound. On a Polymoog, all of them will sound. Each key actually turns on a very special miniature synthesizer where most of the circuitry is on a custom integrated circuit that we've designed and tooled. The Polymoog, I might mention, was developed by Dr. Dave Luze who's the Director of Engineering out at the Moog Factory. He's the one who designed what we call a polyphonic chip. What does this chip do? When you press a key the chip shapes the waveform, filters the sound, determines its loudness, and also has two contour generators that create changes in the filtering, the waveshape and the loudness as the tone progresses from beginning to end. This differentiates the Polymoog from most other polyphonic instruments in that you can get a great deal of motion in each individual note; each individual note is articulated separately. There is something that confuses people sometimes, but I'll try to explain it. The Polymoog, even though it's polyphonic, is a two oscillator instrument. Each note has its own two tones. What happens is that there are two oscillators in the instrument and all the tones that are derived from these two oscillators are divided by top octave division. If I set the two master oscillators a fourth apart, each key will produce two tones a fourth apart. They can be any interval apart at all. They can be an octave, they can be almost in unison, exactly in unison, anything at all. So that further enriches the sound and now by pressing one note you can produce two pitches. Another thing that's unique is the touch sensitive keyboard. The harder you press, the louder and the brighter the sound gets, and you can vary the amount of this touch sensitivity. For instance, you can set it so that just the beginning transient of the sound gets loud to give it a punch effect when you hit the keyboard hard. Another thing that's particularly synthesizer-like about the Polymoog is that there is a hierarchy of control means. At the very top of the hierarchy there are eight factory presets. You push a button that says piano and all the variables that define that piano sound are turned on. Then one step down there are whole groups of parameters that can be set up on sections of the control panel ahead of time, and called into play just by pushing one button.

Synapse: *So you can modify any of the sounds that you pre-set?*

Robert: That's right. You can call up a preset and then you can take a whole area of it such as the dynamic responses or the filtering and vary just that part of it. The lowest level in the hierarchy is in making the entire instrument variable, not using any of the presets at all, but using all of the controls over all of the parameters.

Synapse: *Do you think polyphonic systems are one of the most important issues now in the design of synthesizers?*

Robert: I think that for the next couple of years they'll be coming into something very important. Except for the Polymoog, as far as I know, there are no true fully polyphonic synthesizers on the market. There are instruments like the Oberheim which you might call multi-phonic or limited polyphonic because it can produce four or eight tones at a time.

Synapse: *What other design projects are you working on?*

Robert: We just concluded the design of a new line of guitar amplifiers. People think of guitar amplifiers as gross and very simple. Well, they're not at all. To make a guitar amplifier that's loud, rugged, cheap, and sounds good, is a fairly sophisticated business. And frankly, Gibson amplifiers have had a reputation for being, shall we say, lacking luster, for a good many years now and we believe that this new series of amplifiers is an abrupt change in the quality of their product line. Another thing we did is design a really first rate synthesizer/amplifier. This is the deluxe amplifier/speaker system. It has two 200-watt output channels, four input channels each with parametric equalizers, a fast distortion pre-compressor and a very efficient wide-range speaker system. As far as I know, there are almost no sound systems, especially for synthesizers and other wide spectrum keyboard instruments. As I mentioned before, we've designed the electronics for a Gibson guitar. Right now they're called the RD77. Traditional electric guitar design is a series of compromises. Musicians like a lot of output. They like a guitar to be hot but the way you get a hot guitar is by putting a lot of turns on the pick-up, and the more turns you put on, the less high frequency response you get. All the tone controls in a guitar can do is cut out the high frequency. There's no way for them to boost the high frequency. So this guitar will have in it a very high quality amplifier and tone control circuit that enables us to use pick-ups with a few number of turns that will get all the high frequencies out and it will have tone controls that boost as well as cut the high frequencies and the low frequencies and operates without noise and without distortion. And we're also experimenting with a type of circuitry built into the guitar that compresses the output of one pick-up and expands the output of another pick-up, which, when you mix them enables you to articulate in a radically different way from standard guitars. When you play softly all you hear is one pickup. When you play it louder the other pick-up comes in and gives you exaggerated punch. Oh, and then we're introducing a line of so-called "keyboard modifier instruments." You know, a Maestro box for guitars? That's one thing. It's designed for a guitar signal to go in and go out but keyboard instruments place much greater demands on sound modifiers. If you want a phase shifter to act on a keyboard signal with a wide spectrum, it has to be very distortion free and have a wide frequency range. So we're designing a line with a phase shifter, a graphic equalizer, a parametric equalizer, a voltage control filter, and a flanger.

Synapse: *I remember a story you once told about the Moog synthesizer receiving a standing ovation when it was brought on stage at an Emerson Lake and Palmer concert. Do you remember it?*

Robert: Oh, yeah. Yeah. I think that sort of thing was more important a few years ago and that's what might have given rise to the keyboardist piling up the huge mounds of keyboards. But when Keith Emerson first took a synthesizer out, it was a completely intractable model, you know, and there was all this violence in association with it. I remember one performance, I guess he did at Rich Stadium for an outdoor concert, and he was fighting with the machine on stage. He'd throw himself back and get on the floor and then at the end he had the sequencer going with this riff, and it's going faster and faster and the lights are on the machine only. The musician steps back and bam, a big explosion goes off and inevitably people go crazy when that happens. I think people saw it as a fight acted out between the ultimate human being, the musician, and the ultimate machine, the synthesizer. —∿∿—

LEARNING VOLTAGE CONTROL

by Alex Cima

Synthesizers are of interest to students of varied persuasions, some become familiar with synthesizers and electronic music techniques through classes offered by music departments at universities, colleges and high schools, alternatives in the way of commercial studios and inexpensive studios shared by the public (such as Public Access Synthesizer Studio, charging $3.00/hour to play with Buchla, EML, and Serge equipment). Since it is such a personal event, the interplay of teacher/student may differ from one place to another, and the wise student will research his options before selecting a college or alternative instruction.

At some schools electronic music classes attract the attention of a few, however in most cases studio time is available a limited number of hours per week, thus the use of the studio is often inversely related to the size of enrollment . . . all the equipment must be shared by faculty and student alike. Some schools offer only "survey" courses dealing with historical events and names, record playing, and little if any time on the equipment. As always, the best studio is one's own.

One of the main problems involves the actual facilities available for study, these may range from a simple minimoog/cassette studio to outstanding environments costing six figures and including fancy digital hardware. Most university studios probably have some sort of modular instruments and 2 or 3 tape recorders . . . an adequate studio represents an investment of thousands.

Students are faced with the particular biases and elitist fantasies of the institution they attend. In some cases the faculty members are only interested in further elaborations of earlier European tape studio techniques, and in other cases professors are not proficient in synthesizer voltage control techniques. Further, political bullshit is often rampant between electronic music faculty and others in the department, much to the detriment of all concerned. In almost all cases the use of synthesizers or electronic music methods in rock and roll or jazz is profoundly shunned.

Many people interested in synthesizers do not attend a university, they are practicing or aspiring musicians, or producers, songwriters, arrangers, who: a(are curious about how synthesizers may integrate in their present musical activities, b(are interested in keeping up on the latest musical developments; c) want to learn before buying an instrument. Frankly, they may lack interest or awareness concerning the more esoteric sounds in electronic music since their application almost always would be within the context of traditional pop tonality.

A thorough synthesizer curriculum, without prerequisites, and for any stylistic applications could include the following topics and texts:

1) The relation between physical (vibrating object in elastic medium) and psychological (sound sensation, hearing) phenomena. Particularly conceptualized as an electrical signal being processed by a variety of electronic components subject to thermal noise and the like. Anatomy and Physiology of Hearing.

Suggested text: Roederer, Juan. *Introduction to the Physics and Psychophysics of Music*. 1973. New York: Springer-Verlag (125 5th Ave. 10010)

2) Developing a thorough understanding and facility in recording, playback, editing, and casual maintenance of tape decks. Appreciation for the techniques, developments, and ideas in "classical" tape studio, Concrete Music.

Suggested texts: Appleton, J., and Perera, R. *The Development and Practice of Electronic Music*. 1975. Prentice Hall (Bx 500 Englewood Cliffs 07632)

Ruscol, Herbert. *The Liberation of Sound*. 1972. Prentice Hall.

Runstein, Robert. *Modern Recording Technique*. 1974. Indiana: H.W. Sams (Indianapolis 46268)

3) Then, an introduction to a modular synthesizer explaining the function(s) and musical applications of its various components. Naturally, instruments differ in both substantive and subtle matters, so what is available for study depends on budget and administrative choice.

By whatever means, students should be made cognizant of: complex wave form generation, the importance of overtone content in timbral manipulations, subtractive and additive synthesis, that the keyboard voltage and trigger are just another controller, the stacking and mixing of audio and control voltages. The right course content should leave the student with adequate means to generate traditional orchestral instruments as well as new "instruments". More suggested topics:

a) VCO's, VCF's, VCA's, noise generators, keyboard voltage/gate, positive and negative triggers, "ON/ONE SHOT" triggers, envelope generators. (Even presets have most of these facilities).

b) Amplitude, frequency, and ring modulation. Particularly the different effects of modulation in the subaudio and audio ranges. Using DC voltages with ring modulators. Processing external sound sources. (Presets incline to provide only frequency modulation, usually by a low frequency triangle wave, some presets have ring modulation, some amplitude modulation).

c) The uses (and abuses) of reverberation (hopefully voltage controlled), and repetition echo (with variable rate and feedback), phase shifters and flangers, analog and digital sequencers, sample and hold.

d) Voltage processing and mixing: inverting DC and AC sources, effects of periodicity and frequency of control waveform. Some modules control gain at input, some at the output.

e) Manual and voltage controlled location panning.

f) The variety of controller interfaces: EVI, sax, pitch-to-voltage or "slave drivers", joysticks, ribbon, drum. . . .

g) Click track, tuning tones, and other techniques facilitating multitracking.

h) The contents of a contemporary professional recording studio: noise gates/reduction, 27 band EQ, digital delay/harmonizer, computer mix, ad infinitum.

From this point on and if the facilities are available, students should become familiar with digital programming techniques, perhaps supplementing their music class with another department's offering in FORTRAN, BASIC, and such similar languages. ⌐WW¬

Suggested text: Wells, T., and Vogel, F. *The Technique of Electronic Music*. 1974. Austin: University (Bx 7756 Austin 78712).

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a closer look at.....
DIGITAL DRONEZILLA

by Philip Loarie

Digital Dronezilla is an electronic device that I designed to achieve a precisely tuned four-voiced drone with programmability. Basically, the circuit consists of a reference frequency which is fed into four different digital multipliers. In turn each multiplier has four binary load inputs. Depending on whether these inputs are high (connected to the positive voltage supply) or low (connected to ground) will determine which of sixteen possible multiples the reference frequency will go to (see figure 'A'). This circuit utilizes a digital multiplier that composer David Behrman showed me. David uses this multiplier together with digital dividers to derive intervals of the 'just'* intonation system in his collaborative piece with Bob Watts and Bob Diamond, *Cloud Music*.

With modern digital circuits precise tuning is no longer a dream, with a single reference tone thousands of frequencies can be derived accurately. This technique is used in 'state of the art 'Citizens Band Radios in which digital frequency synthesizers with one crystal replace what use to take 23 or more crystals, saving both material and labor costs. However, one cannot get ratios as found in the 'just' intonation system with digital frequency synthesizers or digital dividers alone. It is necessary to incorporate both digital dividers and multipliers for ratio styled tunings. To date there is not a discrete device available on the market known as a digital multiplier as there are digital dividers and so what is described here is a circuit composed of several discrete devices to perform the function of a digital multiplier.

Truth Table for Programming One Voice of Digital Dronezilla

binary load inputs on 8281	*decimal equivalent*	*actual multiplier in the phase locked loop configuration*	*output frequency in cycles per sec.*	*intervalic name*
1111	*15*	*1*	*440*	*fundamental*
1110	*14*	*2*	*880*	*octave*
1101	*13*	*3*	*1320*	*octave +P5th*
1100	*12*	*4*	*1760*	*2nd octave*
1011	*11*	*5*	*2200*	*2nd octave +M3rd*
1010	*10*	*6*	*2640*	*2nd octave +P5th*
1001	*9*	*7*	*3080*	*2nd octave + 7th*
1000	*8*	*8*	*3520*	*3rd octave*
0111	*7*	*9*	*3960*	*3rd octave +M2nd*
0110	*6*	*10*	*4400*	*3rd octave +M3rd*
0101	*5*	*11*	*4840*	
0100	*4*	*12*	*5280*	*3rd octave +P5th*
0011	*3*	*13*	*5720*	
0010	*2*	*14*	*6160*	
0001	*1*	*15*	*6600*	*3rd octave + 7th*
0000	*0*	*16*	*7040*	*4th octave*

Given the reference frequency 440 cycles per second, 0=low=connected to ground
1=high=connected to +5 vdc

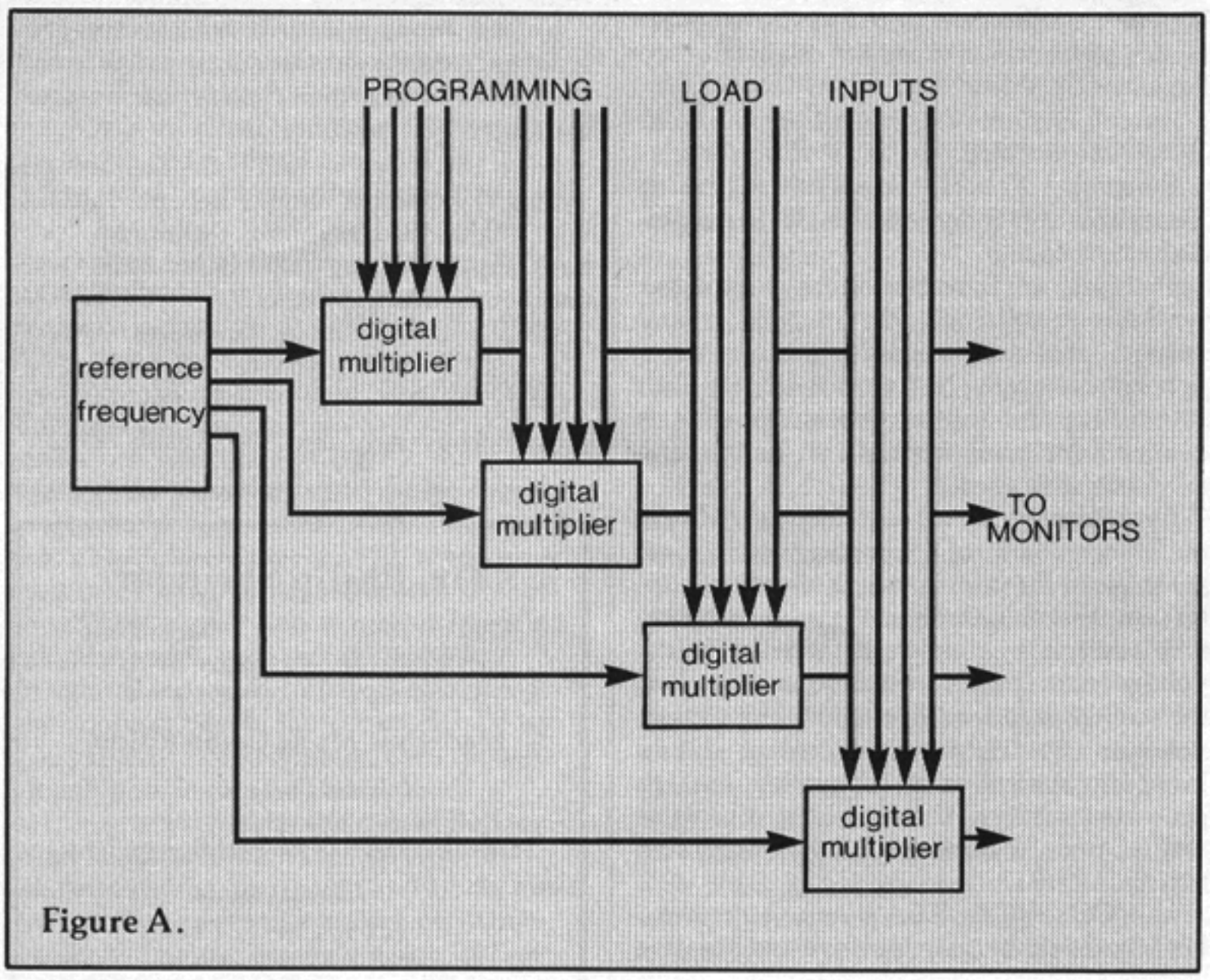

Figure A.

The digital multiplier in Digital Dronezilla is composed of a CMOS PLL (complimentary metal oxide semiconductor, phase-lock loop) notably the RCA CD4046 and a TTL (transistor transistor logic) programmable binary divider, National's 8281 (see figure 'B'). In this fashion the programmable divider is actually a programmable multiplier—as David Behrman says "the phase-lock loop is tricked into multipling". If you are interested in finding out how the 'trick' works, consult the RCA COS/MOS Data Book under application note ICAN 6101. In the 1975 edition this appears on page 471.

When a new pitch is activated by changing the load inputs there are some interesting results such as pulse width modulation, phase shifting, and a glide or glissando from the last pitch assignment to the current pitch as-

signment. The time it takes for this change to stabilize is determined by the value of the capacitor connected near pin no. 9 on the CD4046 (refer to figure 'B'). Since I was interested in building a drone type of instrument, as the name Dronezilla implies, I found that using too large a capacitor (100 micro farads or more) introduces some other elements I found undesirable. One might call it noise but I would rather call it weirdness from outer space. For a more complete discussion of the phase-lock loop (RCA CD4046 or the Motorola MCI4046) see Don Lancaster's article *IC'S For Electronic Music*, Radio Electronics Magazine, February 1974, page 48.

The signal outputs (there are four, one for each voice) of Digital DroneZilla are square waves which are ideal for either electronic or acoustic filtering and phase shifting. In performance I have been feeding each output through an amplifier and then to a speaker mounted on one side of a plexi glass tube. Each tube is about 3" in diameter and they range from 3' to 6' in length. They each add their own formant resonance to the drone. There is a performer for each tube who when given a cue begins to wave their tube to create doppler effects. I got the idea of using tubes from New York composer John Driscoll. Does this mean music is going down the tubes?

Basically, Digital Dronezilla functions in a performance situation like that of other traditional drone instruments, it provides a steady sonority for other musicians to 'sing' with. Recently composers Don Cardoza and Bob Davis have improvised on specially tuned clavinet and Hawaiian Guitar respectively with my drone machine. While Don and Bob were trying out different modalities, I was experimenting with different combinations of tones to drone along with; somewhat of an extension of North Indian Raga Music.

This circuit need not be used in the fashion I have proposed, for instance, instead of a drone device, this circuit could be easily adapted to become a melodic instrument simply by hooking the load inputs to a digital sequencer or small computer to command faster changes in pitch. One might go so far as to introduce more sophisticated divider circuits. Instead of the four bit word capability of the 8281, one might substitute something on the order of a 16 bit device to derive 2^{16} or approximately 65,536 possible pitches. Furthermore an extra divider circuit at the output or the input stages of the multiplier would allow one to derive very accurate ratios in tuning—depending on how many bits the multiplier and divider sections have it is theoretically possible to construct Harry Partch's 43 tones to the octave scale electronically.

Digital Dronezilla is not a very hard circuit to assemble and its parts are not uncommon. It costs about $6.00 a voice. Here are some helpful suggestions for construction. 1) use a well regulated 5 volt power supply. 2) make sure to put a decoupling disk capacitor near all TTL devices as shown in the schematic (figure 'B'). 3) use a grounded, small wattage soldering iron. 4) use Molex pins or IC (integrated circuit) sockets. 5) HAVE FUN! ~WW~

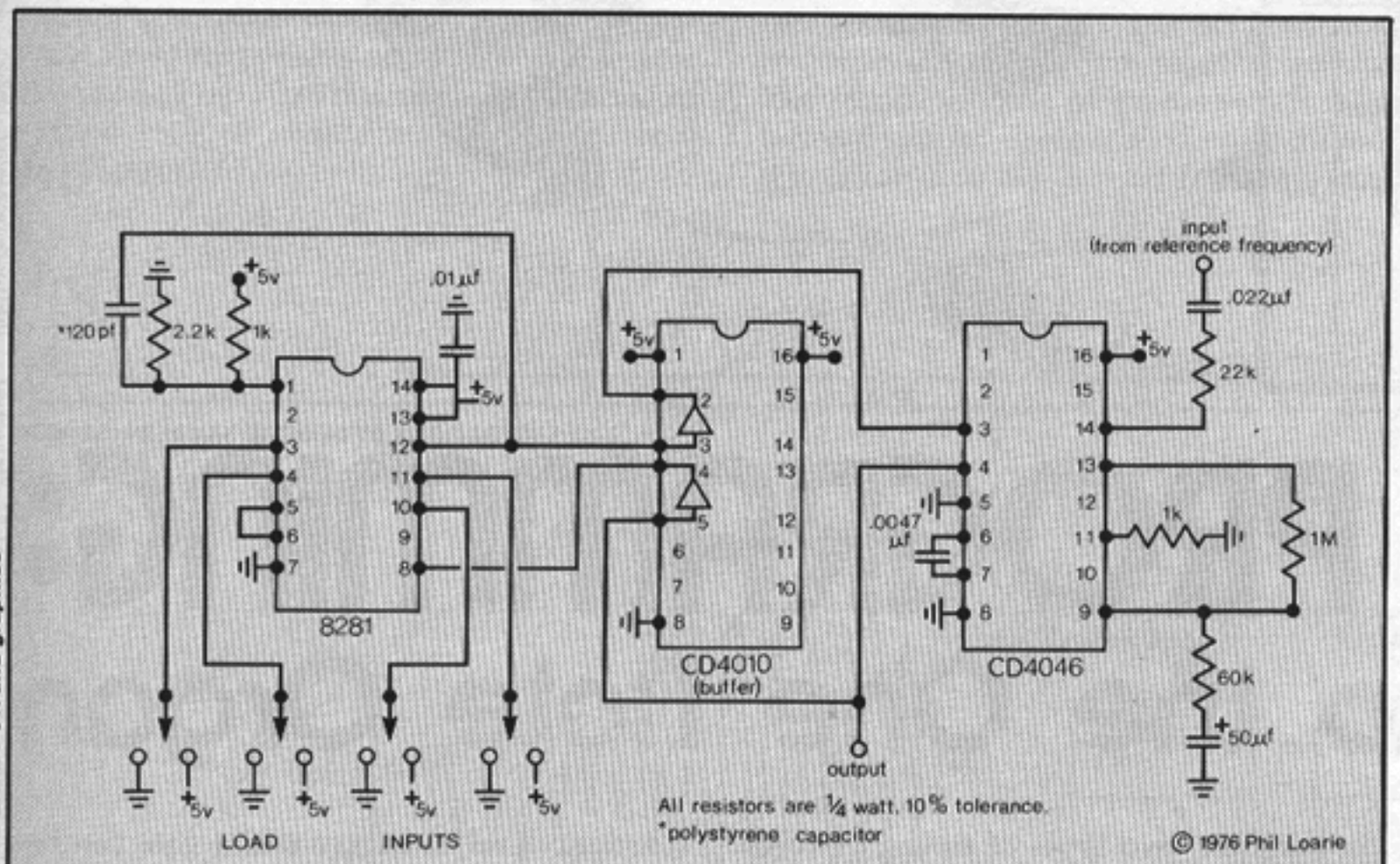

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Figure B. Circuit schematic for the digital multiplier of one voice digital dronezilla.

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* 'Just' intonation, the adoption in performance of the 'natural' non-tempered scale. From *A New Dictionary of Music* by Arthur Jacobs. Penquin Books Ltd. © 1958

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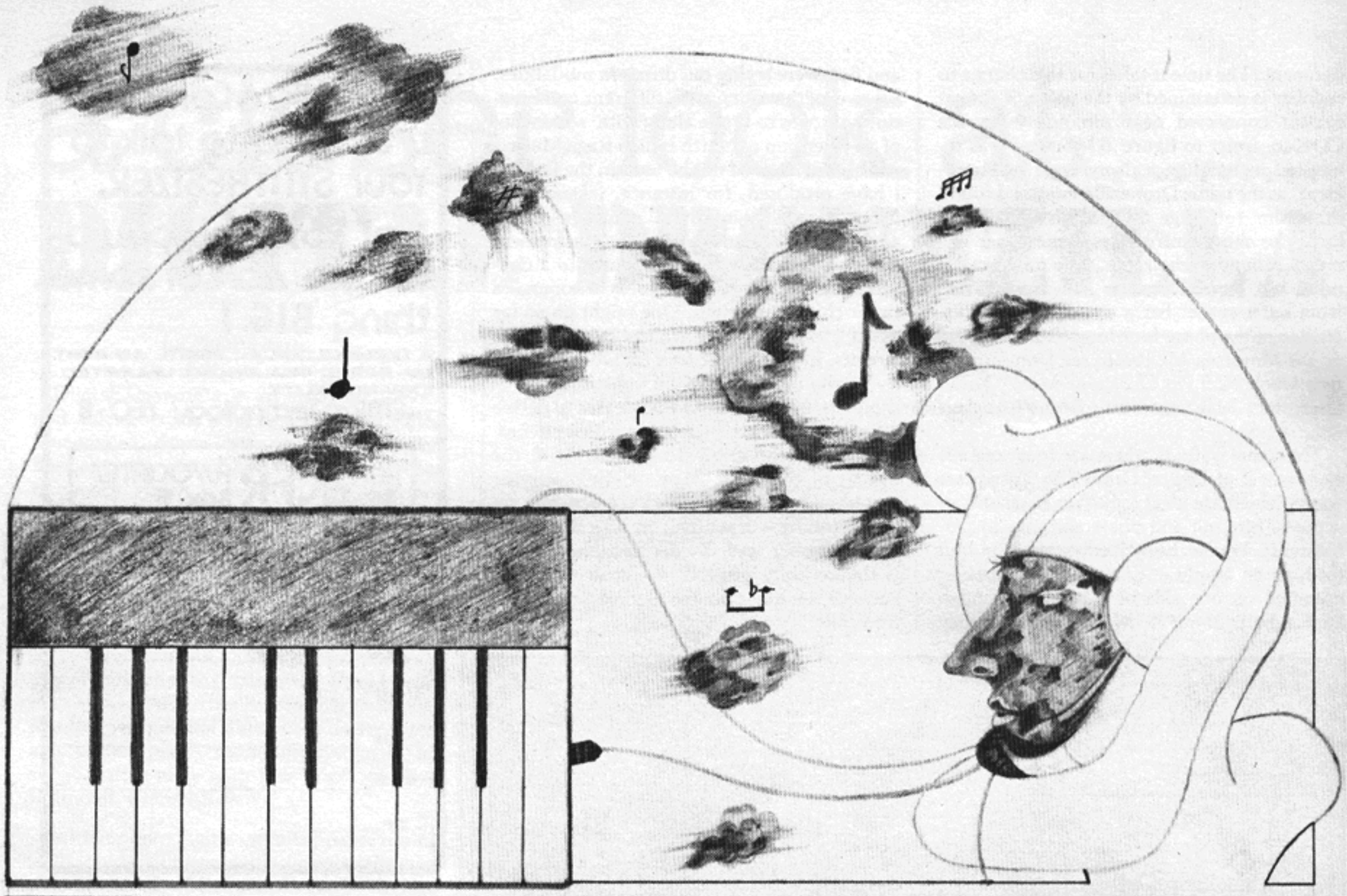

ILLUSTRATIONS BY GEORGE SANDERS (SANDO)

ANALOG PROGRAMMING:
Alternatives to the One Note Organ

by Eric Valinsky

Small keyboard synthesizers such as the Minimoog are useful to the performing musician in that they make instantly available the most common electronic sounds. They are nevertheless limited in flexibility. The synthesizer is pre-programmed such that the depression of a key instigates an event (note) whose pitch and other parameters are controlled directly from the key. Thus, a synthesizer of this type is basically a keyboard instrument capable of producing only one event at a time—a One-Note Organ! Only large modular synthesizer systems allow what is called *analog programming*.

Analog programming is achieved through the production and routing of two classes of *programming voltages*, namely DC *control voltages* and *timing voltages*. The former are usually positive voltages, static or slowly varying, which are used to set the operating parameters of the synthesizer system (e.g. frequency of an oscillator, gain of an amplifier, etc.).

In addition, two types of timing voltages are generally available. A *trigger pulse*, or simply *trigger*, is a rapid rise then fall of voltage level used to initiate events or, as will be seen later, to change the state of the system. The second type of timing voltage is the *gate signal*, or *gate*, a rapid rise to a high voltage level which is sustained for a certain time period (the *on-time*), followed by a sharp drop in voltage to ground (0 volts). Gate signals are also used to initiate events, but will also impart duration to the event corresponding to the gate's on-time. Graphical representations of these programming voltages are shown in figure one.

Programming voltages are generated by numerous modules within the synthesizer system, including keyboards, sub-audio oscillators, and sequencers. An example of a *programming voltage generator* (PUG) which will be used later is the envelope follower. This module produces a dc control voltage output proportional to the amplitude of the audio signal input. In addition, if the input signal, hence dc voltage, exceeds a set threshold level, a trigger and a gate can be produced. The gate is on as long as the threshold is exceeded. Thus the envelope follower produces timing as well as control voltages. The output behavior of the envelope follower is summarized graphically in figure two.

Many types and variations of programming voltage generators exist. In fact, each synthesizer system has unique methods of generating and utilizing programming voltages. It is therefore beyond the scope of this article to provide an overview of analog programming techniques. Instead, a few general programming techniques will be explored through a progression of examples. First, however, one additional programming concept will be explained.

An event is an undefined term in music, but it has at least three properties. The first is its character, which enables a listener to distinguish the event from another event, or from the continuum of non-events, another undefinable. Secondly, it has a starting time, and finally, a duration. A device or collec-

tion of modules which produces an event is called an *event generator*. (EG). It is with the interaction of event generators with each other and the outside world that analog programming is concerned.

What exactly constitutes a musical event is a point of disagreement among composers. However, the event generator concept is independent of event criteria. Thus, an event generator generates an event, no matter what is considered an event.

Examples of Analog Programming

Example One: Direct Programming

For the first example, we will return to the One-Note Organ, for which a possible configuration is given in figure three. As mentioned earlier, a single note (event) at a time is produced, whose pitch, timing and duration is controlled by the keyboard. The system structure consists of one event generator controlled by a keyboard and is depicted in figure four, a simple and straightforward configuration.

Note the blocks within the rectangle labeled "event generator." The amplifier stage represents the modules used to initiate and terminate the event, which could be a VCF or the on or off state of the power switch, as well as a conventional VCA controlled by an envelope generator as in the case of our poor inflexible synthesizer. Notice also, in this example, that certain modules are always on: the oscillator is perpetually oscillating, the filter is continually filtering. However, the event itself will only be on (i.e. heard) when the final amplifier stage is on. As will be seen later, we can obtain control signals from the continuously operating portion of the generator which are independent of the on-off state of the event.

Example Two: A Simple Program Loop

A sequencer can be used to generate a *program loop*, as shown in figure five. The sequencer is clocked slowly and provides triggers which initiate EG I and EG II when the corresponding sequencer stage is reached. The recurring cycle of events which results forms a simple, uncontrolled program loop. It is assumed in this and the following examples that the durations of the events are independent of the on-times of the corresponding sequencer stages. In addition, more than two event generators can be used, up to and including the number of sequencer stages.

Example Three: Controlling the Program Loop

In figure six, an envelope follower processes the continuous signal from each event generator. When the amplitude of the continuous signal from EG I exceeds the threshold level, a trigger is generated which starts the sequencer clock, thus initiating the loop. The loop is terminated by a trigger controlled by EG 11, which stops the clock.

A second controlling technique is shown in figure seven, in which the trigger acts as an external clock advancing the sequencer to the next stage. Thus, the event generator controls the initiation time of its events. In effect, with the help of the envelope follower, the event generator itself is used as a PUG.

Example Four: Branching and Feedback

The use of the *branching* concept allows decisions to be made in realtime. Depending

Fig.1 Programming Voltage

Fig.2 Envelope Follower Outputs

Fig.3 A One Note Organ

Fig.4 Event Generator

Fig.5 A Simple Loop

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Fig. 6 Controlling the Program Loop

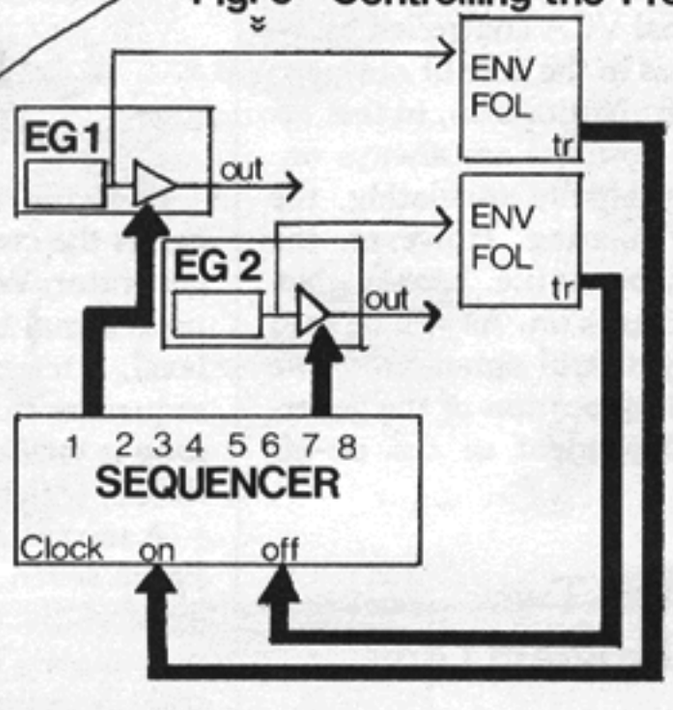


Fig.7 Use of External Clock

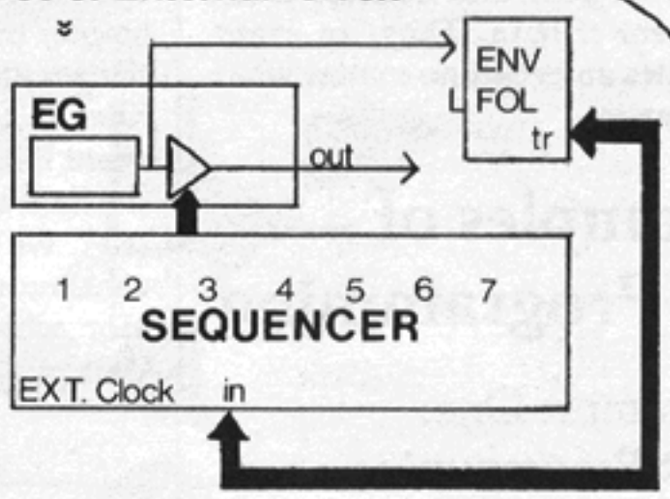
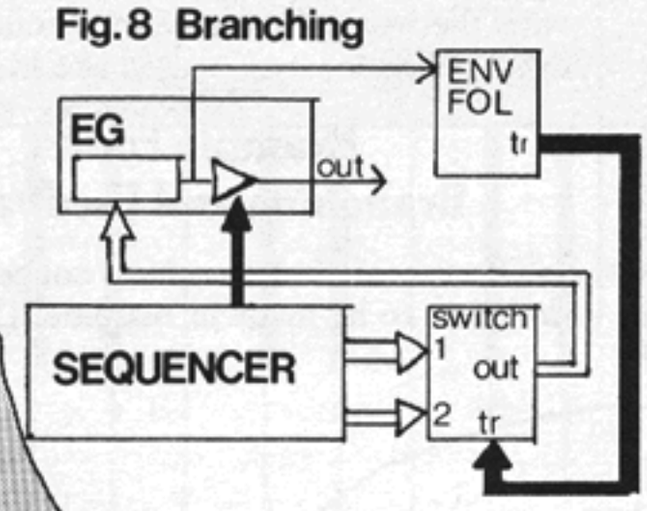


Fig.8 Branching



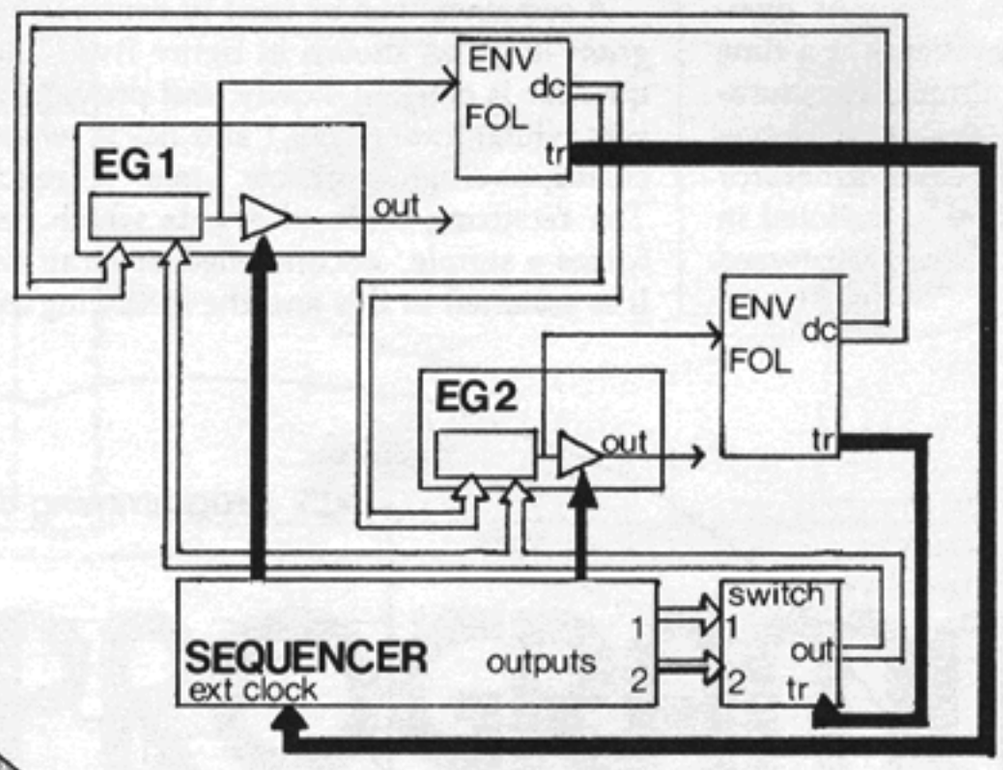


Fig.9 A Combination of Techniques

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changes its state each time it receives a trigger pulse. In this example, one of two sets of control voltages from the sequencer is selected by a trigger pulse from the envelope follower.

Note that the event generator, through the envelope follower, controls the switch which selects the sequencer voltages, which in turn will control the event generator. In this way, the event generator is indirectly controlling itself. This is a rather crude example of a *control loop*, more commonly called a *feedback loop*.

Example Five: A Combination of Techniques

Programming complexity increases in the final example, illustrated in figure nine. The timing of the program loop of example two and three is controlled by EG I, as in figure seven. EG II controls the branching between the two sets of sequencer control voltages as in example four. The use of sequencer control voltages is nontrivial, since again it is assumed that the durations of the events are independent of the sequencer stage on-time.

In addition, there are three feedback loops. In the first, EG I controls the clocking of the sequencer which provides control voltages, controlling EG I. The second, involving EG II was described in example four. Thirdly, through an envelope follower, EG I controls EG II, which in turn controls EG I through a second envelope follower.

What is the difference between a feedback loop and a program loop? Feedback implies interaction among all the components of the loop. A program loop may be a feedback loop. In this example, the timing of the program loop is controlled by a feedback loop. However, the program loop itself (i.e. the sequence of events in time) is independent of the event generators and the switch, and thus is not a feedback loop.

In summary, a number of programming concepts have been presented and related to analog systems. These include straightforward direct programming, appropriately dubbed "The One-Note Organ Syndrome"; program loops to provide automatically recurring events cycles; branching to allow decision making; and control or feedback on its state, a system can automatically select one of several alternatives. For example, in figure eight, the branching device is an electronic switch which operates as follows: one of two inputs will appear at the output of the switch, depending on its state. The switch loops, involving interaction among system components. These techniques are used in combination to construct the program structure.

The design of the program structure is only the first step, however. In an analog system especially, most of the work is left to be done. Most importantly, the event generators must be defined and their parameters set. Threshold levels of the envelope followers must be determined to allow fine control of timing signals. A band-pass filter may be inserted between the event generator and the envelope follower to introduce frequency dependence of the control signals. This also must be tuned. All this must be done with the system fully patched and operating so that the final musical result can be selected. It is easy to lose sight of it, but it is the musical result which is most important. The beauty of analog programming lies in the ability to enhance the complexity of the final musical result. ⌐∿∿⌐

VOCAL SYNTHESIS

by Peter Hillen
consultant, National Semiconductor

An article on computer generated speech wouldn't seem right without a reference to Star Trek or 1984. That was it. The fact is that computer speech is here today and is in reach of electronic music performers both from an availability and a cost stand point.

The first speech synthesizers were a mechanical replica of the vocal tract. Soon after followed the electronic synthesizers using analog circuitry. The problem with analog synthesis is that sound sequences are hard to generate. Next came the digital synthesizers. Entirely digital speech synthesis techniques require a large, high speed and expensive computer to perform all the algorithms necessary to produce speech. The breakthrough comes in the form of a trade off in digital vs. analog technique which reduces computer speed, power and cost with the addition of some special purpose analog hardware. One such speech synthesis sytem which uses this approach is the Computalker (PO Box 1951, Santa Monica, Calif. 90406). The Computalker speech synthesizer is a card full of analog electronics which fits into computers designed to be compatible with the S-100 hobbyist computer interface for which there are a number of suppliers of inexpensive ($500) good quality computers.

The Computalker breaks down the task of speech synthesis into two parts. First is the generation and formating of analog signals to make speech-like sounds. The Computalker circuits take care of this. Second is the generation of control signals to sequence the Computalker module in the correct way to make its output sound like speech. This is accomplished by the computer using a digital interface to the module and extensive software to follow the complex rules of speech.

Let us examine how we humans speak and break the contributing functions into blocks which the computer can control. For reference, a schematic of the whole vocal synthesis system is shown in Figure 1. It is the electronic analog of the vocal tract which starts at the vocal cords and ends at the lips. As we go through the derivation you will find that the electronic counterparts of our vocal tract are made up of the very familiar electronic music functions of voltage control.

First, the vocal cords or vocal folds. The vocal folds open and shut one end of the vocal tract interrupting the flow of air from the lungs. These short bursts of air serve as the oscillator in our vocal system. The form of these waves looks like a half wave rectified sine wave as is shown in Figure 2. The electronic analog of the vocal folds is a variable frequency oscillator. It is variable because the frequency at which each of us use our vocal folds is different. Furthermore, when we speak, the frequency of the sound generated by the vocal folds does not stay constant. Its variation is used to increase the meaning of the words being spoken. Speech amplitude is also important to meaning, adding emphasis to what is being spoken. The amplitude of the oscillator is controlled through a variable gain amplifier.

The sound generated by the vocal folds makes its way up the vocal tract to the lips. The vocal tract can be treated as a straight tube. From physics, it is known that a characteristic of a tube such as this is to be resonant at odd multiples of the wave length of the tube. From the analysis of speech, it has been found that only the first three of these resonances need be considered when developing a model for speech. If you have looked into your mouth lately, you may have noticed it doesn't look like a straight tube. All along the way, there are things which can change the characteristics of the sound. Some to consider are the shape of the mouth, the nasal cavity, the position of the tongue, the teeth and the lips. Each of these can be modified depending on what is being spoken to deliver the desired sound characteristics. The resonant frequencies are not fixed at the odd multiple intervals and can vary in accordance with the change in the physical shape of the tract. These resonances are simulated in Figure 1 as three variable frequency filters in series with the vocal cord oscillator and amplitude control. This path is called the oral

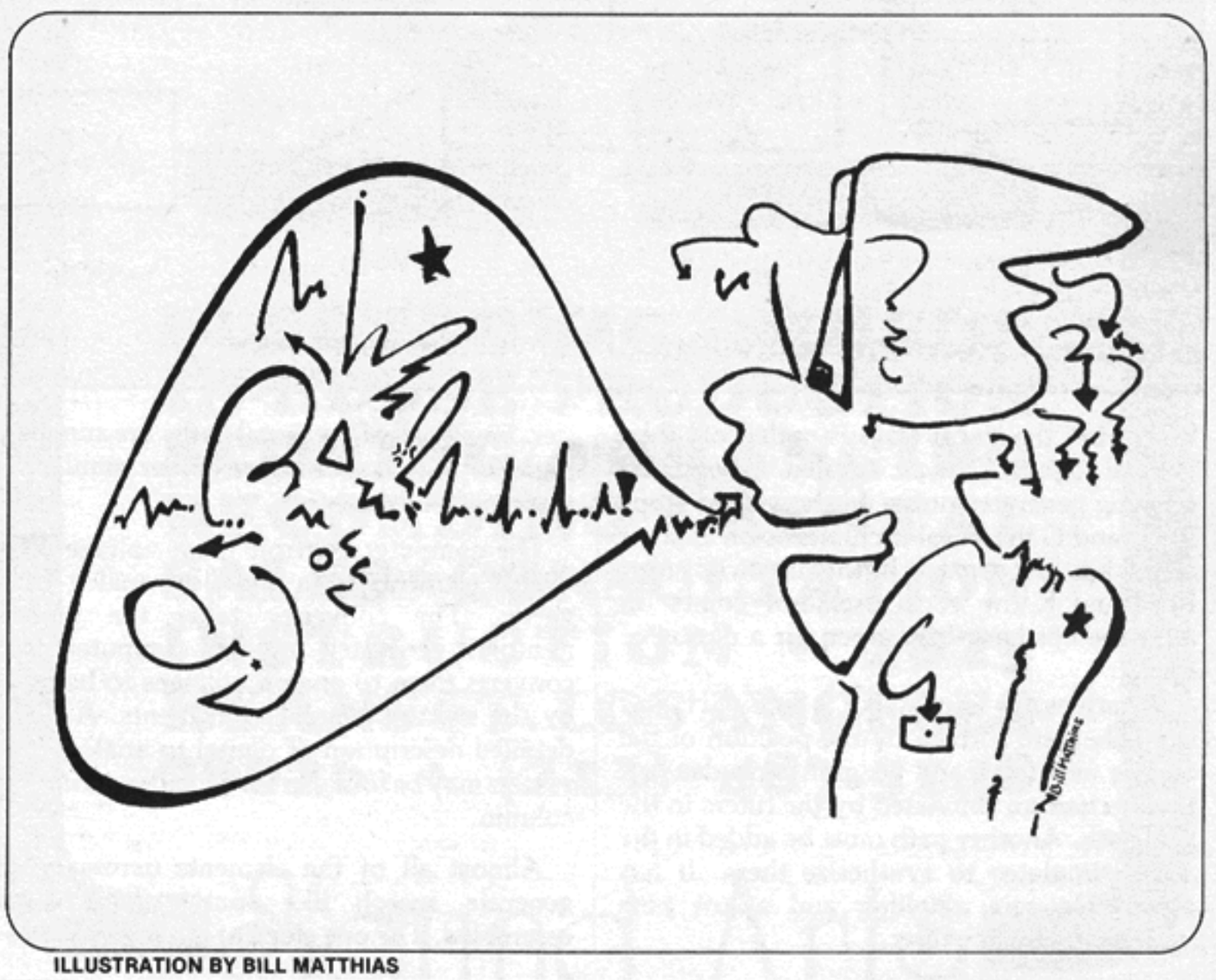

ILLUSTRATION BY BILL MATTHIAS

VOCAL SYNTHESIS

path. It is used to form all of the vowel sounds (A, E, I, O, and U) and some of the consonant sounds.

Consonants are divided into 4 classes: liquids, stops, fricatives and nasals. The liquids are comprised of the sounds W, Y, R and L. They are formed very much like vowels except that the way the mechanism is used is timed differently.

The next two classes, stops and fricatives, make use of noise. We generate noise by exhaling through a narrow opening formed by the lips and tongue. Noise is simulated in the electronic vocal tract by a noise source followed by variable gain amplifiers to control its amplitude.

Stops come in two forms: voiced and unvoiced. They are both formed in a similar way. First the vocal tract is sealed off then opened slightly. The air exhaled through this opening generates noise. In the voiced stops B, D, and G the vocal oscillator is on as soon as the lips are opened. In the unvoiced stops P, T and K the vocal oscillator comes on after the lips have been open for a period of time.

Fricatives are sounds like S, F, Z, SH, and TH. They are formed by the position of the tongue and teeth and are not dependent on the mechanism simulated by the filters in the oral path. Another path must be added in the vocal simulator to synthesize them. It has a variable gain amplifier and a low pass variable frequency filter.

The last path in the vocal simulator must be added to take into consideration the nasal cavity. The nasal cavity is important in generating consonant sounds like M and N. They are made by closing the vocal tract and exhaling through the nose. The cavity itself is fixed in size and can be simulated by a fixed bandpass filter of fairly wide band width.

Finally every block in Figure 1 has been defined. All along filters, amplifiers, oscillators and noise sources have been mentioned. Let's be specific and relate these to electronic music modules. The vocal cord oscillator is nothing more than a VCO with about a 2¾ octave range and a modified sine wave output. The noise source is a standard wideband white noise type. The amplitudes of both of these signal sources are controlled by VCAs which contour the amplitude envelope before passing the signal on to the filters. There are two types of filters used in the vocal simulator: variable and fixed. Both are the bandpass type. The format filters ae variable and work like a VCF. The nasal cavity filter is fixed and works like a preset graphic equalizer. Finally all of the signal paths are summed together by a summing amplifier similar to a microphone mixer.

The computer controls these voltage controlled elements by a digital to analog converter. The converter takes the binary numbers generated by the computer and converts them to analog voltages to be used by the voltage controlled elements. A more detailed description of digital to analog converters may be found in the Synapse computer column.

Almost all of the elements necessary to generate speech like sounds have been assembled. The one element missing is the cohesive force to link everything together in an intelligent way to generate speech. This force comes in the form of a computer software program. The software program is responsible for the timing of the changes in amplitude and frequency of all the elements involved. The problem now is how does a human operator of the computer give the commands to synthesize speech? There are two methods.

The first gives excellent speech quality but is time consuming to generate. It is referred to as synthesis by hand. Synthesis by hand is accomplished by using a spectrum analyzer and amplitude envelope follower to determine the frequency/amplitude profile of the speech for a human speaking into a microphone connected to the equipment. The data from these devices is usually in the form of a graph which must be analyzed to define each parameter on an instant by instant basis and then coded into the computer. Additional editing must be done to improve the quality of the speech by compensating for deficiencies in the hardware. Synthesis by this method requires expensive analysis equipment and is restricted by the fact that the synthetic speech is patterned after the voice of the person making the sample.

The second method which is most useful is the use of a phonetic alphabet. This is a set of symbols compatable with the keys on a typewriter and corresponds to the elements of sound (vowels and consonants) described above. The phonetic symbols contain information about timing, intonation and stress levels for the words being synthesized. A person familiar with the dictionary can translate directly from English text to phonetic text. The computer takes the phonetic text, interprets the rules and produces speech.

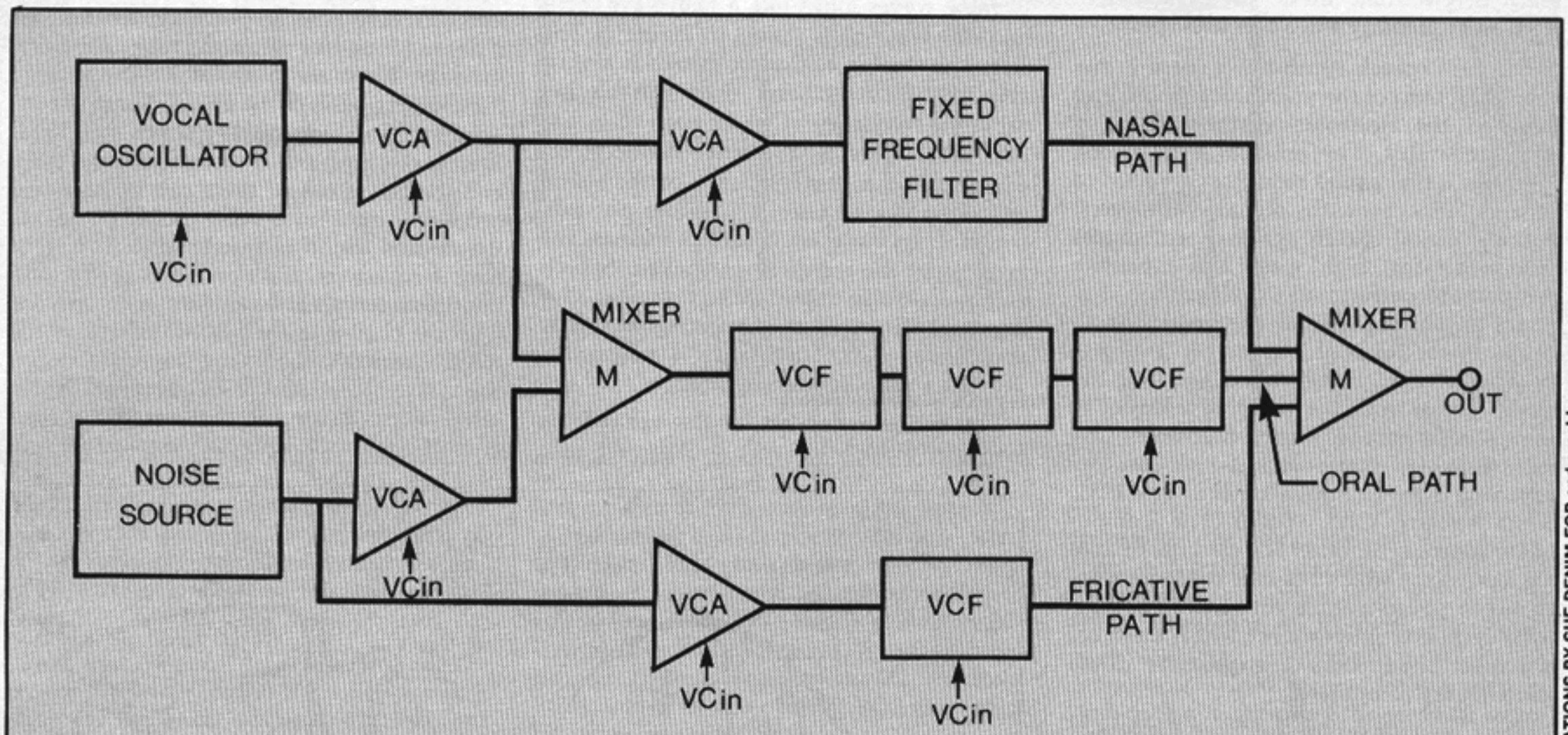

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Figure 1. Electronic equivalent of the vocal tract.

Figure 2. Output of vocal oscillator.

Take as an example the word *this*. The phonetic dictionary representation is *dhih3s/* which seems pretty obscure.

It's not really all that bad. The *DH* symbolizes the *the* sound as in the word *that*. *Th* symbolizes the *i* as in the word *bit*. The *3* is a stress level symbol which follows a vowel. *S* is the symbol for the sound an *s* makes in the word *sat*. With a little memorization and practice it is not difficult to compose sentences quickly. The power of the phonetic dictionary is not without penalty. English is a very complicated language and is full of many exceptions to the rules. Words like *two, too* and *to* which are spelled differently but sound alike (all are synthesized as *tuw*) prevent a one to one relation between English text and phonetic text. Further problems arise with context dependent words like: *"read* Synapse" (*riyd*) or "yesterday I *read* Synapse" (*rehd*). Even more important is the relationship of each phonetic element in a sentence to the others. There must be a smooth transition from one to the next. At this time the stage of development of the computer software for all speech synthesizers is not good enough to provide it. Because of these reasons phonetic dictionary generated speech is not as easy to understand as hand generated speech. Good example of both hand generated speech and phonetic text speech are on a demonstration cassette from Computalker available at the address given above for $2.95.

A brief overview of synthetic speech has been given. Now the question is how can the electronic musician use it. Robbie the Robot like sentences tucked away in the middle of a composition spouting some profound idea (ALL PERSONS ARE SYBLINGS) would be a waste for such a tool. A microphone into a fuzzbox or use of the EMS voice synthesizer could accomplish a similar effect much easier. The real value of a computer speech synthesizer comes from what it can do that the human voice can't.

In the most generalized case the speech synthesizer can be used as a computer controlled sequencer having nothing to do at all with speech. The VCO for the vocal cords can be tuned over about a 2¾ octave range and the filters, amplifiers and noise generator can be used in a similar manner to ones in a conventional synthesizer. This is useful in storing repeating patterns such as bass lines or rhythmic sounds. It allows for easy recall because the information can be preprogrammed and stored for later use.

Now for the human sounds. Two parameters the speech synthesizer can control better than we humans is frequency and time. First consider time. Computer speech differs from tape recorder modified speech with respect to the effects of speed changes. The tape recorder can double or half the speed at which something is said but at the same time alters the frequency of the speech. The speech synthesizer does not. Voice frequency stays constant no matter how fast or slow a word is said. It is even possible to vary the speed within a word or sentence on a phrase by phrase basis. For example, one could hold the *a* in the word *pause* indefinitely, certainly longer than a human voice could. Also words or groups of words could be synthesized backwards. This is extremely easy to do when compared to the old method of tape editing, permitting real time backward speech on a word by word basis. An interesting case would be to have each word in a sentence followed by its mirror image in time.

So much for becoming unstuck in time. Frequency can also be manipulated in several ways. As voice frequency is independent of time in speech synthesis so is time independent of frequency. Sentences can be spoken at normal speed but the voice frequency could be an octave higher, a fifth lower or any place you want it. This opens up possibilities in a multi-track recording studio environment to perform near perfect multipart harmonies with exact timing and phrasing.

Voice frequency can be made independent of phonetic phrasing but would require a departure from phonetic dictionary. It is possible to have the vocal cord oscillator do the melody while the rest of the vocal tract circuits are "mouthing" something different. Taking this one step further, why not eliminate the vocal cord oscillator altogether and use alternate sound sources such as a guitar or recorded voices which would be modulated by the vocal tract circuitry? Such an effect would be similar to the now infamous blow bag used by Peter Framton. It would require modification to the speech synthesizer because of the vocal cord wave shaping filters.

As you can see the speech synthesizer opens up a vast new area of exploration for the electronic music composer and musician. The technology is new but does exist and is affordable to anyone who wishes to try.

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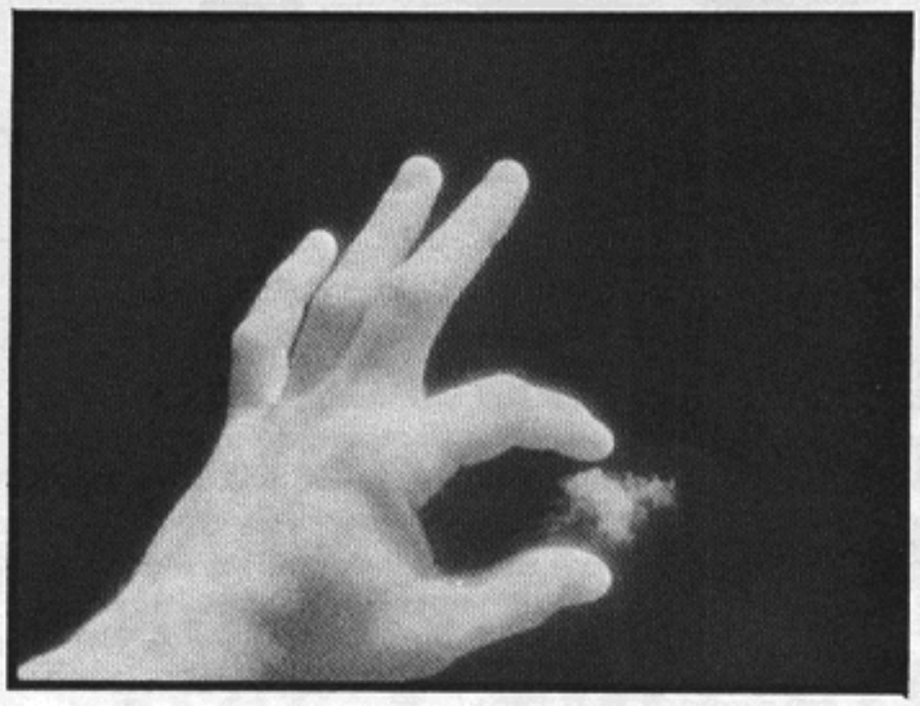

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SYNTHESIS

Modulation: Part One

with Danny Sofer

Modulation is the process of controlling a component on a synthesizer with a changing voltage of some sort. The effects may be broken down into two groups: modulation with control voltages that are themselves audible (approximately 20 hz. and up), and with voltages that are not audible (20 hz. and below).

Slow modulating voltages may be applied in different ways. A good place to start is to use a sine wave (of 5-10 hz.) from a low frequency oscillator to control the frequency of another oscillator. In small dosages, the effect known as vibrato is achieved. However, *frequency modulation* of this type is not limited to sine waves or small amounts. Injecting a large amount of sawtooth wave will create many science fiction movie effects, and the use of a square wave results in a sound not unlike that of european ambulances.

A sine wave applied to a *voltage controlled amplifier* or "gate" will cause "tremolo". Similarly, a large amount of sawtooth or square waves will turn the sound on and off rapidly in an envelope that takes on the shape of the waveform.

Amplitude modulation of this type is not restricted to slow moving oscillators. An analog sequencer applied to a VCA will result in rapid changes of volume, in sequence; applied to an oscillator, the sequencer will give the customary sequence of pitches.

Sequencer control of a *voltage controlled filter* will cause the timbre of the sound to change in sequence. By turning the regeneration (also known as "emphasis" or "Q") up to just below oscillation, a melodic sequence will be heard in addition to the sound being processed through the filter. If a waveshape, such as a sawtooth is processed, all of the pitches in the sequence will be in tune with the processed sound because the filter picks out the harmonics of the sawtooth wave to play the sequence on. This effect requires careful manipulation of the controls, so be patient if it doesn't quite work the first time.

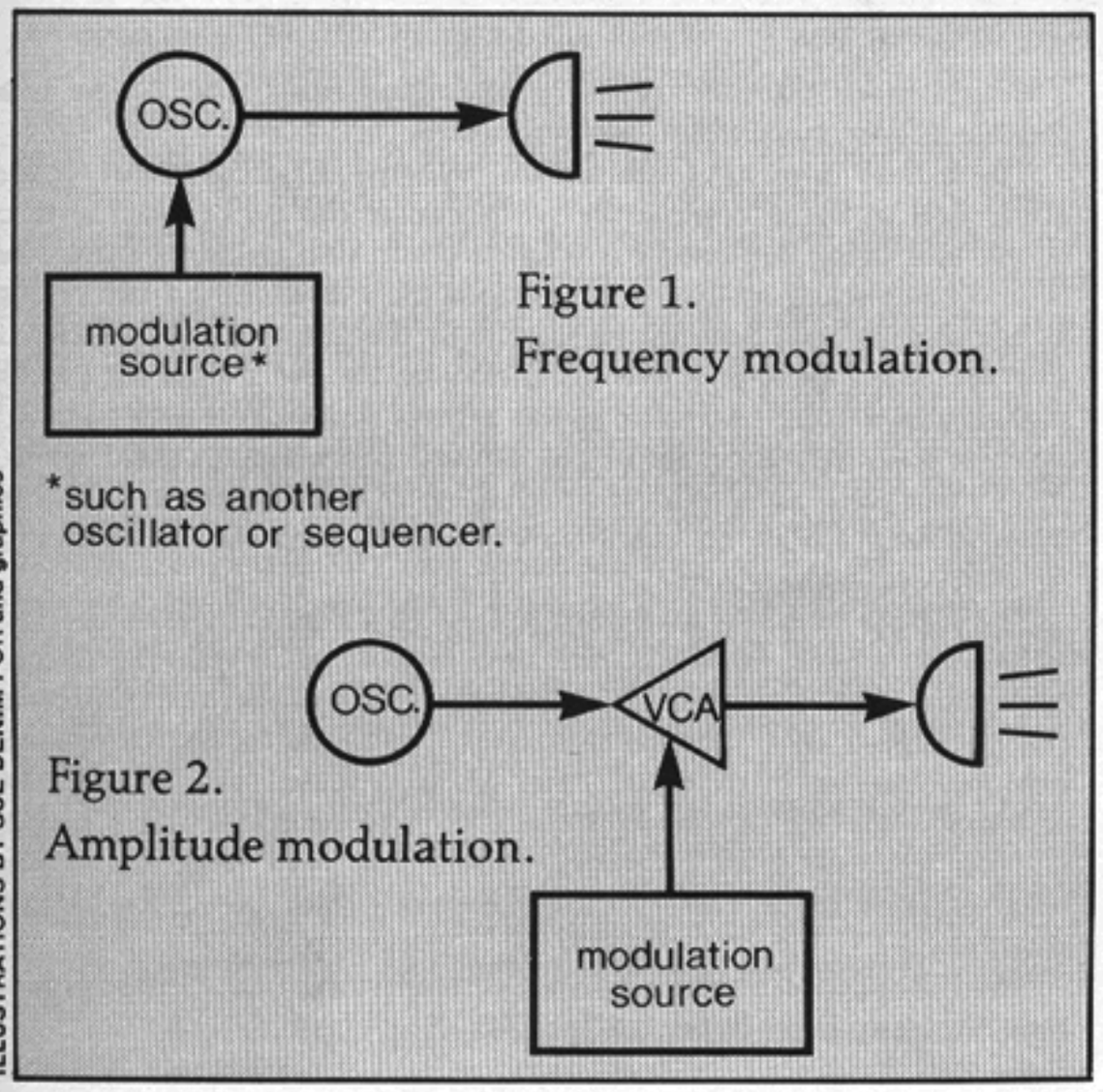

Figure 1.
Frequency modulation.

Figure 2.
Amplitude modulation.

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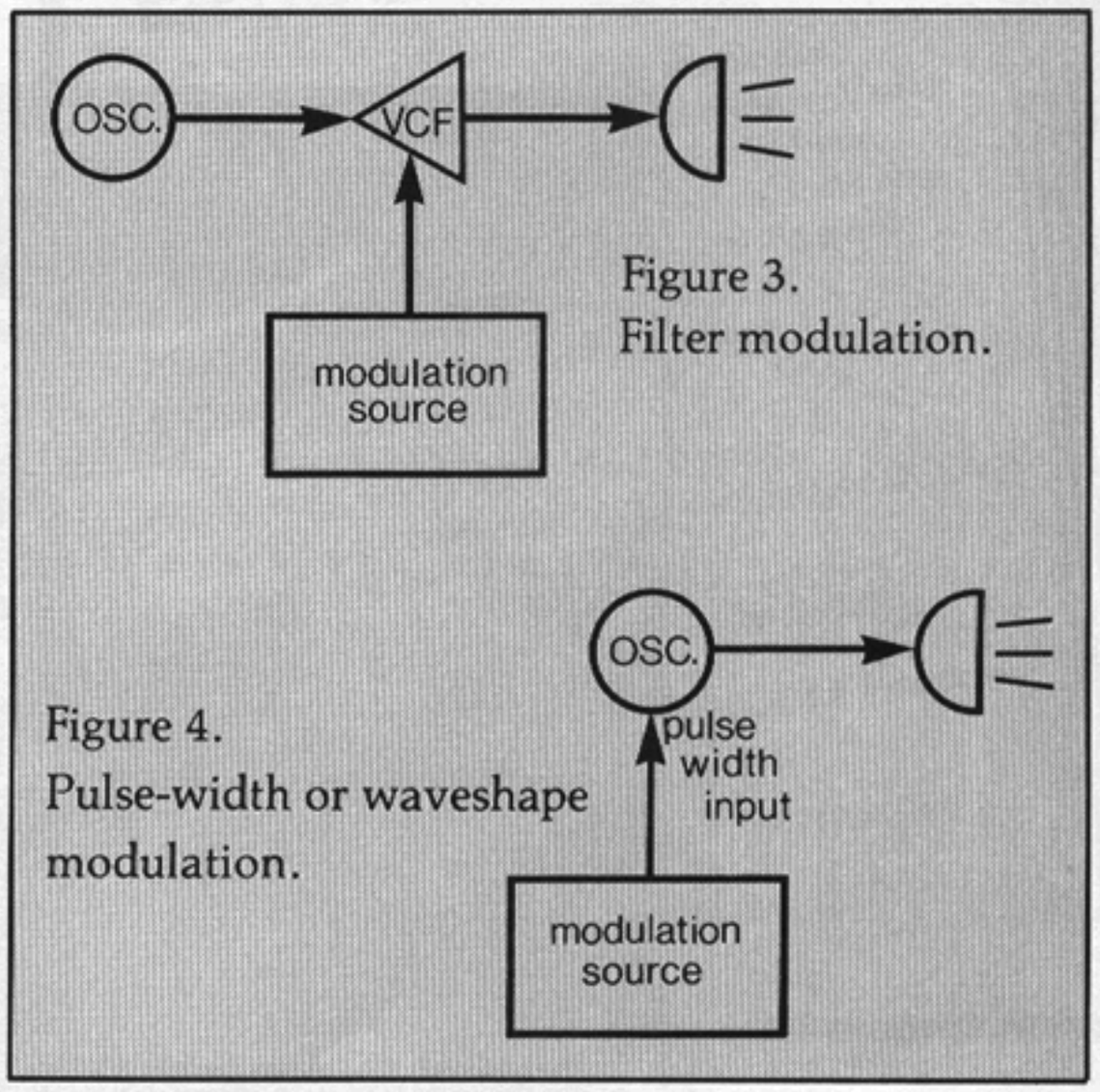


Figure 3.
Filter modulation.

Figure 4.
Pulse-width or waveshape modulation.

Low frequency oscillators may also be used to control the filter. The small amount of sine wave will cause an effect similar to tremolo, but by using a large amount of the sine wave control voltage, and using a very slow frequency (1 hz. or less), the filter will sweep up and down, changing the timbre of the sound gradually. If this is done with the regeneration up, the filter will pick out all of the overtones, one at a time.

Another effect, similar to using the sequencer, is to use the *sample and hold* on the filter. This will result in constant timbral change.

Pulse-width modulation or *waveshape modulation* are two other ways to change timbre that may be done with some synthesizers. Use of a sine wave (of 5-10 hz.) to control the pulse width results in something that sounds like vibrato, only without the pitch change of vibrato. A very slow sinewave causes a constant thinning and thickening of the sound. A sequencer or *sample & hold* generator applied to control *pulse-width* or *waveshape* results in the rapid timbral changes as when these two devices were applied to the filter.

Use of these types of modulation will make performance more interesting, providing a welcome relief from plain synthesizer sounds. Next column will discuss fast modulation (above 20 hz.) and the use of noise as a modulation source. ⌇

Footnotes:

1. The filters on some synthesizers can create sine wave oscillation on their own, such as the Micromoog and Minimoog, the Serge, EMS Synthi, and others. Some filters are designed not to oscillate, such as the Moog modular filter. If your filter is not capable of oscillating, then turn it all the way up.
2. It should be noted here that *pulse width* applies only to square waves, while waveshape generally applies to sawtooth waves. Sometimes these functions are combined as on a Micromoog.

EQUIPMENT

PHOTOGRAPH BY BILL MATTHIAS

E-Bow
Heet Sound Products
Los Angeles

The E-Bow (short for "Energy Bow") is a perpetual sustain device for any steel string guitar, electric, or acoustic. At $125.00 list it's one of the most expensive distortion devices you can buy for a guitar. It's definitely priced for the professional market.

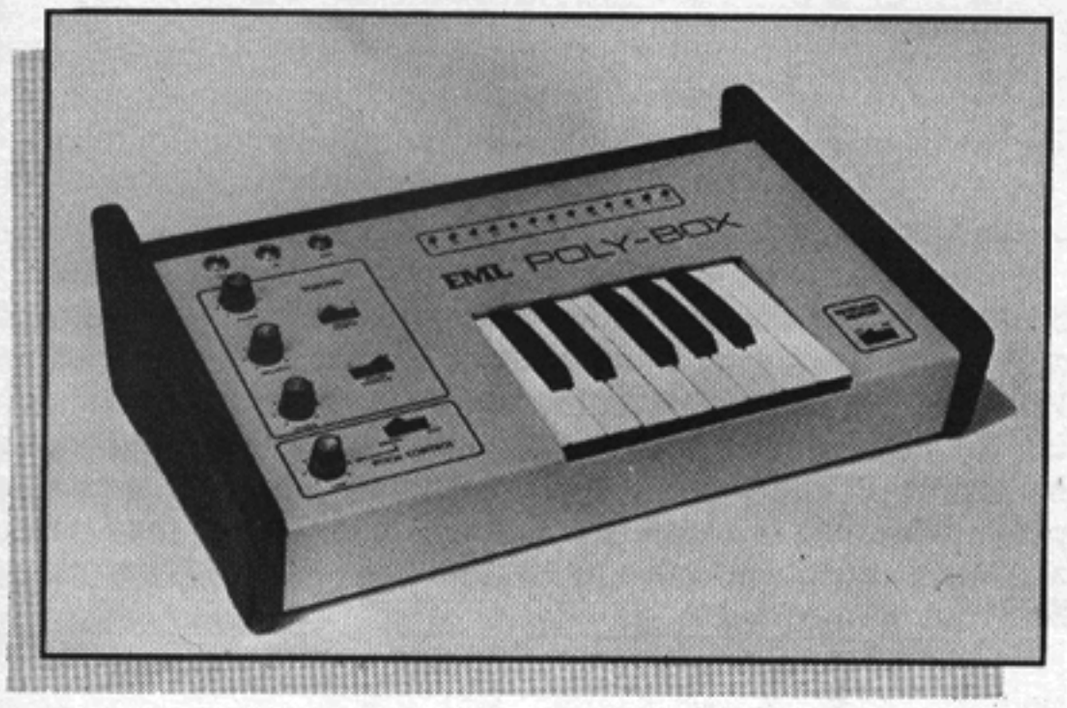
Essentially, the E-Bow is an electronic guitar pick. Instead of vibrating the string by striking it, the E-Bow vibrates it with an alternating magnetic current. This gives you a clean, unlimited sustain, but more than that, the E-Bow gives a guitar an unlimited range of sumptuous, satiny textures. On the bass strings, it gives a guitar a rich mellow tone, like a cello or an oboe. On the higher strings it lends a lilting, reed-like tone. The effect is surprisingly realistic. Put to work in the nightclub band I belong to, the E-Bow serves as a utility in-fielder, covering all those holes in a song that can't be filled with regular bass-guitar-keyboard arrangement. It's been used as a violin in "Nights in White Satin," as a flute in our Jethro Tull songs (by starting at the first and hammering rapidly on the third, you can bet a pretty good Ian Anderson flutter) and as a continuous tone synthesizer for some of our spacier songs. By playing with a slide-bar, you can achieve a piercing air-raid siren wail guaranteed to drive the dogs in your neighborhood bananas. You can slide in and out of key like a keyboard player with a pitch bender. Through more standard types of distortion tools, the E-Bow is as flexible as any continuous tone synthesizer.

The E-Bow does have limitations. When it first came out, it was advertised as being compatible with regular flat picks. At the time, it was still being explored for what it could and could not do. Heet Sound has backed-away from this since then. Switching from regular guitar picking to E-Bow in the middle of the guitar solo is awkward. The best thing to do in a live situation is to use the E-Bow for specific passages in a song. Acoustic guitar strings don't drive well. Though there is steel in the center of the strings, the magnetic field doesn't drive them well. Same with the high-E on an electric guitar. If you are playing with slinky or super-slinky strings, you will have trouble driving your high strings.

The E-Bow may feel awkward at first. It's not really intended as a speed instrument, and for the first few days of playing it may seem hard even to put together melodies. As the brochure included in the package states, it is an instrument and has to be learned and explored like an instrument. After about a week, you should have developed enough of a feel for the E-Bow to be comfortable playing it. You will find a lot of things you can do with it go far beyond what is described in the operating manual or played on the demonstration tape.

The E-Bow comes with a holster, operating manual, demonstration tape company press hype, for $125.00.

—Richard Wadholm



Poly-Box
Electronic Music Laboratories
Vernon, Connecticut

The "Poly-Box" from EML is an inexpensive synthesizer accessory designed to give your system a certain limited polyphonic capability. By means of top-octave division, the Poly-Box is able to play all thirteen tones at once within a one octave range. A tuning pot determines the actual pitch identity of the tones. Or, if the tuning control is switched to "automatic", the Poly-Box will precisely follow, via an external connection, the pitch output of an oscillator from the synthesizer. This makes the production of brilliant sounding passages of parallel chords a very easy thing to do, although true harmonic accompaniment is trickier. If the system oscillator is pitched at 440' A and a C-major triad is pressed on the little Poly-Box keyboard, the Poly-Box output will be a triad in A. Play a G-major triad on the Poly-Box (oscillator still on A) and the output will be an E triad. Then change the oscillator pitch to G and the output (with the Poly-Box G triad still pressed) will be a D-major triad. Got that?

Although it appears that one must be a transposition mastermind to play the Poly-Box extemporaneously with any facility, any one can overcome the limitations of the instrument and use it to good effect. One problem to be surmounted is the fact that the meager one octave range makes for limited progressions in terms of voice leading and inversions. A two-octave range would have made all the difference. The Poly-Box output is a raw waveform only slightly modifiable, but luckily it can be processed just like any signal from the system. Properly filtered and reverbed, and with its own internal phasing control cranked up, the Poly-Box is indistinguishable from either an ARP-type string synthesizer, or, with less brightness, a Mellotron. However, I find the Poly-Box most useful not for harmonic applications but for effects. Because the Poly-Box is so accurate in its tracking of the controlling oscillator, in essence it can be directly voltage controlled by any voltage source on the system, thus giving it much more versatility as a sound source than if it were controlled only from the keyboard. Also, since the Poly-Box output can be either continuous or gated, routing the Poly-Box signal through the ADSR/VCA on your own synthesizer can create effects involving double enveloping, for example, short repeated chords can be made to seem to echo and fade if the ADSR has a long decay time.

Other features on the Poly-Box include the aforementioned phasing control, switches for octave transposition and octave doubling, and a "gate" output for directly triggering an envelope generator. Insofar as it lists for only $475, the Poly-Box is a cost effective accessory that can greatly expand the capabilities of most synthesizers, especially small mini-systems.

—Tom Davey

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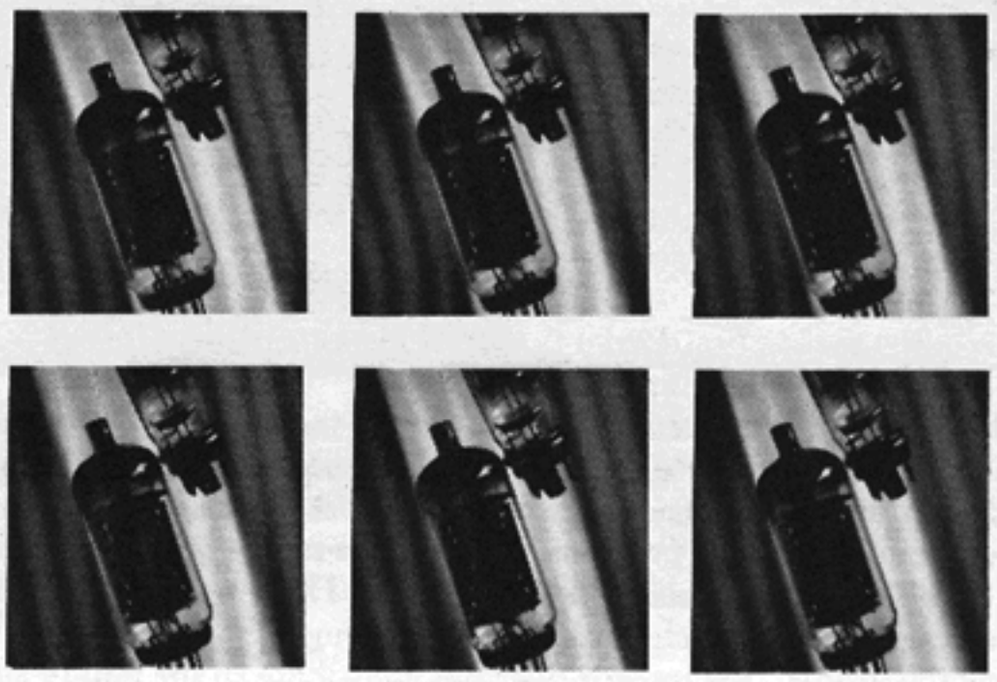

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The Link Between Computers & Synthesizers

Part 3

with Peter Hillen

Now all the theory on digital to analog converters in the last two articles can be put into practice. First, we will build a simple D/A Converter which is operated by toggle switches. Then we will add a "computer" that will automatically control the converter's function.

The three basic components that were defined in the theory of D/A converters are; the switch, the weighted summing resistors and the amplifier. For the time being, a simple single pole single throw switch will take the place of an electronic switch. This will keep the "human speeds". The resistors are common carbon 5% types. They will be used as the binary weights. It is not possible to get exact binary multiples in 5% resistors so some substitution must be made. The error is only 2.5% The amplifier is a standard 741 type which is very cheap and readily available. Figure one shows the schmetic of the circuit.

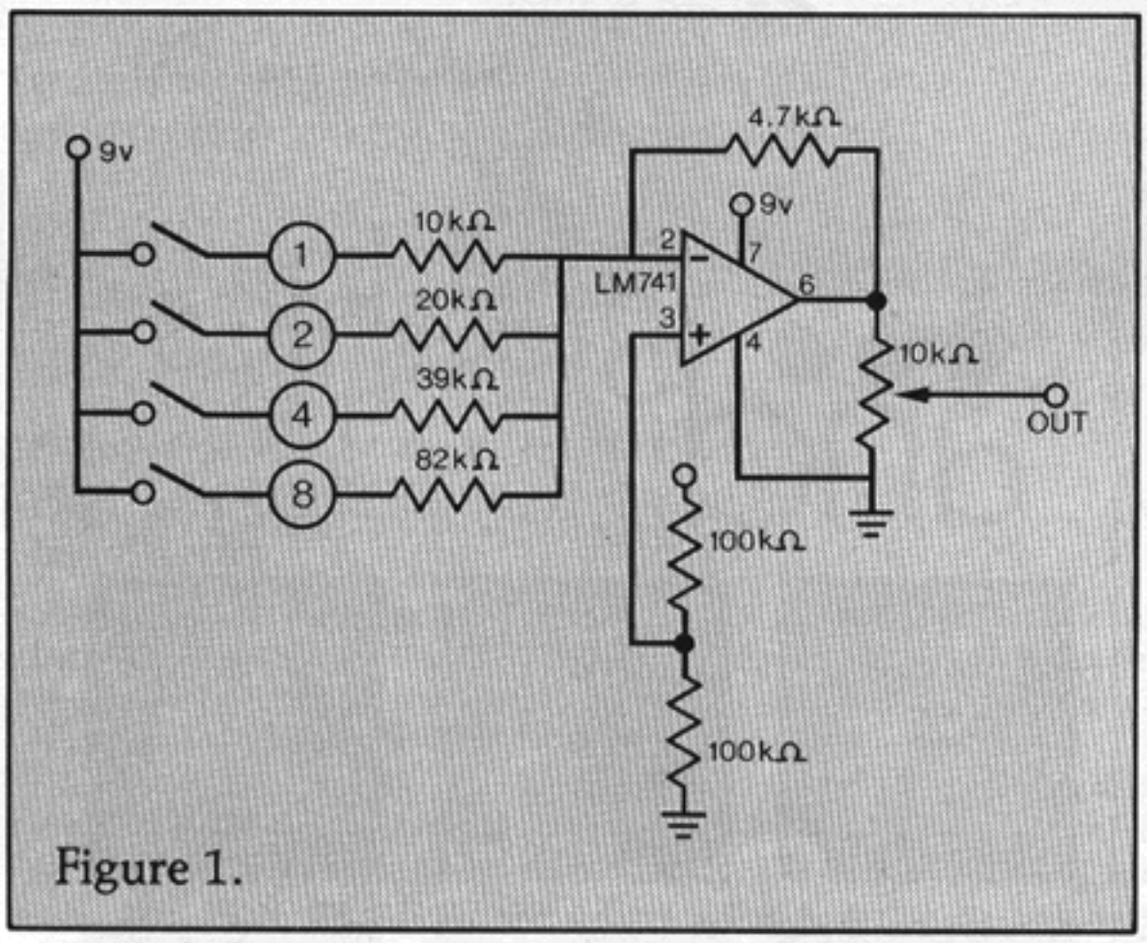

Figure 1.

The op amp is connected in the summing mode with the feedback resistor controlling the gain which is equivalent to controlling the maximum full scale range. The summing resistors are picked as close as possible to a binary progression. A 39K must be substituted for a 40K and an 82K is substituted for the 80K. These summing resistors are connected to the reference voltage through the switches. When the switch is open, the resistor does not contribute to the binary sum.

A point that I forgot to mention in the last article was that the op amp connected in this mode inverts the input signal. If there is a positive voltage on the input, there will be a negative voltage times the gain on the output. Since this is a very simple single power supply circuit, there are no negative voltages. Therefore, it is necessary to bias the output to some positive voltage (½ the battery voltage). The output with nothing connected to the input will be about 4.5 volts. When the switches are closed the output will go from 4.5v toward 0v. in a binary fashion. The output will never ground because of limitations in the output of the op amp. When the converter is plugged into a VCO the frequency will go higher and must be adjusted to the correct pitch by the VCO frequency set control.

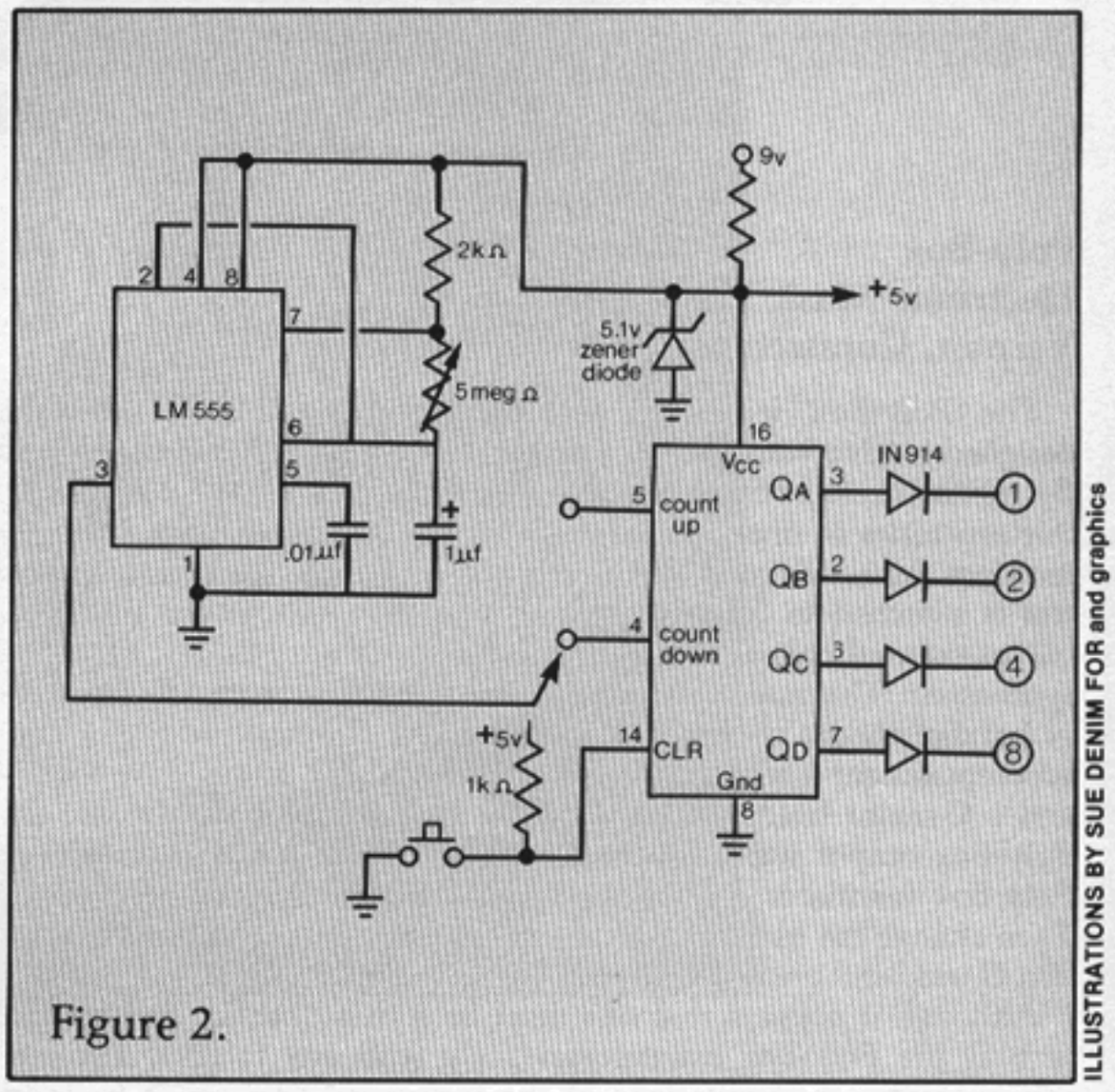

Figure 2.

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The pot on the output is used as a full scale adjust. It sets the step size of the binary numbers. When it is all the way up the output will go from 4.5v with all the switches open to lv with all switches closed.

Now that the converter has been constructed, let's do some experiments. First, we will try a binary well tempered keyboard. Adjust the output scale pot so that each of the binary numbers produced by the D/A converter will be a half tone apart. The procedure for calabrating the converter is to switch between two notes, an octave apart and tune by ear. Use 0000 (all switches open) as one end and the binary number 1011 (decimal 11) as the octave. Why not 12? Well, 0 is the first note, 1 is the second—all the way up to 11 as the 12th note. Note also, that 1011 is a lower pitch than 000 because of the inversion of the output mentioned earlier. Since our converter has 4 bits, it can produce 16 (2^4) notes which is a 1½ octave range. When in tune it is possible to use the four switches in place of a 16 key keyboard. Try to play a chromatic scale. It would consist of flipping the switches in a consecutive sequence from 0000 to 1111. If you can't remember how to count in binary look back three issues at the article on computer arithmetic.

In a synthesizer system, this circuit can be useful in supplying preset parameters. For example, used in conjuction with a keyboard or a sequencer as an input to a VCO, one could transpose to any key by just a flip of the switches. It can be used to pre-set several vibrato or tremolo speeds or to tune the resonance of a VCF to different harmonics of a waveform.

To add a little intelligence to the D/A converter and to do the second experiment, the circuit in figure two can be added in place of the toggle switches. This circuit is a binary counter with its own oscillator to control the count rate. The counter has four binary outputs. It will count sequentially from 0000 to 1111. When an output is a 1, there is a voltage on the corresponding summing resistor which is summed according to weight. When the output is zero, then the diode is cut off and there is no voltage to the summing resistor.

The counter can count either up or down depending on whether the oscillator is connected through the switch to the up count pin or the down count pin. The pot on the LM555 controls the count rate. The count can be reset to 0000 at any time by pressing the reset button. It will remain at 0000 for as long as the reset button is depressed.

Connect the circuit to a VCO. When the full scale control is at maximum, very distinct transistions can be heard in frequency because the output of the converter is like a staircase. As the step size is reduced, the output of the D/A converter more and more resembles a continuous ramp wave. Try to see how far down you can turn the full scale pot before you can no longer hear the steps and the sound is if it is being driven by a smooth ramp. It will be at the point at which the step size is less than the resolution of your ears. When this happens, the total range of the converter will be very small, maybe only a semitone. Remember though, this is only a 4 bit converter and the 10 bit converters used in real computer synthesis systems have 64 times more bits.

Even this D/A converter with the counter can be used in a synthesizer system. When controlling a VCO, the output will sound like a sequencer or sample and hold. If the VCO is then hooked to a ring modulator, the modulation will sweep through preselected frequencies. Likewise, if a VCF is set as a band-pass filter, the signal being filtered, can be swept selectively through its harmonics by setting the stop size accordingly.

Next issue, the other side of the converter problem will be examined: analog to digital conversion. ⌐WW⌐

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Manufacturers:

Advanced Tools for the Arts, P.O. Box 825, Tempe, Ariz. 85281
Aries Music Inc., P.O. Box 3065, Salem, Mass. 01970
ARP Instruments, 320 Needham St., Newton, Mass. 02164
John Blacet*, 4019 Chico Ave., Santa Rosa, Calif. 95401
Buchla, Box 5051, Berkeley, Calif. 94705
CFR Associates*, Box F, Newton, N.H. 03858
Computone Inc./Lyricon, P.O. Box 433, Norwell, Mass. 02061
Concert Company,** 3318 Platt Avenue, Lynnwood, Calif. 90262
Davel, Box 279, Verdugo City, Calif. 91246
D.B.L. Electronics, 502 Sherman, Canton, Mass. 02021
Dennis (Electronic Music Components) 2130 Metcalf, Honolulu, Hawaii 96822
Electrax, P.O. Box 149, Tarzana, California 91356
Electron Farm/Harvest Gregory Kramer, 135 W. Broadway, New York, N.Y. 10013
Electronic Music Laboratories, P.O. Box H, Vernon, Conn. 06066
Electronic Music Studios, The Priory, Great Milton, Oxford, England
E-mu Systems, 3046 Scott Blvd., Santa Clara, Calif. 95050
Farfisa, 1330 Mark St., Elkgrove Village, Ill. 60007
Gentle Electric, 119 Brainerd Rd., No. 15, Allston, Mass. 02134 (617)731-4844
Ionic Industries, 128 James St., Morristown, NJ 07960
Korg/Univox/Merson, 75 Frost St., Westbury, N.Y. 11590
MM Electronics, French's Mill, French's Rd., Cambridge, England CB4 3NP
Moog/Norlin, 7373 North Cicero Ave., Lincolnwood, Ill. 60646, Customer Service: Box 131, Academy St., Williamsville, N.Y. 14221
Musicomputer, 15, 112 W. Sierra Hwy., Canyon Country, California 91351
Musitronics Corporation, Sound Lab 10, Rosemont, N.J. 08556
Oberheim Electronics, 1549 Ninth St., Santa Monica, Calif. 90401
Octave Electronics Inc., 35-73 Steinway St., Long Island City, N.Y. 11103
Octron, 1346 Bayport Avenue, San Carlos, Calif. 94070
Omniphon, Box 166, Churchill Rd., Mason, N.H. 03048
Oznie Process Electronics, Box 7, Centerville, Penn. 16404
PAIA*, Box 14359 Oklahoma City, Okla. 73114
Polyfusion Inc., 160 Sugg Road, Buffalo, N.Y. 14225
Roland, 2925 South Vail St., Los Angeles, Calif. 90040
Sequential Circuits Company, 7150 Rainbow Drive No. 7, San Jose, Calif. 95129
Serge Modular Music, 1107½ N. Western Ave., Hollywood, Calif. 90029
Star Instruments Inc., Box 71, Stafford Springs, Conn. 06076
Steiner-Parker, 2258 South, 2700 West, Salt Lake City, Utah 84119
Strider Systems, P.O. Box 2934, Norman, Okla. 73070
Syn-Cordian, 32-73 Steinway St., Long Island City, N.Y. 11103
Syn-Key, 114 W. Hintz Road, Wheeling, Ill. 60090
THINC-Technical Hardware Inc., P.O. Box 3609, Fullerton, Calif. 92634
VAKO Synthesizers Inc., 4651 62nd Avenue North, Saint Petersburg, Florida 33565
Yamaha International, Box 6600, Buena Park, Calif. 90620
360 Systems, 2825 Hyans Street, Los Angeles, Calif. 90026

Note: * manufacturer makes kits only
** manufacturer makes both kits and finished product

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Boston Experimental Electronicmusic Projects, Robert Ceely, 33 Elm St., Brookline, Mass. 02146, (617) 731-3785
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Different Fur Music, John Vieira, 3470 19th St., San Francisco, Calif. 94110, (415) 863-WAVE
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DS Music, 811 Franklin St., Santa Monica, Calif. 90403, (213) 463-8772
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People's Computer Company, P.O. Box 310, Menlo Park, Calif. 94025
Pi Corporation, 1741 East 24th St., Cleveland, Ohio 44114, (216) 781-2207
Ron Rivera, 48 Brighton Avenue, No. 11, Allston, Mass. 02134
Dr. Philip Springer, Box 1174, Pacific Palisades, Calif. 90272, (213) 454-5275
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FROGG (Design Engineering Labs Inc.), 4121 Redwood Ave., Los Angeles, Calif. 90066 (213) 823-8220
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Rothchild Musical Instruments (distributor Furman and Alembic products), 65 McCop pin St., San Francisco, Calif. 94103 (415) 626-2260
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Scientific Audio Electronics Inc., P.O. Box 60271, Terminal Annex, Los Angeles, Calif. 90060
Scotch/3m Magnetic Audio/Video Products Division, 3M Center, Saint Paul, Minn. 55101
Shure Brothers Inc., 222 Hartrey Avenue, Evanston, Ill. 60204
Scully Recording Instruments, 475 Ellis St., Mountain View, Calif. 94943
TDK Electronics Corporation, 755 Eastgate Blvd., Garden City, N.Y. 11530
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Oberheim Digital Sequencer DS-2A. $700. (212)247-1533 or (514) 522-8272. Call any time.

PERFORMANCE

from page 14

thesizers galore I picked it up and quickly it became one of my favorite mellow albums. Out in Aspen, Colorado I would play it for my outdoor electronic music seminar and the mysterious Ravel harmonies of Part One would attract the trombones practicing by the river and draw out the dingy classrooms dozens of students that would lie out on the lawn watching the hangliders float over the mountain.

With such gentle associations foremost, the Tangs New York concert at Avery Fisher Hall came as something of a shock. Like some macabre throwback to a late '68 groovy-acid-be-in-stomp the members of the group slunk onstage, three mysterious presences basking in the half-glow of pseudo rock n'roll stardom.

They began with that old standby of live synthesizer shows, comb filtered white noise, and while this innocuous aural steam wafted around the hall, some of the high energy tension I felt from the neo-psychedelic atmosphere dissipated. But soon the hard driving synthesized motor rhythms the Tangs presumably are known for started up, and when played at the nerve numbing volume they prefer, my uneasiness doubled.

It had nothing to do with the sounds. Unquestionably, the Tangs have the most beautiful synthesized drums I have ever heard. Yet the steady insistence on a simple four-four, the obviously random, insensitive sequencer patterns made me realize that no one in the group was listening very carefully to the moment to moment musical effect. For all its sophisticated synthesis, the imitation drum kit had less imagination than the rhythm section of a cheap home organ.

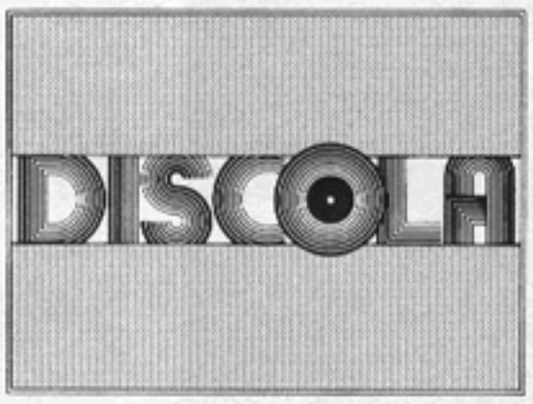
The keyboard improvisations were little better. I was astonished at the sheer lack of skill being displayed. The phrasing was incredibly sloppy, tempos erratic, the improvisations careless. Nevertheless, since the first piece remained consistently in a lugubrious if somewhat conservative Aeolian mode, and the sounds were incredibly lush, an innattentive or reasonably stoned listener could have been fooled.

Their second piece began with another old standard, processed mellotron vocals under which a low bass note shook the very foundations of Avery Fisher Hall in a manner not unlike Sensurround. But then those rhythms began again, just as random as ever and the improvisations came back incredibly enough in the same key. Had the music for one moment contained the seriousness of purpose of a Riley or a Glass, this would be understandable. Given the obvious rock context, the lack of variety showed a remarkably cynical, uncaring attitude.

The rest of the concert continued without change. Edgar Froese would occasionally pick up an electric guitar and play some undistinguished leads. The Laserium tried in vain to find synch with the music and always managed to be slightly and annoyingly off. When it was over, the audience howled for more.

My original pastoral view of the Tangs music has been irrevocably altered. Never again shall I make the mistake of considering them the Seventies' answer to Debussy. No, they are an imitation underground rock super group, albeit a poor and pretentious one. It's a living, I suppose. I just wish Tangerine Dream would pay as much attention to the content of what they play as they do to the quality of sounds they synthesize. A Tang concert could be a lot of fun if they only played with more care.

—Richard Einhorn



from page 10

One of Wakeman's charming idiosyncrasies is his taste for highly resonant filtering, (cranked-up "Q"). This and the constant portamento give his synthesizing an especial pungence. Wakeman remains a dramatic, almost melodramatic composer. He is an old pro at generating excitement by the sudden entrance of an instrument or a sound effect, and of making music out of timbral dialogue. These virtues alone however are not sufficient for a satisfying work. The listener cannot escape the feeling he is partner to a contrivance.

The fact that Wakeman has recently rejoined Yes, the band that originally brought him to fame, makes this an appropriate time to examine the merit of his entire solo career. It must be admitted in all candidness that his best work has not been on "The Six Wives of Henry VIII", or "Journey to the Center of the Earth", or "King Arthur", or "No Earthly Connection", and certainly not "White Rock". No, his best work was on "Fragile", "Close to the Edge", and "Tales from Topographic Oceans". His return to Yes is perhaps Wakeman's own admission that his solo career has not been all that he hoped it would be. In retrospect it is surprising he ever left Yes, so perfectly did they complement each other in precisely the areas where each needed it most. Yes's stylistic purity curbed Wakeman's tendencies toward excessive eclecticism while their fluid vocals spared listeners embarrassment over his own songwriting efforts. Wakeman, for his part, lent Yes the showmanship and accessibility that enabled them to gain a mass following. With all due respect to the English Rock Ensemble, the new Yes album, expected shortly, will give Rick Wakeman his first chance in a long time to interact with musicians of his own caliber. It may restore to him his reputation as the finest keyboardist in rock, a reputation somewhat tarnished by his own solo career.

—Tom Davey

Pat Martino: Joyous Lake
WB BS-2977 (6-98)
Warner Brothers

In jazz/rock music these days it is rare to hear hollow body electric guitar free of distortion. Pat Martino combines this with synthesizers to produce a clean melodic sound on this album with the help of producer Paul Rothchild (Paul Butterfield, The Doors, Bonnie Raitt).

The synthesizers on this record (Oberheim Polyphonic and EML models 101 and 500) are used in a very low-key manner: Usually the main theme is stated by Martino's guitar with a filtered synthesizer in unison and an octave below. The synthesizer lines with the guitar form a new timbre which sounds like a guitar except that a guitar without distortion is not able to sustain as long as these lines do.

But mostly, it is the playing not the sounds that distinguish this album. Martino, along with his band, consisting of Delmar Brown keyboards, Mark Leonard on bass, and Kenwood Dennard drums, are a proficient, and tasteful quartet. And they cook! Sometimes they sound like Weather Report, but generally, they sound rather unique, even though there are a lot of familiar elements that make up the sound: Brazilian rhythms, Rhodes piano, the jazz/rock drumming, etc.

Brown uses his phase shifter faster and deeper than most piano players, which is nice at first, but wears thin by the end of the album. However, there are spots where he puts the phase shifter's doppler effect to good use. In "Pyramidal Vision" the Harmonizer is used for special effects by feeding it back on itself. (for more on the harmonizer, see Tom Davey's report on Synapse No. 5)

There are other effects (filtered noise, sequencers, etc.) interspersed freely throughout the album, but they never interfere with the band's groove. In fact, the wide open sound of the record belies the amount of tracks playing simultaneously (guitar, bass, drums, 2 Rhodes tracks, 2 synthesizer tracks, clavinet, Oberheim violas, occasional grand piano, and percussion), a tribute to Rothchild's masterful production.

—Danny Sofer

What's Happening

from page 6

Minimoog) features a traditional compliment of modules and the ability to split one sawtooth oscillator to make it sound as two. It retails for $995. The **Microcon** *is the size of a normal module but features the functions necessary to add another voice to an existing performance synthesizer. The Microcon retails for $300. . . . . .*

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A six input, stereo output mixer by Stage

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. . . . . .

. . . *Be on the lookout for* **The Sorcerer** *by* **William Friedkin.** *The entire sountrack was composed and performed by* **Tangerine Dream** *before the movie was made. . . . . .*

. . . . . .

. . . *The* **New England Conservatory** *will be offering an* **Electronic Music Workshop** *from June 27 to July 1. The one week course with* **Robert Ceely** *will cover traditional electronic music studio techniques. Also slated is a basic Audio and Recording Techniques Workshop. For more information, contact Bob Annis, New England Conservatory, 290 Huntington Ave., Boston Mass., 02115, (617) 262-1120. . . . . .*

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. . . *You may not believe it, but it's supposed to be true.* **Yes** *will be touring the U.S. in late summer. Get in line for tickets. . . . .*

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. . . *Please refer to "Listings" on page 46 for any addresses not found above. . . . . .*

Tangerine Dream

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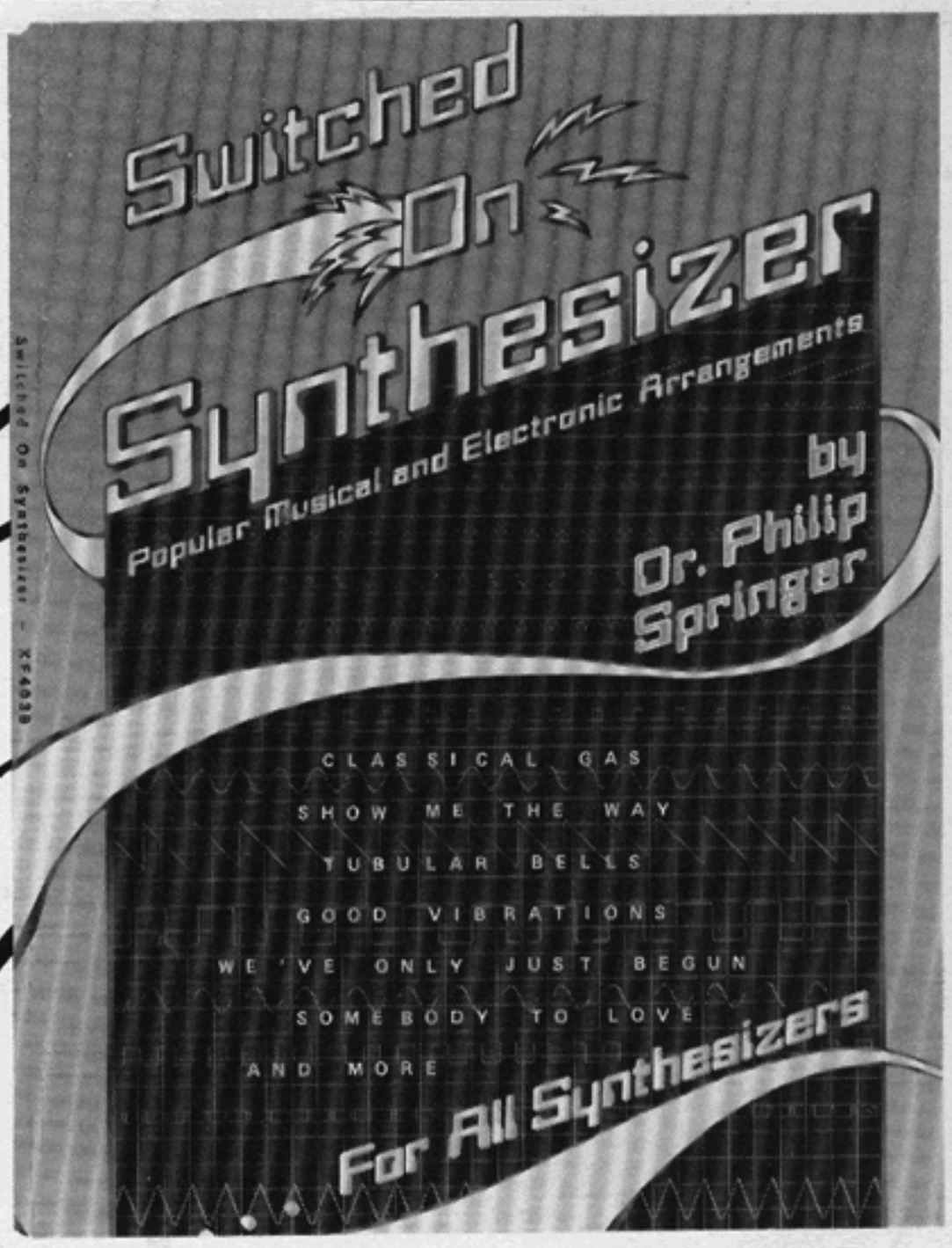

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