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Looking to the 80's—
Doing what he wants
to do



SYNTHESIZE IT YOURSELF

ERECTOR SETS FOR GROWNUPS

by JON BALLERAS

My initial reaction to the popularization of electronic music in the '60s was hardly positive. Perhaps my dozen years of playing acoustic piano, gigging in a variety of contexts, made those electronic/baroque renderings seem neon and the obligatory synthesizer glides and wah wahs sound gratuitous and contrived. More than once on these pages I've bemoaned an album's electronic gurglings. But now I'm happy to report that I've undergone a critical reversal, or at least a retrenchment: a change in outlook caused partially because more quality electronic music is in distribution, but moreso because of the effects of what started as my own modest musical electronics construction project, which lead me into realms of a music I understood only faintly before.

My passport to the new music was PAIA Electronics (1020 W. Wilshire Blvd., Oklahoma City, OK 73116), a firm founded by John Simonton, a design engineer who started his enterprise as a one-man garage shop operation around 1970. Simonton's early efforts were sometimes more like electronic toys than musical instruments—wind, surf, chimes and steam whistle synthesizers. His appeal was first to the electronics experimenter, second to the musician. Even so, his Leslie effects simulator, percussion boxes, guitar sustainers and stereo tremelo kits look to be genuinely useful musical items. The breakthrough came in 1973, when PAIA introduced its first complete synthesizer kit, including a three-octave professional keyboard, audio oscillator, two filters, low frequency oscillator and power supply, all for \$255. I'm still using modules from this simple, somewhat limited package in my current, much expanded rig.

Since entering the synthesizer market, PAIA has steadily expanded its module complement and design philosophy. Their current ad copy reads "Advanced Electronic Music Products," and that they are. The 4700/J, PAIA's top of the line unit, is built around a 6500 based microcomputer, allowing for four voice polyphony, stochastic compositional programs (you enter the pitches and time values, the computer does the rest), and, most recently, a remarkably flexible piece of software, a monophonic digital sequencer program for computer controlled recording and transposition of melodic sequences entered directly from the synthesizer's keyboard.

PAIA is certainly not the only manufacturer of synthesizer kits, but since their modules are extremely cost effective and I've worked with them almost exclusively, I'll center first on



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Will He Make It?

this equipment before discussing some of the other options available for the musician-turned-kit-builder.

PAIA synthesis equipment, like the big daddy Moog 15s, 35s and 55s, is entirely modular. Unlike, say, assembling a Heathkit or a Schober organ, you're working with one discrete sub-assembly at a time, a module which in itself can have a number of potential uses within (or without) a full system. Additionally, how you interconnect these modules (within the limits of electronic logic) is up to you, depending on your needs and imagination. For example, a bare bones but versatile signal processor (not a synthesizer) for organ, electric guitar, piano or microphone can be patched up using a preamp, envelope follower, voltage controlled amplifier, filter, envelope generator, low frequency oscillator, power supply and perhaps a foot pedal. If you build your own case, this equipment runs less than \$200. A builder might take two months to get this gear together. And you're free to expand from this; add a keyboard, audio frequency oscillator—another month's work, perhaps—and you've a synthesizer—not an elaborate one, yet an instrument having the

capabilities of many of the "mini" monophonic synthesizers on the market. Features include pitch and timbre modulation, glide, envelope sweeping, plus a multimodal filter and four oscillator wave-shapes. This workable and instructive instrument, an inroad into electronic music, is readily expandable, all the way up to a polyphonic computerized system.

Can you take equipment like this on a bandstand? Yes, but be warned that all those patch chords slow you down. Since there are no tabs labeled "banjo," "marimba," or whatever, it's up to you to work out the patches that feel right for your own style of playing, and doing so is an ongoing, time consuming process.

Since the inner workings of even a simple synthesizer, not to mention the new breed of polyphonic gear, understandably mystify many musicians, and understanding the design philosophy of any audio electronic device requires some specialized knowledge (perhaps even one or two leaps of faith), let's backtrack to explain how this gear gets put together.

The process of actually assembling a typical synthesizer module is relatively straightforward. PAIA instruction manuals, for instance,



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Dr. Balleras, Master Builder.

start at ground zero, assuming you know nothing about soldering, much less the difference in physical appearance between a resistor and a diode. You're guided by a step by step checksheet ("Cut a 1 3/4 inch length of insulated wire and strip 1/4 inch of insulation from each end. Connect one end of this wire to lug #1 of R 81 and the other end to lug #1 of R 82. Solder the connection at R 81 only."), clear pictorial diagrams, and instructions for calibrating and testing the module when you've finished. Actual calibration procedures on PAIA gear require a minimum of test equipment. If you've built the unit carefully and properly, a VOM (volt-ohm-milliammeter) is all you need. Also included in the documentation package are application notes, explaining what to do with the module now that you've built it. Finally, and certainly most interesting to mad wire freaks, is a stage-by-stage analysis of the unit's design theory. If you know little about electronics, here's some education; if you've a little knowledge and have made an error (a little knowledge ...) this kind of documentation is a helpful guide for troubleshooting while you're getting ready to haul out your oscilloscope, signal generator, digital logic probe, *ad technicum*.

Interestingly enough, rank beginners are often more successful in building kits like these than are more advanced builders. As Bob Snowdale, president of Aires Music, wrote to me recently, "People who experience the most difficulty seem to be those with some electronics experience. Complete novices do quite well, as do those who are more experienced. Presumably, the really inexperienced builder reads the instructions while those more experienced feel less need to do so. . . . Success

rests more with the builder's patience and care than his expertise."

As a kit builder, I fall into Snowdale's middle category. I've fooled around with electronics since in grade school, built gadgetry from magazine plans, and done some reading, but have no formal training. So, with this smattering of overconfidence, when I'm putting together a large unit it becomes difficult to build slowly, especially if I'm soldering up the fourth oscillator or second filter. The same kind of impulse that keeps jigsaw puzzle fanatics up half the night, just to get the damned thing finished, sets in, a kind of rapture of the circuit board. The only cure is to consistently remind myself just how long it took to troubleshoot the last module I rushed through (I've spent weeks straightening out some problems), of the frantic letters to the factory, of the chasing around for an obscure integrated circuit.

Because of the temptation to build fast, it's a mistake to invest in a lot of modules at one time. Having a three foot carton of inviting, sensitive, unbuilt technology sitting on your dining room table and wanting to get the whole thing powered up before the gig next Saturday is inviting disaster. Even though you save by purchasing a complete synthesizer kit package, the savings don't mean very much if you wind up with a bunch of out of whack, half usable circuitry.

Yet, paradoxically, I've come to value a half functioning module, perhaps because I went into this project with a predisposition toward fiddling around with electronic gadgetry—scopes, meters, and the like; perhaps because I find the process of systematically working through a defective circuit to be edu-

cational and rewarding. Since these systems are modular, unless you blow your power supplies (unlikely) you're never completely without sound. When I converted my keyboard to digital output, my instrument was partially shut down for over a month. During that time I verified the rubric found in almost every book on electronic music: a synthesizer is a sound shaping device, not a souped-up organ. Without a keyboard it's still a viable (albeit abstract) instrument. So an intermittent transistor in a digital-to-analog converter introduced me to the ideas of Pierre Schaeffer, and the world of *musique concrete* and tape manipulation which he explored. And working with a limited number of resources can solve, temporarily, at least, the perennial quandary of every synthesist: which sound to make out of a theoretical infinity of them. If you let it, a synthesizer, even an incomplete one, can give you lessons in acoustics and psychoacoustics hard to learn any other way. Much in the same way that learning photography can change the way you perceive and respond to light and teach you how to shape it into artifact, so can learning something about the nature of sound, via a synthesizer, change the way you hear, create and judge musical events.

Your experimentation, of course, doesn't necessarily have to be done on PAIA equipment. Aires Music (P.O. Box 3065, Salem, Massachusetts 10970) is a second modular synthesizer kit manufacturer. Judging from their spec sheets and price lists, Aires leans toward a conservative, musician-oriented philosophy. For example, Aires' voltage controlled oscillator has calibrated coarse and fine tuning (a much needed and easily added

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As soon as the ensemble has become comfortable singing the notes and the scat syllables in Larry's piece, the following refinement routines may be applied:

1. In section A, some of the chords are rootless, requiring choir members sometimes to hear their parts in relation to an imagined root. To insure true pitch when later sung a capella, section A therefore should be practiced first with a piano or bass sounding the chord roots designated by the chord symbols. If intonation problems occur in section B, the same process can be helpful.

2. In section A, the texture provides consistent four-part parallel harmony, useful for balancing dynamics among parts, for achieving ensemble blend, and for developing precision in homophonic attacks. In section B, the texture provides two-part sequential counterpoint, useful for balancing the call-and-response pattern, for achieving unison blend, and for developing precision in unison attacks.

3. Throughout the piece, all quarter notes which occur on the beat should be short.

4. All notes longer than a quarter should make a crescendo. When such a longer note is preceded by a tied-over eighth note, the eighth note should be accented, then the crescendo made.

5. Two eighth notes followed by a rest should articulate as long-short, accenting the second note.

6. Continuous eighth-note passages at fast tempos should articulate as above, while those at slower tempos should articulate in a more uneven triplet shuffle rhythm.

Larry Lapin's *Warmup #1* can be sung comfortably by most groups in the keys from B^b up to E^b. It should be practiced in different keys and at different tempos. db

SYNTHESIZERS

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refinement to PAIA gear). Documentation is thorough, but a shade faster moving than PAIA's. Like Heathkit, the granddaddy and acknowledged industry standard of electronic kit manufacturers, Aires, as far as I can tell, doesn't encourage design modification of its products. (Not a bad way to make kits that work and stay working.) But, as in the ecology of the universe, there's no free lunch. An Aires unit having roughly the same module complement as a ready-to-play ARP 2600 costs only about \$200 less than the ARP, sweat equity notwithstanding.

Like the major synthesizer manufacturers, Aires is casting its eye in the direction of polyphonics. In the works is a duophonic (two voice) keyboard, a four voice keyboard, and an all-the-notes keyboard. Currently available is a sequencer and a pitch and envelope follower (alas, it won't track guitar or piano).

Aires, incidentally, distributes one of the best operating manuals I've come across. Written by Kenneth L. Perrin and the staff of the Boston School of Electronic Music for use on the Aires 300 system, this text is both theoretically and practically adaptable to any modular synthesizer and to many prepatched ones as well.

Constructing a solid, dependable modular synthesizer is a time consuming process. If you're enamored by electronics, it's great fun and a rewarding experience. But suppose your interests are strictly in playing, or you simply don't have the time to get involved with soldering all those threatening looking components together? There are some ways out. Both PAIA and Aires sell assembled versions of most of their modules. Prices are naturally higher, but there's a significant savings in construction time, and you'll be starting out with fresh, factory built and tested equipment.

Electronics Music Laboratories (P.O. Box H, Vernon, Connecticut 06066), a long time manufacturer of well regarded ready-to-play synthesizers, has recently carried the idea of prebuilt modules one step further. Their new line of "circuit modules" and keyboards is sold factory assembled. Before ordering you're supplied with applications notes for hard wiring and patching the modules together, along with instructions for laying out the synthesizer's front panel. As an additional service, EML will even drill out the mounting holes on your panel for pots, switches and jacks—25¢ a punch.

Specs on EML's equipment seem more than adequate. This prefabricated approach seems especially useful for the musician who owns a small prepatched unit and wants to upgrade it and for someone who's picked up enough about basic synthesizer modules and signal flow paths to know what he wants in his own custom unit.

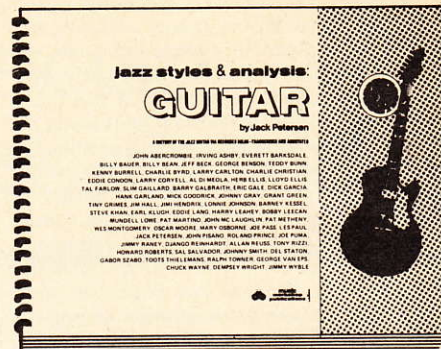
Other suppliers which may be of interest to the budding electrophile: Heathkit (Benton Harbor, Michigan 49022) has amps and p.a. kits; even more useful are their sturdy test instruments—multimeters, oscilloscopes, frequency counters and the like. Additionally, Heathkit has a full line of computers and peripherals which I suspect enterprising synthesists are already interfacing to their machines. Another supplier, Southwest Technical Products (219 W. Rhapsody, San Antonio, Texas 78216), is strong on low cost, high power audio gear, preamps, and equalizers. Additionally, they make an inexpensive version of one of the first electronic instruments, the Theremin—it looks like fun to build, if only for nostalgia's sake, in remembrance of interplanetary wails in those old sci-fi films. Southwest also manufactures a stereo analog delay line (expensive, but flexible) and computer systems. A newcomer to kit marketing is Blacet Music Research (18405 Old Monte Rio Road, Guerneville, California 95446). John Blacet's fascinating digital pattern generators, programmable event arrangers and similar devices have graced the pages of *Synapse: The Electronic Music Magazine*. *Synapse*, incidentally, is required reading for anyone seriously involved in electronic music. It's published at 2829 Hyans Street, Los Angeles, California 90026. Another helpful magazine is *Polyphony*, a PAIA offshoot which grows more sophisticated with every issue.

Finally, anyone involved with electronics in music should know about two remarkably readable and useful books by musician/electronics designer Craig Anderson. His *Electronics Projects For Musicians* contains plans for 19 projects, ranging from metronomes and preamps to ring modulators, compressors and electronic switches. Additionally, Anderson's book has some 50-odd pages patiently and clearly explaining the ins and outs of components, schematics, and construction tools and techniques. *Home Recording For Musicians*, Anderson's second book, is a similarly pragmatic guide to tape recording materials and

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